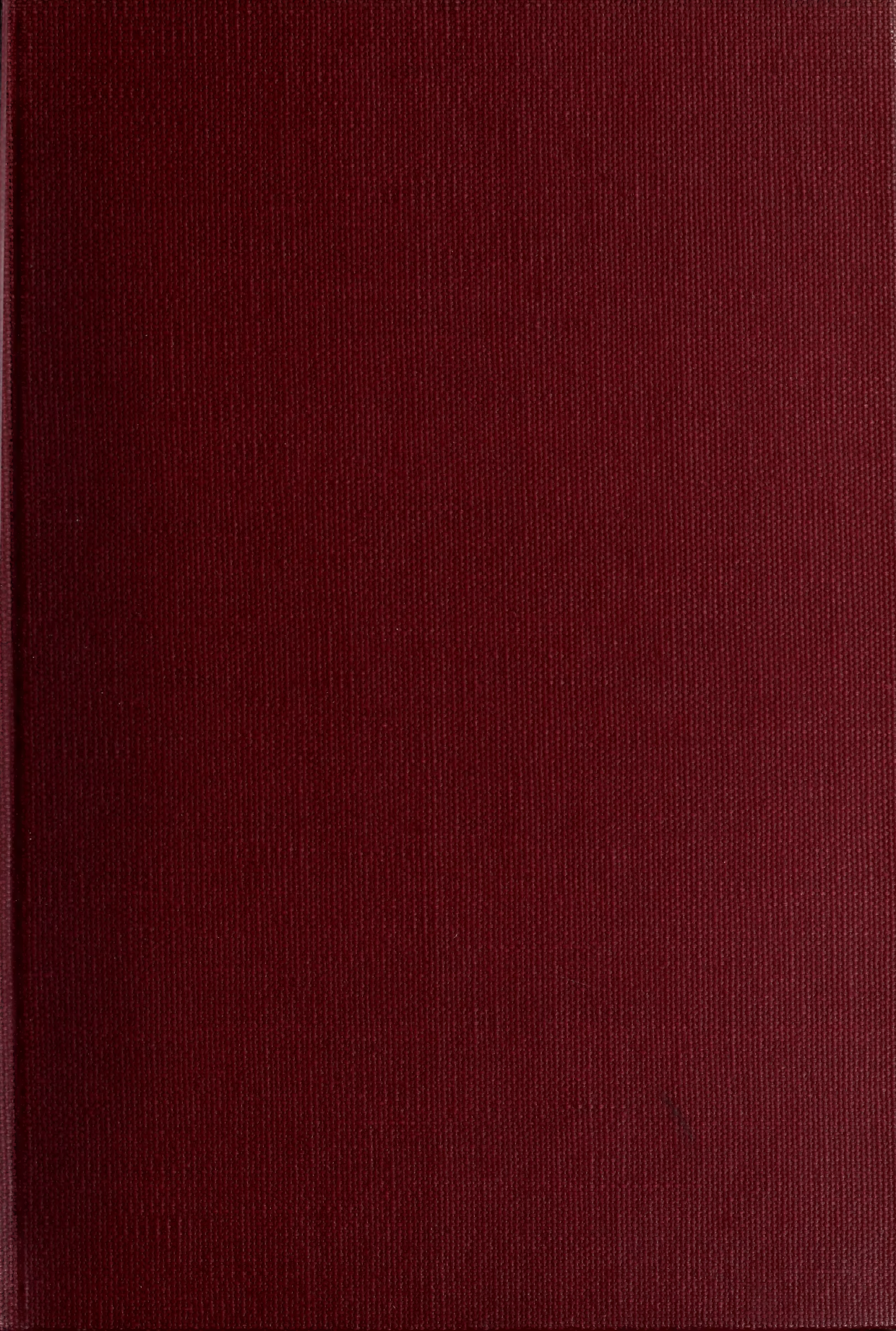








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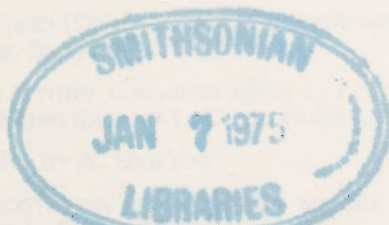
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THE BOTANICAL SOCIETY
OF THE BRITISH ISLES**

VOLUME 9

EDITED BY

**E. F. GREENWOOD, G. HALLIDAY,
N. K. B. ROBSON AND C. A. STACE**

1972-73



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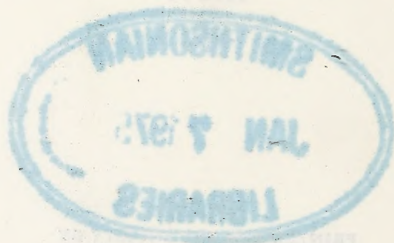
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The history and occurrence in Britain of hybrids in *Juncus* subgenus *Genuini*

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ABSTRACT

The discovery and distribution of hybrids in *Juncus* subgenus *Genuini* are outlined. Special attention is paid to *J. effusus* $\times$ *J. inflexus* and to the Lancashire hybrids involving *J. balticus*. The latter are discussed in relation to the distribution of *J. balticus* itself.

INTRODUCTION

Early on in a programme of research into the taxonomy and biosystematics of the subgenus *Genuini* Buchenau of the genus *Juncus* it became clear that a great deal of confusion existed regarding the identification and occurrence of hybrids. Much of this confusion in identity results from a lack of knowledge of the literature, for, although there are several poor or misleading accounts to be found, there is no lack of sound and informative references. However, the occurrence of the two British hybrids of *J. balticus* (with which this research is mostly concerned) has received little attention in the literature. No precise statements concerning their identification, abundance or fate have appeared in print. Thus it seems advisable to place the available facts on record. Data on the identification and limits of variation of the species and hybrids will be published in a later paper.

In Britain there are five species of the subgenus *Genuini*: *J. effusus* L., *J. conglomeratus* L. (*J. subuliflorus* Drej.), *J. inflexus* L. (*J. glaucus* Sibth.), *J. filiformis* L. and *J. balticus* Willd. The first three are widespread over most of the British Isles. *J. filiformis* is confined to the Lake District apart from a very few scattered localities elsewhere in England and in Scotland. *J. balticus* occurs in Scotland as far south as Fifeshire, and in a very restricted area of Lancashire. It appears never to occur in close proximity to *J. filiformis*. Perring & Walters (1962) provide further details. All the species except *J. balticus* have been treated in the Biological Flora of the British Isles (Richards & Clapham 1941, Richards 1943), but much of the information is now of course out of date and was in any case published at a time when contributions to the series were much less detailed than is customary today. Tweed & Woodhead (1946) published much additional (and contradictory) information concerning *J. effusus* and *J. conglomeratus*.

The hybrids may be conveniently discussed in three groups.

JUNCUS EFFUSUS $\times$ *J. INFLEXUS*

This combination is the only well-known hybrid, and is known as *J. $\times$ diffusus* Hoppe.



The first British record appears to be a report by Babington (1843) that M. W. Sanden of Hamburg had received a specimen from Kincardine, Scotland. The collector and year were not given, but the latter must have been 1842 or earlier because Babington's note was dated January 1843. No original specimens have been traced, but there is a gathering at **MANCH** collected by J. W. Rimmington in 1849 from 'near Kincardine'. Nevertheless Boswell-Syme (1870) doubted the presence of the hybrid in Scotland. He distributed specimens of a sterile variant of *J. inflexus* (which he described as *J. glaucus* var. *pseudodiffusus* Boswell-Syme) collected from the shores of the Firth of Forth (**BM**, **K**, **MANCH**, **OXF**) in 1869. He stated: 'It is probably to this form that all the Scotch specimens supposed to be *Juncus diffusus* belong.' He was, however, mistaken.

The first English record seems to have been made by W. H. Coleman in 1844, from Cole Green, 3 miles west of Hertford. The record was not published at the time, but specimens labelled Hertingfordbury, 1844, are at **BM** and **CGE**, and the discovery was mentioned by Ansell (1846) when describing a further discovery by Coleman and himself at Darman's Green, 3 miles south of Hertford in 1846. Specimens bearing these data are at **BM**, **CGE**, **E**, **MANCH** and **UCNW**. *J. × diffusus* was reported from east of Hunstanton, Norfolk, by Backhouse (1844), but a subsequent note by Notcutt (1846) states that Backhouse's specimens, as well as some collected from the same locality by Notcutt himself in 1846, were determined by Babington as a variant of *J. inflexus* with a solid pith.

After this period notices of the plant in the literature were mainly passing comments, because by about 1850 the existence of *J. × diffusus* as a British plant was well established. Specimens dating from then onwards are frequent in the major national herbaria.

Gibson (1862) is credited with the suggestion that *J. × diffusus* is a hybrid of *J. effusus* and *J. inflexus*. He based his idea on the occurrence of *J. × diffusus* usually 'in very small quantity only, and amongst abundance of *J. glaucus* and *J. effusus*, . . .' He gave four Essex records. This hybrid origin was not accepted, however, by all authorities. H. C. Watson, for example, considered that *J. × diffusus* was a distinct species (Druce 1884), but by the end of the century this view was no longer current. The *London Catalogue of British Plants* retained *J. × diffusus* as a species up to and including the eighth edition (Hanbury 1886), but the ninth (Hanbury 1895) and subsequent editions treated it as the hybrid.

The precise present-day distribution of *J. × diffusus* is not clear, largely due to mistaken identity. It is very frequently confused with sterile or partly sterile plants of *J. inflexus*, which are common, and in my view *J. × diffusus* is much less common than is often admitted. It is, however, undoubtedly widespread. Perring & Sell (1968) provide a map of the hybrid, described as 'readily recognised', which indicates that it is distributed from Cornwall and Kent to Northumberland in England, but that in Wales, Scotland and Ireland it is rare and very scattered. The data were obtained from four herbaria and from 'Floras'. The inclusion of the latter is unfortunate because a considerable number of erroneous records will have been included. This is indicated by a consideration of the herbaria consulted in the present study. Some largely contained correctly identified specimens (e.g. **MANCH**, by R. D. Tweed and N. Woodhead; **K**, by P. W. Richards and by L. A. S. Johnson) but others were not recently revised and contained numerous errors (e.g. **BM**, **CGE**, **OXF**). Perring & Sell's data

included records from **BM** and **CGE**, but whether the specimens were first determined correctly is not stated. Very few annotations were made on the sheets.

In the herbaria examined there are about 70 specimens at **BM**, 45 at **K**, 44 at **CGE**, 36 at **OXF**, 24 at **MANCH**, 17 at **NMW**, 14 at **E** and 4 at **UCNW**. Many of these are duplicates, but they include specimens from 37 British and 3 Irish vice-counties: 6, 9, 11, 13–15, 17, 19–21, 23, 24, 26–28, 30, 31, 33–38, 41, 52, 55, 57, 58, 62–67, 69, 85, 90, H20, 30, 38. This compares with 36 vice-counties given by Hanbury (1925) and 23 by Druce (1932). Druce included 8 not covered by my observations, and several more are given by Perring & Sell (1968); they should all be carefully checked before acceptance.

Nevertheless the contention that the hybrid is rare is supported by many sources. Clifford (1959), after two years searching in Durham, found only one locality, and found hybrids 'very rare' in Surrey even though he investigated localities from which they had been reported. J. G. Dony, a B.S.B.I. referee for *Juncus*, has made careful searches for *J. × diffusus* for many years, but never with success. P. W. Richards has found it only four times in over thirty years. I have searched scores of localities in the past six years but in Britain have encountered it only in one of Richards' known sites. There is no evidence that the hybrid is now less or more common than it was last century. It is very widespread on the continent of Europe.

HYBRIDS INVOLVING *JUNCUS CONGLOMERATUS*

Hybrids between this species and both *J. effusus* and *J. inflexus* have been reported.

Of *J. inflexus × J. conglomeratus* Richards & Clapham (1941) wrote: 'reported in Britain, but must be very rare', and Richards (1952, 1962) states 'doubtfully reported as British'. It was included in the plant lists of Hanbury (1908, 1925) and Druce (1908, 1928), but not in the immediately previous edition of Hanbury (1895) nor in the plant list of Dandy (1958). Druce (1919) implied that he discovered this hybrid in Berkshire. Bowen (1968), however, referred the record to a specimen in **OXF** collected by W. Holliday in 1861, and added that it is probably a variant of *J. inflexus*. I have seen the specimen and consider it undoubtedly *J. inflexus*. A specimen in **BM** labelled '*J. conglomeratus × glaucus*?', collected by E. S. Marshall from Kent in 1893, seems to be *J. × diffusus*.

Present evidence is thus not sufficient to maintain this hybrid as a British plant.

J. effusus × J. conglomeratus has been reported more frequently than the last hybrid in recent years, although it was not included in any of the British plant lists before that of Dandy (1958). Specimens thought to be this were collected in 1919 by Adamson (1920) in Cheshire from a single clump growing among *J. conglomeratus*, but the specimen in **NMW** is in my opinion *J. × diffusus*, which was also suggested by J. W. White at the time. The supposed duplicate at **BM** appears to me to be *J. effusus*. Tweed & Woodhead (1949) implied that they never encountered hybrids between these species. Richards & Clapham (1941) stated that the hybrid 'with intermediate characters and high sterility' was 'reported from Britain but needs confirmation', and Richards (1952, 1962) later made similar comments.

Agnew (1968) took a different view, for he considered that 'hybrids exist both as populations of hybrids and as populations introgressing with *J. effusus*',

and that 'hybrids observed in the field moreover appeared fully fertile'. Agnew recorded these hybrids only above 152m altitude, and mostly above 300m, in Scotland and north Wales. Davis (1970) reported this hybrid in Pembrokeshire at 120m in 1969, but the specimen deposited in NMW has well developed capsules and appears to me to be simply *J. conglomeratus*. There are specimens labelled *J. effusus* $\times$ *J. conglomeratus* in the herbaria at BM, K, NMW and UCNW from a range of localities in England, Wales and Scotland. In my view, however, all of these specimens can be at least equally well placed with one or other of the putative parents. Some of the specimens are too young, others are too old, yet others are abnormal in some way or have deteriorated on drying; as a result various workers have doubted that such specimens can be conveniently accommodated in either species. The relatively close similarity of the species and their considerable variability has added to the problem. I am not attempting to deny that hybrids exist, but I have seen none despite many searches in mixed populations, and I have not heard any convincing evidence of their existence.

Much the same situation exists on the continent of Europe as in Britain. Both the above hybrids involving *J. conglomeratus* were recorded by Ascherson & Graebner (1904) from several European countries, and there are many subsequent records in Floras and many specimens so labelled in herbaria. Kriska (1962), from a study in Czechoslovakia, considered that *J. effusus* and *J. conglomeratus* represented only end-points in a continuous series, whereas most other authors (except Agnew) have identified hybrids by their sterility. But to me the evidence concerning the existence of either hybrid in Europe is as unconvincing as it is in Britain.

Both the hybrids have received binomials: the hybrid with *J. inflexus* has been described as *J. $\times$ ruhmeri* Aschers. & Graebn.; that with *J. effusus* as *J. $\times$ kern-reichgeltii* Janch. & Wacht. ex van Ooststr. The earlier names for the latter (*J. $\times$ brueggeri* Domin and *J. $\times$ haussknechtii* P. Fourn., non Ruhm.) are both invalid, and the validly published names are, of course, only applicable if the type specimens are genuine hybrids.

HYBRIDS INVOLVING *JUNCUS BALTICUS* AGG.

In Europe there are two taxa which are sometimes considered specifically distinct from *J. balticus*: *J. pyrenaicus* Jeanb. & Timb. and *J. arcticus* Willd. The first is confined to the Pyrenees and is not known to form hybrids. It is nowadays usually reduced to a synonym of *J. balticus*. *J. arcticus* is variously considered a distinct species or a subspecies of *J. balticus*. It occurs in more northern latitudes than *J. balticus*, but like that taxon it is also found on mountain ranges further south in Europe, where, however, the two taxa are never sympatric.

Both *J. arcticus* and *J. balticus* form hybrids with *J. filiformis*. The combination *J. balticus* $\times$ *J. filiformis* is known as *J. $\times$ inundatus* Drej., and appears to be frequent in suitable areas (usually duneslacks) all around the Baltic Sea where the two parents occur together, and similarly in Norway (Flatberg 1970) and Iceland. *J. arcticus* $\times$ *J. filiformis* (= *J. $\times$ montellii* Vierh.) is recorded in northern parts of Scandinavia (including Iceland) and in south Greenland, where *J. arcticus* replaces *J. balticus*, and also in a few areas of the Alps of Switzerland (Welten 1967) and France.

Neither of these two hybrids occurs in Britain; *J. arcticus* is not British, and *J. balticus* never occurs in close proximity to *J. filiformis* in this country. Hybrids between *J. balticus* and *J. arcticus* are sometimes recognised in Scandinavia (including Iceland). By those botanists who consider these two taxa subspecies of one species such presumed hybrids are known as *J. arcticus* subsp. *intermedius* Hyl. Hylander (1953) also recognises hybrids between this taxon and *J. filiformis*.

The only other hybrid reported for the continent of Europe is *J. balticus* $\times$ *J. effusus*, of which I have traced three records. It was described as *J. scalovicus* by Ascherson & Graebner (1893), from wet sand-dunes near the Baltic Sea coast of East Prussia (now Kaliningrad, U.S.S.R.), but S. Snogerup of Lund has informed me that the type specimen is probably *J. balticus* $\times$ *J. filiformis*. Rothmaler (1965) described the hybrid *J. balticus* $\times$ *J. effusus* var. *compactus* Hoppe under the binomial *J. $\times$ obostritorum* Rothm. from the Baltic Sea coast of northern East Germany. This locality is about 600 km west of the locality of *J. $\times$ scalovicus*, but both lie in the geographical range of *J. balticus* $\times$ *J. filiformis*. Further comment on these two plants must await a close examination of the type specimens. Flatberg (1970, *in litt.*) has informed me that he discovered what he considers to be *J. balticus* $\times$ *J. effusus* in Norway in 1970.

In Britain there exist colonies of *J. balticus* $\times$ *J. effusus* and *J. balticus* $\times$ *J. inflexus* (Stace 1970, 1970a); at least the latter is believed to be endemic. The former hybrid has been found in two sites and the latter in three; all five localities are in the Lancashire coastal dune systems between Liverpool and Blackpool (Fig. 1). None of the discoveries was published at the time, and it seems that the only printed records apart from the two mentioned above are in Travis's *Flora of South Lancashire* (Savidge *et al.* 1963), and in the report of a B.S.B.I. field trip to the area in 1954 (Allen 1955).

J. balticus $\times$ *J. effusus* was first noticed by S. Taylor in July 1933, and was sent by F. W. Holder to Kew, where it was wrongly determined as *J. $\times$ diffusus*. This specimen at K has since been determined as *J. balticus* by two independent authorities. The colony was apparently first correctly named in 1954, on the above B.S.B.I. field meeting, the name representing a consensus of obviously expert opinion. Confirmation of its identity rests on anatomical evidence (Stace 1970, 1970a). The locality remained known to a few local botanists, who now and then pointed it out to interested visitors, and it was independently discovered by several others. The colony lay in a fairly wet duneslack just to the south of the tip of the road from Ainsdale Station to the shore, at Locality 1 in Fig. 1. Unfortunately there is no note of the extent of the colony at the time of its discovery, but in 1966 it completely covered an area approximately 40 by 20 metres in the wettest part of the duneslack. The colony then also had a few disjunct offshoots up to 20m from the main patch, presumably originating from the extensive human disturbance in the area. In 1968 the entire colony was eradicated by the construction of a holiday camp as part of a large-scale development of the Ainsdale Beach area. Fortunately samples of the colony had previously been removed to the Ainsdale Sand Dunes National Nature Reserve, 2km south-west of the development, where they are thriving (Fig. 1, Locality 9). Herbarium specimens collected after the last war are present at BM, CGE, K and LIV.

In 1966 Miss V. Gordon noticed a single tuft of '6-inches' diameter of an unusual *Juncus* in the small dune system close to Hightown (Fig. 1, Locality 2), some 9km south of the Ainsdale hybrid. In 1970 she re-found the tuft, then

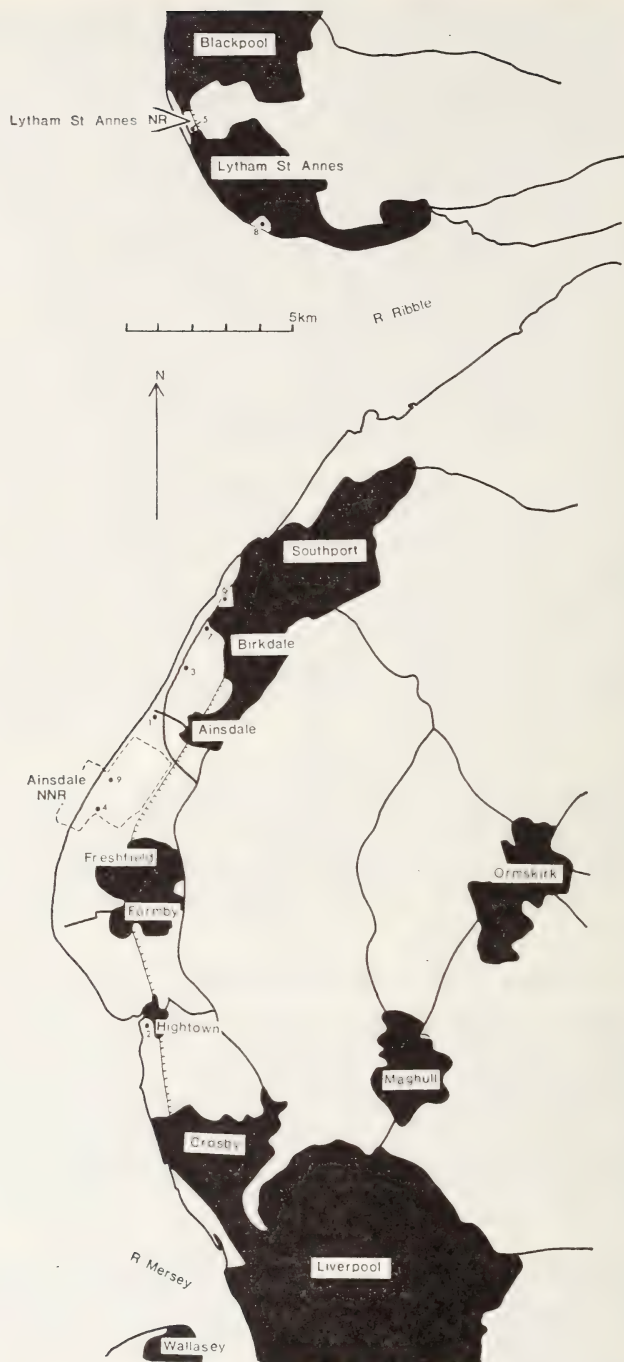


FIGURE 1. Distribution of *Juncus balticus* and its hybrids in Lancashire.

about 0.5 square m, and kindly brought it to my attention. Anatomical study showed that it represents the same taxon as the Ainsdale hybrid, of which it is therefore the only remaining wild representative. The colony is close to new housing development.

J. balticus $\times$ *J. inflexus* exists in three localities. It was first discovered by D. E. Allen in 1951 (not 1952 as given by Savidge *et al.* (1963) and repeated by Stace (1970)) in a duneslack between Birkdale and Ainsdale (Fig. 1, Locality 3), about 2 km north-east of the Ainsdale hybrid locality. It also was apparently first named accurately by the combined efforts of the members of the 1954 B.S.B.I. field meeting, and their identification has since been checked anatomically (Stace 1970, 1970a). In 1970 the colony measured approximately 20 m square, and was obviously spreading vigorously. A further colony of the same hybrid was discovered in the period 1950–52 about 4 km to the south-west, in what is now the Ainsdale Sand Dunes National Nature Reserve (Fig. 1, Locality 4), by Miss B. Blanchard, who surveyed that area in the years 1949–52 (Blanchard 1952). She referred to the plant as '*Juncus* sp.', but mentioned that P. W. Richards, to whom she sent a sample, had commented that it was 'possibly' *J. inflexus* $\times$ *J. balticus*. Her discovery was not publicised at the time, and the colony has been independently rediscovered since by several other workers. In 1970 the plant covered an area about 15 m to 20 m square. Specimens from both these colonies of *J. balticus* $\times$ *J. inflexus* are in **BM** and **K**.

In 1966 I came across a clone of an obviously hybrid *Juncus*, approximately 10 m by 5 m in extent, on the area of coast known as Starr Hills, about 18 km north of Ainsdale (Fig. 1, Locality 5). The site is in the dunes on the Fylde coast, viz. that stretch of coastline lying between the Ribble and Lune estuaries, and therefore in v.c. 60 (West Lancaster) rather than v.c. 59 (South Lancaster). The area forms a small but significant buffer between the heavily developed urban areas of Blackpool and Lytham St Annes, and in 1968 the latter Borough declared it the 'Lytham St Annes Nature Reserve'. It is the last remaining undeveloped area of dunes in the Fylde. Anatomical study shows that the plant is undoubtedly *J. balticus* $\times$ *J. inflexus*, although in morphological features (particularly height and vigour) it differs somewhat from the other two colonies of that hybrid.

J. balticus $\times$ *J. inflexus* has not so far received a binomial.

DISCUSSION

Using any yardstick the occurrence of five colonies of two extremely rare or endemic hybrids on less than 30 km of coast is certainly remarkable. Conceivably the two *J. effusus* $\times$ *J. balticus* colonies, and the two south Lancashire *J. inflexus* $\times$ *J. balticus* colonies, are single clones, but even in that case three separate hybridizations must have taken place. The situation is all the more remarkable since the putative parents are frequently found in close association in many other areas of Europe, particularly in parts of Scotland and the Baltic Sea coasts. Many possible explanations of this anomaly present themselves, but clearly the correct one can be obtained only by experimental work.

There remains the possibility, of course, that these hybrids may occur elsewhere than in Lancashire. *J. inflexus* $\times$ *J. balticus* is a distinctive plant, and one unlikely to be overlooked in a well-explored region. But *J. effusus* $\times$ *J. balticus* is superficially very similar to *J. filiformis* $\times$ *J. balticus*, which is widespread in

the Baltic region and may have caused the former to be overlooked. Moreover, both these hybrids superficially resemble certain slender specimens of *J. balticus* itself, particularly the variant known as var. *pseudo-inundatus* Aschers. & Graebn.

There are other aspects of these plants which can only be explained by experimental work. The variation of the hybrids, particularly *J. inflexus* $\times$ *J. balticus* and to a lesser extent *J. inflexus* $\times$ *J. effusus*, is a notable feature and one which demands an investigation of the fertility of the hybrids. A high level of sterility is often considered characteristic of *Juncus* hybrids. The hybrids of *J. balticus* seem completely seed-sterile, except some variants of *J. balticus* $\times$ *J. filiformis*, but *J. inflexus* $\times$ *J. effusus* produces a varying amount (albeit often nil) of fertile (i.e. germinable) seed, a fact which contributed to the relatively late recognition of this plant as a hybrid. Plants which have been named as hybrids involving *J. conglomeratus* are sometimes sterile, but sometimes highly fertile. The question of the very existence or otherwise of *J. conglomeratus* hybrids is one which will not be settled until comprehensive breeding programmes have been completed.

A further feature of significance with regard to the Lancashire hybrids of *J. balticus* is the distribution of *J. balticus* in Britain. According to Druce (1932) it was first recorded in Scotland in 1821. Elsewhere in Britain it is confined to Lancashire, where it was first discovered on 29th May, 1913 by R. S. Adamson (Adamson 1913, 1914, Wheldon 1914). Several comments make it clear that it was there 'very local' as it is now. Adamson (1913) concluded that it occurred in only 'one series of dune hollows', and Wheldon (1914), after much unsuccessful searching in July 1914, concluded that 'it seems to be limited on our dunes to the very restricted area in which it was first discovered.' Specimens exist in several national and local herbaria (e.g. **BM**, **CGE**, **K**, **LIV**, **MANCH**, **NMW** and **OXF**) dating from the first record and from a return visit to the colony made by Adamson, Wheldon and W. G. Travis on 4th October, 1913. Nevertheless the precise location and distribution of the plant at that time is still uncertain.

At present three separate colonies are known to me within about 1km of one another at the southern end of Birkdale, close to the limit of housing development (Fig. 1, Localities 6 & 7). The main colony at Locality 6 was largely destroyed in 1968 by the construction of the new coastal road from Ainsdale to Birkdale, but a very small part remains on the seaward side. Moreover in 1969 N. A. Robinson discovered a further colony approximately 50m to the south-west, a few yards seaward from the new road, thinly distributed over an area about 20m by 15m. The third colony (Locality 7) is in a slack about 1km southwards, just beyond the present limit of housing, a few yards landward of the new road. It is scattered over an area approximately 20m by 10m.

Clearly all these colonies are in danger of eradication; and so one or two portions have been transferred to the Ainsdale Sand Dunes National Nature Reserve further south (Fig. 1, Locality 9), where they are just holding their own. These are not the first attempts at transplantation. In a letter to A. Bennett, dated 28.X.1913 and attached to an herbarium sheet in **BM**, Travis wrote: 'We thought it advisable to put down some rhizomes and scatter seeds of the plant in a large slack nearer to Ainsdale where it is less likely to be disturbed'. Whether or not these survived is unknown.

Localities 6 and 7 are referred to by Savidge *et al.* (1963) as 'Birkdale' and

'Hillside' respectively. Judging from notes from various sources (especially Travis's manuscript Flora at LIV) it seems likely that the original locality was at Birkdale, and that the Hillside site was discovered by Travis in 1929, but whether the present sites are exactly the same as the original one(s) or not is uncertain. The above three localities lie between approximately 1.5 and 13.5 km from the five Lancashire localities of *J. balticus* hybrids.

The second Lancashire record of *J. balticus* was made by E. S. Marshall on 10th August, 1914 (Marshall 1915, 1916, Wheldon & Wilson 1925) at Ansdell, near Lytham St Annes (Fig. 1, Locality 8), in West Lancaster. This was interestingly enough only about 4 km from the third site for *J. inflexus* $\times$ *J. balticus*. Only two specimens collected at the time have been traced (E and NMW), but a specimen collected by the late H. E. Bunker in 1947 at 'St. Annes, by Queen Mary School' is present in Bunker's herbarium, which is now in the possession of Mrs Bunker (*vide* E. F. Greenwood). Marshall originally described the plant as 'rare' at Ansdell, but Whellan (1948) found it 'abundant in one damp spot in the dunes' in 1946. The colony was eradicated by development in 1965. Literature comments and the herbarium material make it clear that the plants belonged to the var. *pseudo-inundatus* referred to previously, and not (like the Birkdale examples) to the type variety.

J. balticus has also been recorded on the coast of Furness in north Lancashire (Druce 1932, Wilson 1938, Perring & Walters 1962), but no herbarium specimens have been traced and the circumstances of the alleged discovery have not been uncovered. Unless confirmation is obtained the record is best treated as dubious.

The origin of the *J. balticus* hybrids is presumably from recent crosses in Lancashire. But the origin of the Lancashire *J. balticus* is less obvious. The lack of any records prior to 1913, and the very restricted extent of the colonies, tend to suggest a recent arrival, perhaps by sea-borne rhizomes. If the var. *pseudo-inundatus* is a genetically-determined variant, it would seem that at least two separate immigrations have occurred.

Because of the great rarity and precarious existence of these colonies of *J. balticus* and its hybrids small portions of all of them (except from the extinct Locality 8) are kept in the Manchester University Botanic Garden. With occasional weeding but no other attention they thrive in ordinary garden soil and show a rate of spread not found in the wild populations. Voucher herbarium specimens from all these colonies are preserved at MANCH.

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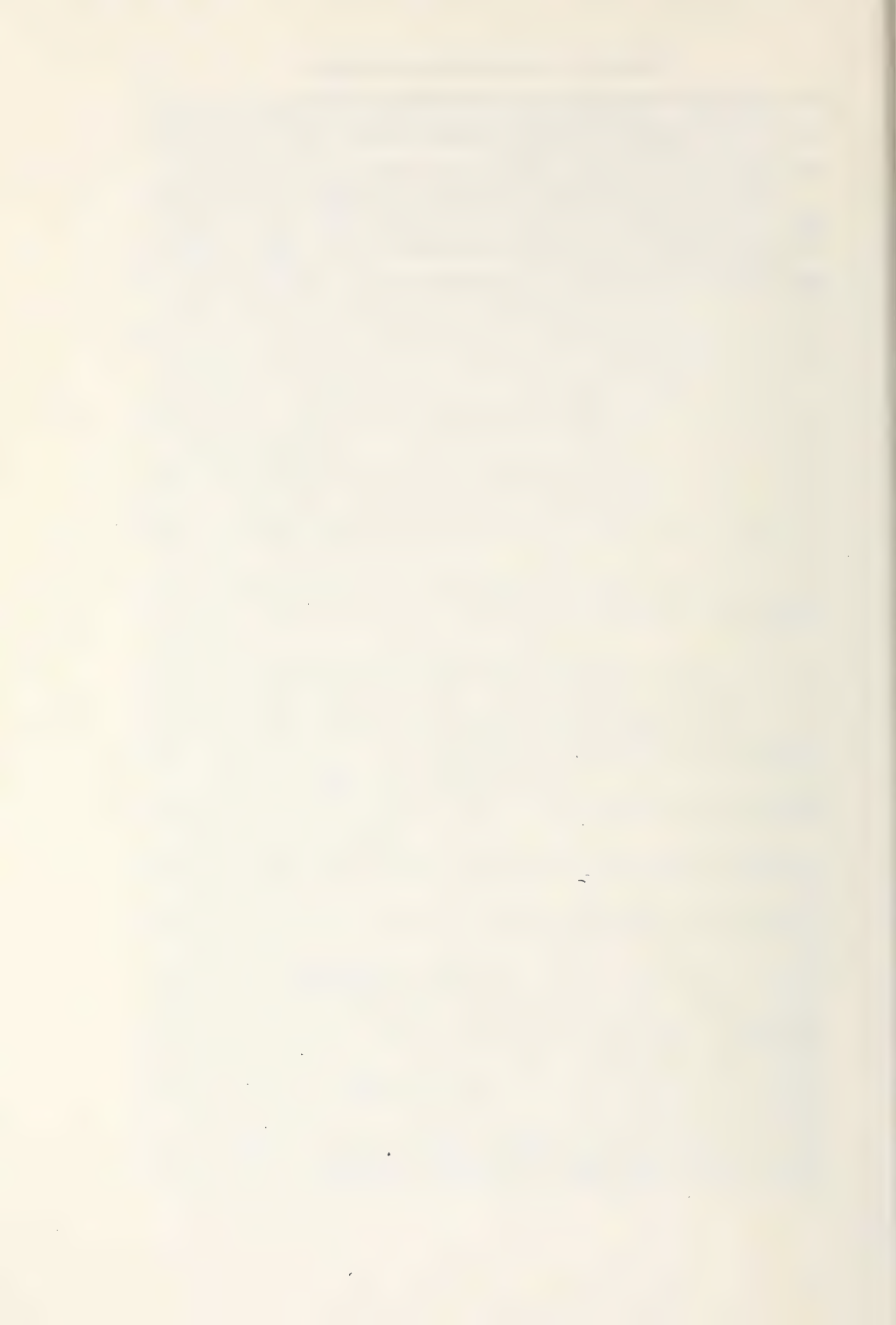
I am grateful to many people for supplying helpful information, but wish to mention by name D. E. Allen, Vera Gordon, N. A. Robinson, and particularly E. F. Greenwood who provided many of the facts concerning the history of the Lancashire *J. balticus*. Thanks are also due to the Nature Conservancy for permitting me to work in the Ainsdale National Nature Reserve.

REFERENCES

- ADAMSON, R. S. (1913). *Juncus balticus* Willd. in England. *J. Bot., Lond.*, **51**: 350-352.
ADAMSON, R. S. (1914). *Juncus balticus* Willd. *Rep. botl Soc. Exch. Club Br. Isl.*, **3**: 394, 499.
ADAMSON, R. S. (1920). *Juncus effusus* $\times$ *conglomeratus*? *Rep. botl Soc. Exch. Club Br. Isl.*, **5**: 840.

- AGNEW, A. D. Q. (1968). The interspecific relationships of *Juncus effusus* and *J. conglomeratus* in Britain. *Watsonia*, **6**: 377–388.
- ALLEN, D. E. (1955). Field Meetings, 1954: Southport (Lancs.). *Proc. bot. Soc. Br. Isl.*, **1**: 543–546.
- ANSELL, J. (1846). On the occurrence of *Juncus diffusus* near Hoddesdon, and on its specific distinctness from *J. glaucus*. *The Phytol.*, **2**: 662–663.
- ASCHERSON, P. & GRAEBNER, P. (1893). Beiträge zur Kenntnis der norddeutschen Flora. *Ber. Dt. bot. Ges.*, **11**: 516–530.
- ASCHERSON, P. & GRAEBNER, P. (1904). *Juncus*, in *Synopsis der Mitteleuropäischen Flora*, **2**(2): 415–490. Leipzig.
- BABINGTON, C. C. (1843). *Juncus diffusus* Hoppe and *Drosera obovata* M. & K. *Annal. Mag. nat. Hist.*, **11** (67): 78.
- BACKHOUSE, J. (1844). Note on *Juncus diffusus*? *The Phytol.*, **1**: 1140.
- BLANCHARD, B. (1952). *An ecological survey of the vegetation of the sand-dune system of the south-west Lancashire coast, with special reference to an associated marsh flora*. Ph.D. thesis. University of Liverpool.
- BOSWELL-SYME, J. (1870). *Juncus glaucus* Sibth. var. *pseudo-diffusus*. *J. Bot., Lond.*, **8**: 263.
- BOWEN, H. J. M. (1968). *The Flora of Berkshire*, p. 277. Oxford.
- CLIFFORD, H. T. (1959). On putative hybrids between *Juncus inflexus* L. and *Juncus effusus* L. *Kew Bull.*, **13**: 392–395.
- DANDY, J. E. (1958). *List of British Vascular Plants*. London.
- DAVIS, T. A. W. (1970). Field Meetings, 1969: Pembrokeshire. *Watsonia*, **8**: 188.
- DRUCE, G. C. (1884). *Juncus diffusus* Hoppe. *J. Bot., Lond.*, **22**: 348.
- DRUCE, G. C. (1908). *The British Plant List*. Oxford.
- DRUCE, G. C. (1919). Additions to the Berkshire Flora. *Rep. botl Soc. Exch. Club Br. Isl.*, **5**: 443–480.
- DRUCE, G. C. (1928). *British Plant List*, 2nd ed. Arbroath.
- DRUCE, G. C. (1932). *The Comital Flora of the British Isles*, pp. 300–301. Arbroath.
- FLATBERG, K. I. (1970). The hybrid *Juncus balticus* Willd. × *filiformis* L. in Norway. *Blyttia*, **28**: 1–20.
- GIBSON, G. S. (1862). *The Flora of Essex*, p. 320. London.
- HANBURY, F. J. (1886). *The London Catalogue of British Plants*, 8th ed. London.
- HANBURY, F. J. (1895). *The London Catalogue of British Plants*, 9th ed. London.
- HANBURY, F. J. (1908). *The London Catalogue of British Plants*, 10th ed. London.
- HANBURY, F. J. (1925). *The London Catalogue of British Plants*, 11th ed. London.
- HYLANDER, N. (1953). *Juncus* L., in *Nordisk Kärleväxtflora*, **1**: 160–182. Stockholm.
- KRISA, B. (1962). Relations of the ecologico-phenological observations to the taxonomy of the species *Juncus effusus* L. s.l. *Preslia*, **34**: 114–126.
- MARSHALL, E. S. (1915). *Juncus balticus* Willd. in W. Lancs. *J. Bot., Lond.*, **53**: 91, 147–148.
- MARSHALL, E. S. (1916). *Juncus balticus* Willd. var. *pseudo-inundatus* A. & G. *Rep. botl Soc. Exch. Club Br. Isl.*, **4**: 214, 283.
- NOTCUTT, W. L. (1846). *Juncus diffusus*. *The Phytol.*, **2**: 674.
- PERRING, F. H. & SELL, P. D., ed. (1968). *Critical Supplement to the Atlas of the British Flora*, p. 140. London.
- PERRING, F. H. & WALTERS, S. M., ed. (1962). *Atlas of the British Flora*, pp. 319–320. London.
- RICHARDS, P. W. (1943). *Juncus filiformis* L., in *Biological Flora of the British Isles*. *J. Ecol.*, **31**: 60–65.
- RICHARDS, P. W. (1952). *Juncus*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, pp. 1240–1254. Cambridge.
- RICHARDS, P. W. (1962). *Juncus*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 984–994. Cambridge.
- RICHARDS, P. W. & CLAPHAM, A. R. (1941). *Juncus* L., in *Biological Flora of the British Isles*. *J. Ecol.*, **29**: 362–391.
- ROTHMALER, W. (1965). Beiträge zur Kenntnis der Flora von Mecklenburg II. *Wiss. Z. Ernst-Moritz-Arndt Univ. Greifswald*, **14**: 77–92.
- SAVIDGE, J. P., HEYWOOD, V. H. & GORDON, V., ed. (1963). *Travis's Flora of South Lancashire*, p. 299. Liverpool.
- STACE, C. A. (1970). Unique *Juncus* hybrids in Lancashire. *Nature, Lond.*, **226**: 180.
- STACE, C. A. (1970a). Anatomy and taxonomy in *Juncus* subgenus *Genuini*, in ROBSON, N. K. B., CUTLER, D. F. & GREGORY, M., ed. *New Research in Plant Anatomy*, pp. 75–81. London.

- TWEED, R. D. & WOODHEAD, N. (1946). A consideration of *Juncus effusus* L. and *Juncus conglomeratus* L. *J. Ecol.*, **33**: 210–213.
- TWEED, R. D. & WOODHEAD, N. (1949). The taxonomy of *Juncus effusus* L. and *Juncus conglomeratus* L. *N. West. Nat.*, **22**: 216–222.
- WELTEN, M. (1967). *Juncus arcticus* Willd. neu im westlichen Berner Oberland und in den nördlichen Schweizeralpen und der Bastard *Juncus arcticus* Willd. × *J. filiformis* L. neu in den Alpen. *Bauhinia*, **3**: 345–357.
- WHELDON, J. A. (1914). On the older dunes at Ainsdale. *Lancs. Chesh. Nat.*, **7**: 149–150.
- WHELDON, J. A. & WILSON, A. (1925). West Lancashire Flora: Notes, additions and extinctions. *Lancs. Chesh. Nat.*, **17**: 117–125.
- WHELLAN, J. A. (1948). *Juncus balticus* Willd. *Rep. botl Soc. Exch. Club Br. Isl.*, **13**: 311.
- WILSON, A. (1938). *The Flora of Westmorland*, p. 233. Arbroath.



The pollination ecology of *Viola*. 2, Pollen loads of insect-visitors

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ABSTRACT

The pollen loads of insects associated with populations of *Viola riviniana* Reichb., *V. reichenbachiana* Jord. and *V. hirta* L. were analysed. An unexpected variety of insects carried *Viola* pollen either alone or mixed with foreign types. Combinations of more than two types (when one was *Viola*) were rare among the pollen loads of bees but common among those of hoverflies. Despite the deliberate selection for study of areas with high densities of *Viola* flowers there appeared to be some assortative foraging among the *Viola* visitor-species: the solitary bees and hoverflies exhibited preferences for actinomorphic flowers, while the social bees exhibited preferences for stereomorphic and zygomorphic flowers. However, by flowering very early in spring, *Viola* may experience little competition for pollen vectors and, by harbouring both nectar and pollen, the chasmogamous flowers may provide vital food sources for anthophilous insects and so receive frequent visits. This may contribute significantly to the incidence of cross-pollination.

Many insects which carried pure loads of *Viola* pollen had foraged exclusively among its flowers and shown temporary constant behaviour toward them. Such constancy exhibited by a variety of visitor-species would have two important effects upon pollination: firstly, the quantity of compatible pollen transferred to the stigmatic cavities would increase, thereby ensuring the maximum fertilization of ovules. Secondly, pollen exchange between chasmogamous flowers would be maintained, possibly at a significant level for the immediate and future evolution of the population.

INTRODUCTION

Many species of *Viola* produce seed by means of both cleistogamous and chasmogamous flowers. The cleistogamous flowers are cryptic, obligately self-pollinated and yield the majority of seed in any given season (Valentine 1962, Clausen, Channel & Uzi Nur 1964). By contrast, the chasmogamous flowers are conspicuous, dependent upon insect visits for pollination and frequently fail to set seed. For this reason, in-breeding seems to be the rule with occasional out-breeding resulting from irregular visits of insect pollinators to the chasmogamous flowers. As an insect visit may initiate a small burst of variation through cross-pollination, it may be of considerable importance to the evolution of the population involved. Unfortunately, because of the irregularity or rarity of insect visits, they are extremely difficult to sample. One means of circumventing this problem is to collect insects associated with the chasmogamous flowers and to examine their pollen loads for *Viola* pollen. Its presence betrays a visit to a violet flower. In this way a large enough sample may establish the frequency of visits and consequently the possibilities for out-breeding. The additional value of pollen load analysis is the evidence provided on the foraging

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patterns of pollen vectors. These, in turn, reflect some of the ecological factors operating on the in-breeding/out-breeding balance in *Viola* populations.

MATERIALS AND METHODS

The selection of habitats was governed by the location of suitably sized populations of one or more of the species *Viola riviniana* Reichb., *V. reichenbachiana* Jord. and *V. hirta* L. All the habitats chosen were in the chalk countryside of southern England, six near Winterslow, Wiltshire and one near Mickleham in Surrey. These have already been described in detail (Beattie 1969).

Collections of insects were made during the spring months of 1966 and 1967. Each day was divided into two collection periods, 10.00–13.00 hours and 14.00–17.00 hours, during which insects actually on violet flowers, and airborne insects in the habitat, were trapped and preserved. Forty-three species were found to have visited *Viola* flowers and these were termed visitor-species. Four hundred and one specimens of these were captured for examination, many whilst actually feeding from the flowers. Two hundred and fifty specimens of what turned out to be non-visitor-species were also trapped and examined. These included Lepidoptera, Diptera, Coleoptera, Hemiptera, Araneida and Opiliones.

Immediately after capture each specimen was placed in a 4:1 mixture of 70% ethanol and glycerol in an individual vial. The glycerol formed a viscous layer around the specimen which maintained integumental pollen at its original location. The term 'pollen load' commonly refers to the pollen accumulated by the specialised collecting hairs of bees (the pollen baskets). In the present study it was used to denote all the pollen carried by an insect including that found in the alimentary canal. Therefore, two operations were required for the analysis of each load: firstly, the examination of the integument and the centrifugation of the preservative (to concentrate any dislodged grains) and secondly, the scrutiny of the gut contents and faecal material.

Pollen preparations were mounted in fuchsin glycerine jelly. This semi-permanent mountant stained the grains red and rendered them instantly conspicuous among extraneous material.

A NOTE ON POLLEN CLASSIFICATION

A series of standard pollen preparations of species flowering in the habitats facilitated the identification of pollen removed from insects. Material was collected at the time of study and herbarium material was used as little as possible.

Pollen grains from 14 plant species were identified from the pollen loads. The flowers of these species were classified according to Leppik (1957). This scheme, which used characters of the form and symmetry of the flowers, was suitable for the detection of tendencies amongst the visitor-species to confine foraging to flowers of a particular structure or colour. In Leppik's classification, flowers may be actinomorphic, pleomorphic, stereomorphic or zygomorphic. Actinomorphic flowers are characterised by radial symmetry; the floral organs are arranged on one level, hence pollen and nectar are not usually concealed. Pleomorphic flowers are similar to the last but possess a smaller number of petals; 3, 5, or 6 are common. In stereomorphic flowers the nectar is concealed and insect-visitors must be able to distinguish three-dimensional patterns in order to locate it. Zygomorphic flowers are similar to the last but are characterised by bilateral symmetry.

Three species were difficult to fit into the scheme and were designated according to the availability of their nectar and pollen. The flowers of *Endymion non-scriptus* were regarded as stereomorphic because the corolla partially conceals the pollen and nectar and insects must probe deeply to find it. The category of actinomorphic flowers was expanded to include the actinomorphic inflorescences of *Taraxacum officinale* and *Bellis perennis*. This was done because the attraction mechanisms of these particular flowers and inflorescences were very similar: firstly with regard to the outlines, colours and colour contrasts, and secondly, food was as accessible in the inflorescences as in the flowers. In the flowers nectar was not concealed and in *Taraxacum* it usually filled the corolla-tubes nearly to the top. The pollen of both *Bellis* and *Taraxacum* was liberally dusted over insects which merely crawled over the capitula and was, therefore, as accessible as the pollen of actinomorphic flowers. In both types pollen and nectar were readily available to short-tongued insects.

A NOTE ON THE INSECT VISITORS

A full account of the insect-visitors of *Viola* is to be published shortly but a few comments are necessary here. The list of 43 visitor-species comprised 2 species of Lepidoptera, 21 species of Hymenoptera and 20 species of Diptera. The number and variety of insects in this list contrasted sharply with the paucity and uniformity of species in the lists of other authors (Saunders 1846, Muller 1883, Knuth 1908, Veerman & Van Zon 1965).

Two dimensions of insect-visitors generally considered to be important in the pollination of many flowers including violets, are the length of the extended proboscis and the total length (Knuth 1908). These are considered important in the pollination of *Viola* flowers because they partially determine the details of feeding behaviour, for example whether pollen or nectar can be taken, and in turn the extent of the contact between the insect and the floral genitalia.

All the visitor-species fell into four discrete categories according to the length of the proboscis:

- 1.0 – 4.0mm Small solitary bees (*Halictus*), small hoverflies (*Platychirus*) and all the casual visitors.
- 5.0 – 7.0mm Large solitary bees (*Osmia*), large hoverflies (*Rhingia*, *Eristalis*) and honeybees (*Apis*).
- 9.0 – 10.0mm Bee-flies (*Bombylius*), short-tongued bumblebees (e.g. *Bombus terrestris* L.).
- 13.0 – 14.0mm Longer-tongued bumblebees (e.g. *Bombus hortorum* L.).

Most of the visitor-species fell into two categories according to total length (which did not include the extended proboscis, antennae or sting):

- 6.0 – 11.0mm Most solitary bees, all hoverflies, bee-flies, and all scavenger flies.
- 16.0 – 18.0mm Most bumblebees, cuckoo bees.

At the extremes there were two further categories:

- 3.0 – 5.0mm Very small species of solitary bee.
- 19.0 – 21.0mm Large bumblebee species.

Three species of fly, *Bibio johannis* L., *Orthellia cornicina* Fabr., and *Scopeuma stercorarium* L., were very common in the habitats but were only occasionally

observed visiting violet flowers. Adults of *Bibio* and *Scopeuma* were known to be predacious on other insects (Colyer & Hammond 1951, Hobby 1933, 1934), and those of *Orthellia* were known to be coprophilous and necrophilous (Colyer & Hammond 1951). For these reasons it was thought that these insects were unlikely to visit violet flowers frequently and were probably of little significance as vectors of *Viola* pollen. Examination of large collections of them revealed that only 5% carried any pollen at all; consequently they were termed 'casual visitors'.

RESULTS

FORAGING

All the insects examined fell into one of the following four groups: 1. those which carried only *Viola* pollen, 2. those which carried a mixture of *Viola* pollen and foreign pollen, 3. those which carried only foreign pollen, and 4. those which carried no pollen at all. Fifty-five combinations of the fourteen pollen species were found in the pollen loads. These species were: A. from actinomorphic inflorescences: *Taraxacum officinale* agg., *Bellis perennis* L. (*Salix* spp. were included in this class), B. from pleomorphic flowers: *Ranunculus ficaria* L., *Anemone nemorosa* L., *Fragaria vesca* L., *Prunus spinosa* L., (*Fagus sylvatica* L. and *Mercurialis perennis* L. were included in this class), C. from stereomorphic flowers: *Endymion non-scriptus* (L.) Garcke, *Primula vulgaris* Huds., D. from zygomorphic flowers: *Viola* spp., *Ajuga reptans* L. and *Glechoma hederacea* L. This list reveals that anthophilous insects were exploiting almost every kind of flower available in the habitats.

Table 1 presents the evidence on foraging derived from the content of pollen loads. Of the 401 specimens examined, 144 individuals carried *Viola* pollen, 46 (32%) as completely pure loads and 98 (68%) as a mixture of *Viola* and foreign pollen. Sixty loads containing the most frequent pollen species are listed in column 4. The remaining 38 combinations were so infrequent as to provide little significant information on foraging save that occasional visits were made to less frequent flowering species.

Forty-six individuals representing all four visitor classes carried completely pure loads of *Viola* pollen (column 3), while an additional 19 carried a pure load of *Viola* pollen either on the integument or in the gut with different pollen at the alternative site (column 4, V). Solitary bees carried the largest number of pure loads of both *Viola* and of foreign pollen. Seventy-two per cent of the specimens examined carried pure loads of one genus, 50% being pure loads of *Viola*. Most individuals of *Osmia bicolor* Schrank carried a pure load of *Viola* pollen, while a smaller proportion of *Andrena* spp. and *Halictus* spp. did so too. Social bees came second to solitary bees with regard to numbers of pure loads. Sixty-nine per cent of these insects carried them, 46% being *Viola* alone and the rest being chiefly *Endymion* and *Primula*.

Key to pollen species

V	<i>Viola</i> spp.	E	<i>Endymion non-scriptus</i> (L.) Garcke
T	<i>Taraxacum officinale</i> agg.	A	<i>Ajuga reptans</i> L.
B	<i>Bellis perennis</i> L.	M	<i>Mercurialis perennis</i> L.
P	<i>Primula vulgaris</i> Huds.		

Mixtures of *Viola* plus one of three other pollen species not shown accounted for a further 38 records, but each one occurred so rarely that inclusion was not warranted.

TABLE 1. ANALYSIS OF THE COMMONEST TYPES OF POLLEN LOADS OF *VIOLA* VISITOR-SPECIES

Insect Group	2		3 Number of specimens which carried <i>Viola</i> pollen and no other type	4 Number of specimens which carried pure pollen loads or a mixture with <i>Viola</i> at one or both of the two sites (integument and gut) †												
	Species	Number of specimens examined		V	E	E + V	T	T + V	M	M + V	P	P + V	A	A + V	B	B + V
SOCIAL BEES	<i>Apis mellifera</i>	4		1												
	<i>Bombus</i> spp.	22	10	2					3							
	Totals:	26	10	3	10	2			3	1		1			1	
SOLITARY BEES	<i>Osmia bicolor</i>	17	11	18												
	<i>Andrena</i> spp.	24	6	6			2				1					
	<i>Halictus</i> spp.	13	3	3			9									
	Totals:	54	20	27			11	6		1		1	4		3	
HOVER-FLIES	<i>Rhingia campestris</i>	20	5	5	3		1	2								
	<i>Eristalis</i> spp.	15	3	3	1		1	1								
	<i>Platychirus</i> spp. & <i>Melanostoma</i> spp.	81	4	10	15		3	9		1				3		
	Totals:	156	12	18	19	8	5	4	12	7	1	1	1	3	2	
FLIES	<i>Bombylius major</i>	20	1	5						16						
	Casual visitors	43	3	3	2		1	6						1		
	Totals:	63	4	8	2	1	1	2	6	1	16	4		1		
	Totals:	299	46	65	24	19	17	14	18	9	20	6	1	6	4	6

† If the particular load is restricted to one site, other pollen types may be present at the alternative site. Column 4V, for example, will include specimens with only *Viola* pollen (Column 3) and any specimens with *Viola* pollen at one site and another pollen type at the other.

Forty-seven per cent of hoverflies carried pure loads, 15% being of *Viola* only and the rest chiefly *Taraxacum*, *Bellis* and *Mercurialis*. The fly group included the bee-fly *Bombylius*, which contributed most of the scores for pure pollen loads in this category, excepting *Viola*, which was found chiefly on scavenger flies.

Two hundred and fifty-seven individuals carried either foreign pollen only or none at all. Of these, 138 were the casual visitors. It is possible that in some habitats the abundance of these insects may compensate for the rarity of *Viola* pollen in their pollen loads and so contribute to pollen exchange. However, as mentioned in the previous sections, this did not appear to be the case in the habitats studied.

Fig. 1 presents a record of foraging according to the numbers of plant species visited. Solitary bees were most constant to *Viola* and, in common with the social bees, rarely visited more than two species on individual foraging trips. All four groups showed some constancy to *Viola*, but the hoverflies exhibited the most indiscriminate foraging.

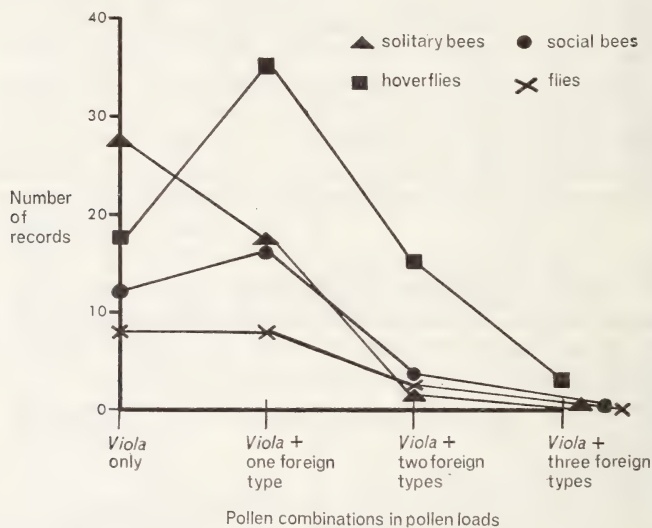


FIGURE 1. The number of pollen species in the pollen loads of the four groups of *Viola* visitors.

In Fig. 2, the foraging insects are grouped according to the floral structure of the species visited with a view to determining what importance this may have had on visiting behaviour in habitats apparently dominated by *Viola*. The first clear result was that actinomorphic and pleomorphic flowers were as important as violet flowers. Where *Viola* pollen was found in mixed loads, it was most frequently associated with actinomorph/pleomorph pollen. Inspection of Table 1 shows that this was chiefly a result of the loads carried by hoverflies and scavenger flies, and to a lesser extent solitary bees. Pollen loads of hoverflies exhibited the greatest complexity, including one load containing 5 pollen species. These 5 species represented a great variety of floral structure and enhanced the hoverfly reputation for the most promiscuous foraging. By contrast, the loads of social and solitary bees indicated a preference for stereomorphic and zygo-

morphic flowers: the commonest pollen combination for bumblebees was *Viola* plus *Endymion*, and *Viola* plus *Ajuga* was an important combination for solitary bees. Overall, the pollen most commonly associated with *Viola* was *Endymion* (Table 1, column 4). Individuals of each of the four visitor classes carried loads of foreign pollen but this was especially true of hoverflies.

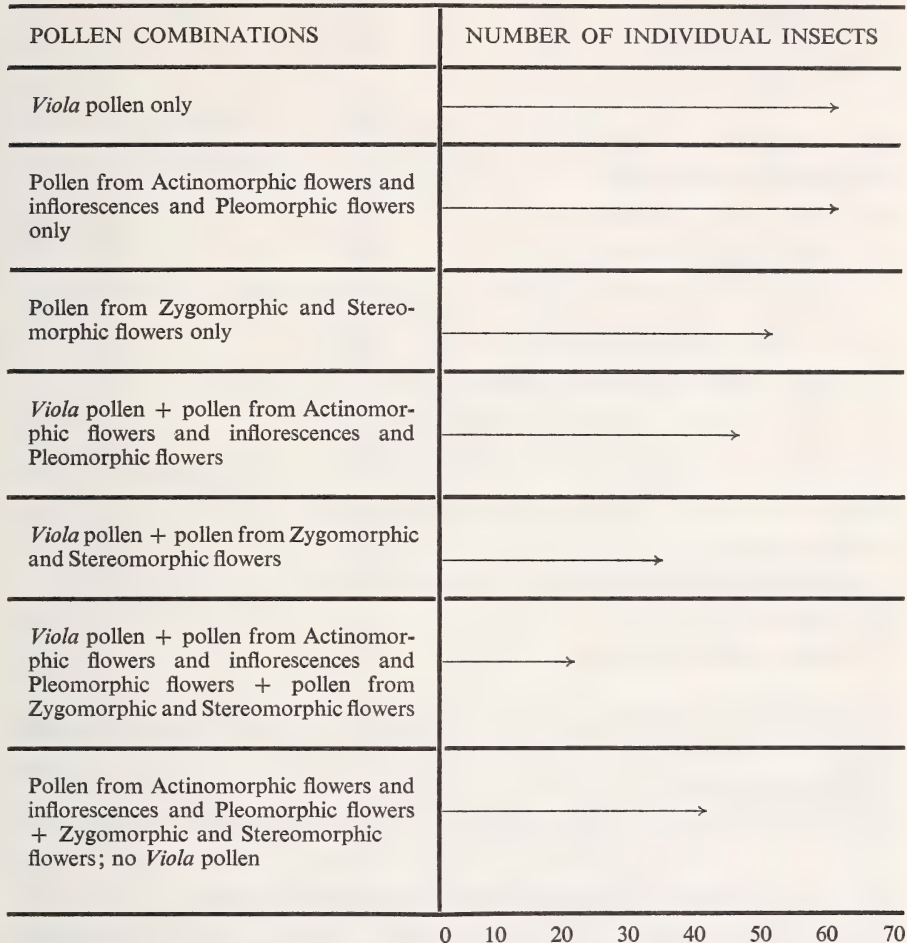


FIGURE 2. The number of individual insects which carried pollen from different flower types.

FOOD SOURCES

Fig. 3 shows the distribution of pollen upon the insects examined. A comparison of categories 1, 4, 8, and 9 with categories 2, 5, and 11 shows that of all the insects which carried *Viola* pollen, the majority carried it on the integument and not in the gut. Analysis of gut contents showed that *Viola* pollen was recorded only 26 times as opposed to 62 times for other pollen species—particularly *Taraxacum*, *Endymion* and *Mercurialis*. These data indicate that, although *Viola* pollen was the food of a variety of visitors, other flowers were the prime pollen source for most anthophilous insects.

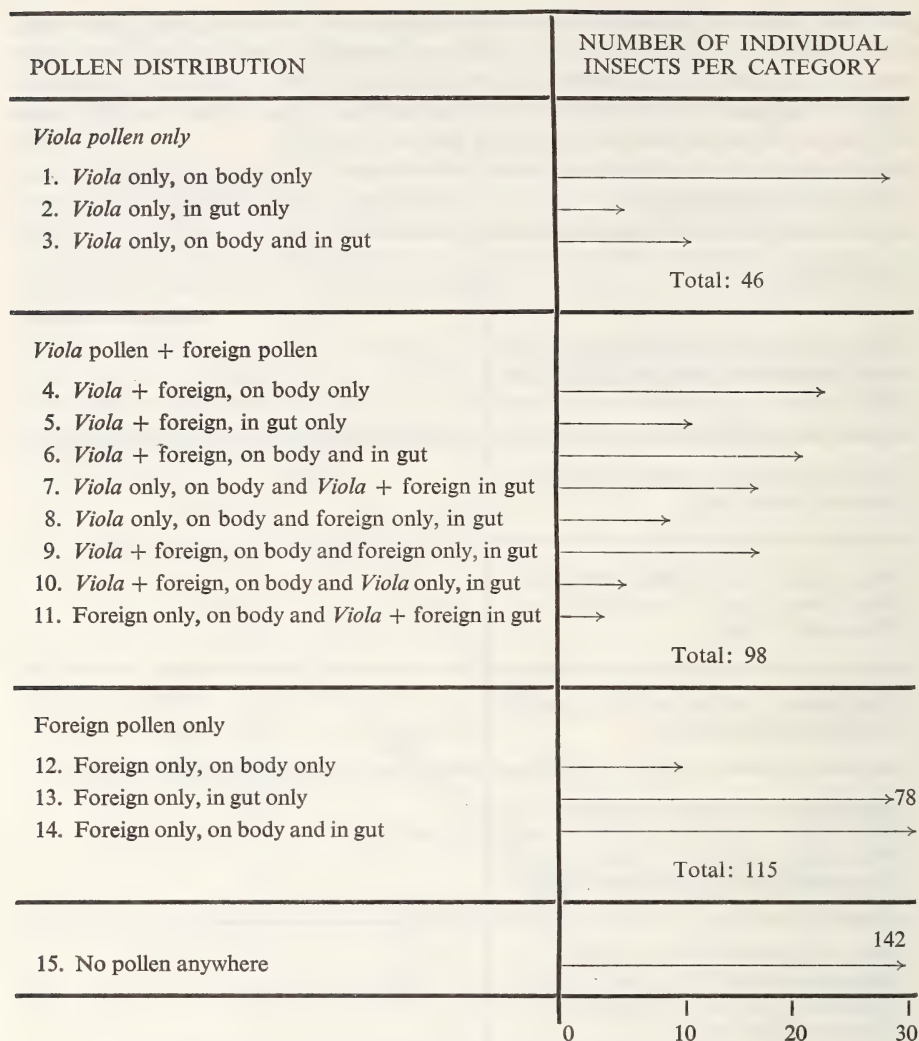


FIGURE 3. The distributions of pollen upon visitor-species.

Fig. 4 relates the pollen distributions of Fig. 3 to the proboscis-lengths and body-lengths of the insects concerned. It shows that the specimens which carried *Viola* pollen on the integument but not in the gut included insects with proboscides of greatly varying lengths. By contrast, the specimens with *Viola* pollen located only in the gut were almost completely confined to the class with the shortest proboscides (1.0–4.0 mm). With regard to body-length, it was clear that most of the insects which carried *Viola* pollen belonged to the class 6.0–11.0 mm. This information collectively suggests that the distribution of *Viola* pollen upon and within insect-visitors is a function both of proboscis and body-length. Proboscis-length seemed to be of particular importance, and influenced the complexity of pollen loads: the majority of individuals which carried a mixture of *Viola* plus foreign pollen belonged to the two classes with the shortest proboscides (1.0–4.0 mm, 5.0–7.0 mm).

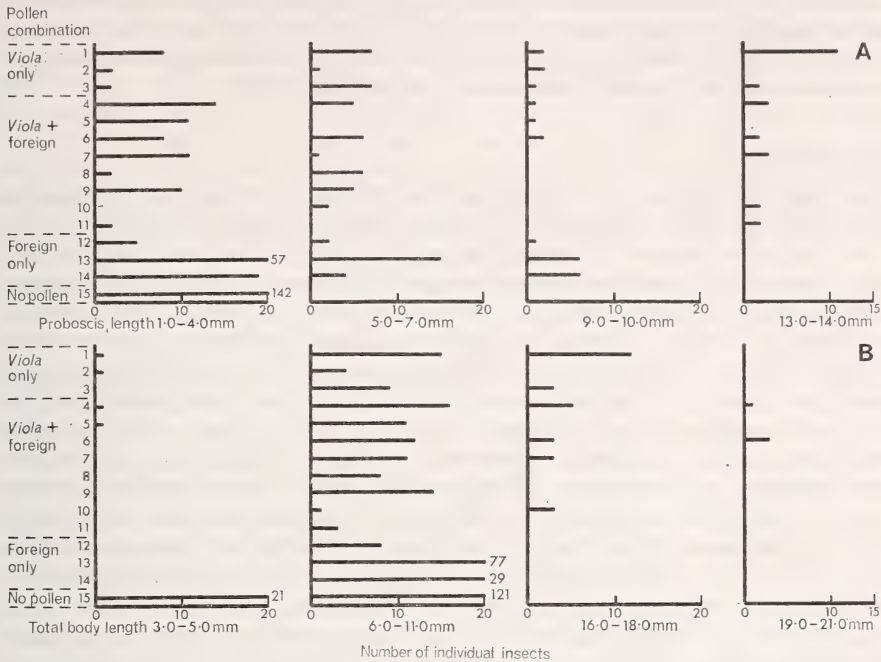


FIGURE 4. Diagrams to show the relationships between the fifteen pollen distributions listed in Fig. 3 and A. proboscis-length, and B. total body-length (but excluding proboscis, antennae or sting).

DISCUSSION

FORAGING

Despite the deliberate selection of habitats with an abundance of *Viola* flowers, the pollen of actinomorphic flowers and inflorescences occurred in pollen loads as many times as that of *Viola*. They were, therefore, at least as important as violets as forage plants for visitor-species. *Taraxacum* was the strongest competitor for *Viola* visitor-species, especially solitary bees and hoverflies. In fact, Graenicher (1935) and Free (1968) have noted that *Taraxacum* is a dominant plant even in the presence of a variety of attractive flowers including highly floriferous fruit trees. On the other hand, the stereomorphic and zygomorphic flowers which were predominantly blue (as opposed to yellow), were clearly the predominant forage plants for social bees; these showed a high preference either for *Viola* or for *Viola* plus one of these types, especially *Endymion*. The data suggest, therefore, some assortative foraging among the *Viola* visitor-species: the solitary bees and hoverflies with a preference for yellow actinomorphs and the social bees with a preference for blue stereo- and zygomorphs.

Mercurialis occupied a rather aberrant position relative to the scheme presented above. Its pollen was commonly found in gut contents and it was clearly an important pollen source. This was of particular interest as *Mercurialis* is generally regarded as wind-pollinated (Clapham, Tutin & Warburg 1962) and yet both honeybees and hoverflies were observed on later occasions combing stands of male *Mercurialis* and collecting or eating the pollen. Frequently their foraging would bring them into contact with female plants. The industry and abundance

of insects at male *Mercurialis* plants suggest that this species is an important pollen source, and that insect visitors could significantly increase pollen exchange between male and female plants. This possibility has been suggested for some otherwise wind-pollinated grass species by Bogdan (1962).

FOOD SOURCES

The relative infrequency of *Viola* pollen and the abundance of *Taraxacum*, *Endymion* and *Mercurialis* pollen in the gut contents suggest that the latter were the chief pollen sources. However, the evidence from pollen loads together with field observations confirms that visitors to *Viola* flowers utilize both the nectar and the pollen for food. Since the turn of the century, flowers of *Viola* have been regarded as 'nectar' flowers, i.e. they were visited exclusively for the nectar (Knuth 1908, Lovell 1918). This is strongly suggested by the elaborate zygomorphic flower with nectar concealed in a special organ and pollen confined within the androecium and its appendages. Indeed, many insects clearly obtained only nectar from the flowers. However, the theory did not take into account the ingenuity and persistence of many visitor-species, including short-tongued ones, which either extracted the pollen for direct consumption or carried it away to their nests to feed their larvae. The evidence that both nectar and pollen were taken from *Viola* flowers by a variety of insects, the predominance of mixed pollen loads and the occurrence of unexpected foraging on flowers such as *Mercurialis* together suggest that food was sometimes in short supply and that anthophilous insects were forced to visit all the available flower species and to investigate them persistently in order to get enough to eat. It is probable that *Viola* is a critical pollen source during very early spring when alternatives are in short supply. The dual availability of both nectar and pollen means that the flowers are particularly important resources at this time. Thus, by appearing very early in the season, when competition for pollen vectors may be least, and by harbouring both high-carbohydrate and high-protein food, the chasmogamous flowers receive sufficient insect visits to increase significantly the incidence of cross-pollination. This is an interesting case of ecological factors modifying the situation anticipated by floral biology theory.

CONSTANCY

During March, *Viola* flowers may predominate among the forage plants of many habitats. With the scarcity of alternative food sources many anthophilous insects, which later in the season would feed from less complex flowers, must nevertheless visit *Viola* for food. The result, as the data show (Table 1), is that the foraging of a variety of visitor-species is entirely confined to *Viola*. This behaviour may be termed 'pseudo-constant' since the insects involved have no choice of food.

True flower constancy is well known among anthophilous insects and there appear to be two main types (Linsley & MacSwain 1958). The first is exhibited by individual insects which confine their foraging to one flower species for a limited time. Thus, while many flower species may be exploited during the season, individual insects frequently carry pure pollen loads. The second type is characteristic of whole species or genera of insects and involves physiological, morphological and behavioural adaptations to one or a few species of food plant to which visits are obligatorily confined.

The present study did not reveal any evidence for the second, or obligatory kind of constancy. However, the solitary bees *Osmia*, *Andrena* and *Halictus* and the social bee *Bombus* carried many pure loads of *Viola* pollen. Also, in the field, these insects were observed visiting violets systematically and to the exclusion of other plant species. This evidence indicates that many visits to *Viola* resulted from the first kind of constancy, namely temporary constancy. Species of the four named genera have been shown to exhibit temporary constancy in other situations (Clements & Long 1923, Brittain & Newton 1933, Linsley & MacSwain 1958) and *Osmia biocolor* has been recorded in Germany as having a specific 'predilection' for *Viola* flowers (Schmiedeknecht 1930).

At first, the pure loads of *Viola* pollen carried by hoverflies were thought to result from pseudo-constancy. However, this was not the only cause. *Rhingia campestris* Meigen, when undisturbed, foraged sufficiently slowly to be closely observed. Individuals were seen to visit violets systematically and exclusively. Similar behaviour was noted in *Cheilosia variabilis* Panzer, and in the drone fly *Eristalis pertinax* Scopoli. Twenty-five per cent of *Rhingia* specimens, 20% of *Eristalis* specimens, and 5% of *Platychirus* and *Melanostoma* specimens carried only *Viola* pollen. Knoll (1926) and Ilse (1949), experimenting with possible colour preferences of hoverflies, showed that they responded consistently to some colours and not to others. Minderhoud (1951) discovered that the foraging behaviour of the hoverfly *Eristalomyia tenax* was very similar in many ways to that of honeybees and bumblebees, and Kugler (1970) reported instances of constancy in hoverflies. The possibilities of floral constancy among this insect group has been little explored, however, and this branch of pollination biology requires further study.

Constancy may be important in the pollination of *Viola* in two ways: Firstly, many violets bloom in early spring when food for anthophilous insects may be in short supply. It has been shown that when floral food resources are limited to the flowers of *Viola* the incidence of pollination can be unusually high (Beattie 1968). This may be attributed to the absence of competition with other blossoms for insect visits. On the other hand, when the flowers of a small number of other species are also available the incidence of pollination of *Viola* flowers may be extremely low and, further, the pollen clusters transferred to their stigmatic cavities may be contaminated with foreign types. The contamination of pollen loads lowers the efficiency of the pollination mechanism in *Viola* as foreign grains are ultimately transferred to the stigmatic cavities of the flowers. The style of the flowers of the three *Viola* species under consideration is cylindrical and hollow, its walls enclosing a lumen which is filled with mucilage. The stigmatoid tissue is confined to the walls of the lumen at the distal end of the style and the single point of ingress for pollen grains is a narrow opening at the tip. The opening of the stigmatic cavity is small in relation to the size of the pollen grains and the mechanisms necessary to manoeuvre them through it are fairly precise (Beattie 1971). In addition to this the capacity of most stigmatic cavities is only sufficient to accommodate a number of pollen grains equal to the number of ovules, and a few more. For these reasons pure pollen loads are at a premium as the passage of foreign grains into the stigmatic cavity will reduce the number of ovules fertilized. Constancy among *Viola* visitor-species would increase the frequency of pure pollen loads and so directly affect the number of seeds produced as a result of pollen exchange between chasmogamous flowers.

The second effect of constancy lies in the possibility that this behaviour is

exhibited by a cross-section of the visitor-species. The incidence of pollination could be maintained when the visits of one or several of the insect groups failed. This situation may have existed in two of the habitats where violets grew in very small clearings some distance from the edge of the wood. Bees rarely penetrated to this distance (a situation also mentioned by Kerner & Oliver 1895) but on sunny days these spots formed pools of sunlight frequented by hoverflies, especially of the genus *Eristalis* (also noted by Buckton 1895). Pollination of violets in these habitats was almost entirely dependent upon the foraging of hoverflies and would have been most efficient had they been constant to them.

In summary, constancy towards the flowers of *Viola* exhibited by all three groups of pollen vectors will have two important effects: 1. The number of pure pollen loads transferred to the stigmatic cavities will increase thereby ensuring the maximum number of ovules fertilized. 2. The level of pollen exchange between the chasmogamous flowers of the same or of different populations will be increased. Both of these effects may be of special significance in the context of the breeding system as a whole.

Many species of *Viola* are largely in-breeding and develop numerous obligatorily self-pollinated cleistogamous flowers later in the year. In addition to this the capsules produced by these flowers have ineffective dispersal mechanisms for the seeds, which are often dumped very close to the parent plant. The majority of seeds produced by many violet species are derived from these flowers (Valentine 1962, Clausen, Channel & Uzi Nur 1964), consequently large clumps of genetically similar plants are formed; an appropriate strategy for stable environments. On the other hand, cross-pollination of the chasmogamous flowers yields new genetic recombinants which, in conjunction with a more efficient dispersal mechanism, would appear to be most valuable in less stable environments. The combined effects of floral constancy to the chasmogamous flowers is the promotion of cross-pollination and out-breeding in a sexual system otherwise geared to systematic in-breeding.

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I am greatly indebted to Professor C. D. K. Cook for all his advice and help throughout the course of this research. I also wish to thank Dr Hal Mooney and Dr Peter Raven for reading and criticizing the manuscript. Without the hospitality of Sir Geoffrey and Lady Codrington this work could not have been carried out and I thank them for all their help. Mr Sankey of the Juniper Hall Field Centre has also been kind in providing facilities for fieldwork. The research was carried out under the tenure of a University of Liverpool postgraduate award.

REFERENCES

- BEATTIE, A. J. (1968). *Studies in the pollination of Viola*. Ph.D. thesis. University of Liverpool.
BEATTIE, A. J. (1969). Pollination ecology of *Viola*. I. Contents of stigmatic cavities. *Watsonia*, **7**: 142-156.
BEATTIE, A. J. (1971). Pollination mechanisms in *Viola*. *New Phytol.*, **70**: 343-360.
BOGDAN, R. V. (1962). Grass pollination by bees in Kenya. *Proc. Linn. Soc. Lond.*, **173**: 57.
BRITAIN, W. H. & NEWTON, D. E. (1933). A study in relative constancy of hive bees and wild bees in pollen gathering. *Can. J. Res.*, **9**: 334-349.
BUCKTON, G. B. (1895). *The natural history of Eristalis tenax or the drone-fly*. London.
CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. (1962). *Flora of the British Isles*, 2nd ed. Cambridge.

- CLAUSEN, J., CHANNEL, R. B. & UZI NUR (1964). *Viola rafinesquii*, the only *Melanium* violet native to North America. *Rhodora*, **66**: 32-46.
- CLEMENTS, F. E. & LONG, F. L. (1923). Experimental Pollination. *Carnegie Inst. Washington Publ.* 336.
- COLYER, C. N. & HAMMOND, C. O. (1951). *Flies of the British Isles*. London.
- FREE, J. B. (1968). Dandelion as a competitor to fruit trees for bee visits. *J. appl. Ecol.*, **5**: 161-178.
- GRAENICHER, S. (1935). Bee-fauna and vegetation of Wisconsin. *Ann. ent. Soc. Am.*, **28**: 285-310.
- HOBBY, B. M. (1933). Prey of *Scatophaga stercoraria* L. (Dipt. Cordyluridae). *J. ent. Soc. S. Engl.*, **1**: 106-110.
- HOBBY, B. M. (1934). Notes on predacious Anthomyiidae and Cordyluridae. *Entomologist's mon. Mag.*, **70**: 185-190.
- ILSE, D. (1949). Colour discrimination in the Dronefly *Eristalis tenax*. *Nature, Lond.*, **163**: 256.
- KERNER, A. & OLIVER, F. W., (1895). *The Natural History of Plants*, **2**. London.
- KNOLL, F. (1926). Insekten und Blumen. *Abh. zool-bot. Ges. Wien*, **12**: 1-645.
- KNUTH, P. (1908). *Handbook of flower pollination*, **2**. Oxford.
- KUGLER, H. (1970). *Blutenökologie*. Stuttgart.
- LEPPIK, E. E. (1957). Evolutionary relationships between entomophilous plants and anthophilous insects. *Evolution*, **11**: 466-481.
- LINSLEY, E. G. & MACSWAIN, J. W. (1958). The significance of floral constancy among bees of the genus *Diadasia* (Hymenoptera, Anthophoridae). *Evolution*, **12**: 219-223.
- LOVELL, J. H. (1918). *The Flower and the Bee*. New York.
- MINDERHOUD, A. (1951). De plaatsvastheid van insecten in verband met de plantenveredeling. *Meded. Dir. Tuinb.*, **14** (z): 61-70.
- MÜLLER, H. (1883). *The fertilisation of flowers*. London.
- SAUNDERS, W. W. (1846). Insects on Pansies. *Trans. R. ent. Soc. Lond.*, **4**: 77.
- SCHMIEDEKNECHT, O. (1930). *Die Hymenopteren Nord und Mitteleuropas*. Jena.
- VALENTINE, D. H. (1962). Variation and evolution in the genus *Viola*. *Preslia*, **34**: 190-206.
- VEERMAN, A. & VAN ZON, J. C. J. (1965). Insect pollination of pansies (*Viola* spp.). *Entomologia exp. appl.*, **8**: 123-134.

Plant records from Mull and the adjacent small islands. 3

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ABSTRACT

Further information is given on early publications relevant to the flora of the area. New records of special interest are noted and in the Systematic List additional data to those already published (Cannon & Bangerter 1968, 1970) on species new to the area and confirmations of some old records are provided.

INTRODUCTION

The five-year period of fieldwork originally planned by our Department as the basis for an account of the vegetation of Mull and the adjacent small islands terminated in 1970. The collation of data from the field, herbarium and library is now being actively undertaken, with the intention of publishing in the near future a 'County' Flora of the area. In the meantime, we present the third in a series of papers (Cannon & Bangerter 1968, 1970) which draw attention to new and interesting records resulting both from our own visits and those of our collaborators, whose assistance has been greatly appreciated by the Department.

To the sources of records previously published we are able to add the following. Robert Sibbald (1684) gives 'rocks of Inch-Columb' (Iona) as a locality for *Cochlearia anglica*. Apart from an unconfirmed record (Wilmott 1942) by the B.E.C. 1939 party, no other report of the occurrence of this species in our area has been traced. Our recent work suggests that these records are probably errors, although the map in the *Atlas* (Perring & Walters 1962) indicates that the existence of the species in our area cannot be ruled out.

Sibbald's record antedates the earliest previously known record for vascular plants which is to be found in Ray (1724). Here Ray quotes from a letter to Richard Richardson from Edward Lhwyd in which the latter recorded what he believed to be *Arctous alpinus* but which Lightfoot (1777), with justification, corrected to *Arctostaphylos uva-ursi*. We are indebted to our colleague J. H. Price for drawing our attention to the date (1699) and text of Lhwyd's original letter, published by Gunther (1945). In this same letter Lhwyd says 'Going up one of the high hills of Mul [sic] we found *Rhodia Radix*; *Pes Cati*; *Cotyledon hirsut*. *Vaccinia rubra*; *Sedum Alp. trifido folio*; and (which I had never seen grow spontaneously) *Alchimilla* [sic] *Alpina quinquefolia*'. These provide the earliest known records of, in modern nomenclature, *Sedum rosea*, *Antennaria dioica*, *Saxifraga stellaris*, *Vaccinium vitis-idaea*, *Saxifraga hypnoides* and *Alchemilla alpina*, in Mull and most likely for the whole of v.c. 103. John Macculloch M.D. (1819), in a work that provides a detailed account of the geology of the Western Isles, includes some observations on plants from those islands which were later grouped by Watson into his Mid Ebudes. The majority of these botanical observations concern Coll and Tiree, but a number provide

early records for Mull, Inch Kenneth and Staffa.

In *Cybele Britannica* (1847–1859), one of the most significant pioneer works on the British flora, H. C. Watson divided Great Britain into eighteen large areas as units of distribution for vascular plants. While the published work is familiar to serious students of the British flora, it is not generally known that the manuscript slips accumulated by Watson as the basis of his account are preserved in the library of this department. These slips, which we consider to be a useful source of information to compilers of Local Floras, are arranged primarily by species and then geographically into the groups of counties which constitute each area. Unfortunately the records although localised are normally not dated, but as they must be earlier than the date of the appropriate volume of the *Cybele*, they provide for some species the first known reference to its occurrence in our area. A paper entitled 'The Flora of the Island of Iona (Argyllshire)', left in manuscript by A. J. Wilmott, has recently been discovered in this department. It describes the results of a visit to the island in 1912 and internal evidence suggests that he wrote the paper in 1913. It is accompanied by a map which divides the island into five recording areas, but for the more interesting species precise localities are given. For some reason, Wilmott (1942) did not mention these earlier observations in his account of the 1939 B.E.C. excursion, perhaps because of his dissatisfaction, for which there is evidence, with the systematic list, which indeed contains some highly doubtful records. Finally, we acknowledge our indebtedness to Dr Heather Salzen, who lent us her notebook containing lists of plants observed by her in 1948 on the island of Ulva. This we found to be most useful in supplementing the information derived from Distribution Maps Scheme cards lent to us through the courtesy of Dr F. H. Perring of the Biological Records Centre. The data for Ulva shown in the *Atlas* maps are mainly based on Dr Salzen's records.

During the early summer of 1970 the British Pteridological Society paid a week's visit to Mull under the leadership of A. C. Jermy. All the fern records, among which were several valuable additions, were made available to us. A short account of the excursion appears in the Society's *Newsletter* (1970). We also acknowledge the continuing assistance of many collaborators both in the field and in the realm of specialist studies. In 1969, through the courtesy of the Royal Navy, a helicopter was again placed at our disposal, enabling our party to make most profitable visits to Staffa, Little Colonsay, Soa and some of the small islands round Iona. A further two species, *Chenopodium bonus-henricus* and *Potamogeton berchtoldii*, of those originally listed (Cannon & Bangerter 1968) as being confined to Iona, have now been found on the mainland of Mull.

The most notable records made during the period under review are: *Ophioglossum vulgatum* and *Najas flexilis*, from the Ross of Mull in 1969 and in 1970, and *Hammarbya paludosa* and *Corallorhiza trifida* from the peninsula to the south of Loch Spelve. The latter year seemed to be a good season for orchids, *Listera cordata* being much more frequently seen than in recent years, *Pseudorchis albida* somewhat more in evidence, and *Cephalanthera longifolia* being found in a new locality, only its second in recent years and the third since the original discovery by G. Ross in 1877.

SYSTEMATIC LIST

In the following list, which follows the order of Dandy (1958), the British Museum (Natural History) Department of Botany Mull Survey is referred to as

BMMS. Specimens in the British Museum Herbarium are indicated by (BM) or by BMMS and number, specimens in the herbarium of the Department of Botany, University of Glasgow by (GL) and those in the herbarium of the University of Oxford by (OXF). Localities, unless otherwise stated, are on the mainland of Mull. Further details (e.g. National grid references) are available in most instances in our files.

The following members of the B.M. Survey are referred to in the list: E. B. Bangerter, Lorna F. Bowden (now Mrs L. F. Ferguson), J. F. M. Cannon, A. Eddy, E. W. Groves, P. W. James, A. C. Jermy, Lynn Kendrick, Elizabeth G. Moyes, N. K. B. Robson, Patricia A. Sims and A. R. Vickery.

29/1. *OPHIOGLOSSUM VULGATUM* L. Previously known in v.c. 103 only from Coll and Tiree but recently discovered in the Ross of Mull. Port nan Ròn, 1969, BMMS 3536 (EDDY). The plants belong to subsp. *vulgatum*.

49/1. *AQUILEGIA VULGARIS* L. Naturalised on roadsides, walls and similar habitats. Aros House woods and cliffs north of Tobermory, 1966, BMMS (CANNON & GROVES); Salen, 1970, BMMS 4314 (CANNON). New vice-county record.

66/6. *FUMARIA MURALIS* Sond. ex Koch subsp. *BORAEI* (Jord.) Pugsl. Previously known in v.c. 103 only from Coll and Tiree. Iona, fields south of Baile Mòr, 1968, BMMS 3395 (JAMES); Sunipol, oatfield, 1968, BMMS 3406 (JAMES); Port Langanmull, roadside, 1969, BMMS 3838 (CANNON & MOYES). Specimens determined by P. D. Sell.

70/2. *SINAPIS ALBA* L. On a low cliff with bird guano, Inch Kenneth, 1969, BMMS 3906 (JERMY). New vice-county record.

88/a. *COCHLEARIA ATLANTICA* Pobedimova A specimen, Gerrans 473 (BM), collected in 1958 at Salen Bay was named by Pobedimova (1968) as this species, which she has recognised from the Outer Hebrides, Arran and Mull. As at present recorded this is endemic to the Western Isles, the type (BM) coming from Lewis in the Outer Hebrides. Study of our more recent Mull collections in the light of Pobedimova's publications (1968, 1969) suggests that populations referable to this taxon occur elsewhere in Mull: Gorton, on Loch Don, 1969, BMMS 3515 & 3517 (JERMY); Ballygown, 1970, BMMS 4123 (CANNON). A complete evaluation of this taxon as it occurs in the British Isles demands a thorough review of all our representatives of this difficult genus. The Gerrans specimen, published in 1960 as *C. officinalis*, thus becomes the first record of this taxon for v.c. 103.

95/2. *EROPHILA VERNA* (L.) Chevall. subsp. *SPATHULATA* (A. F. Lång) Walters All the specimens from our area are this subspecies and it seems likely that field records can be similarly attributed. The first definite record for v.c. 103 for this subspecies is Calgary Bay, 1967, U.K. DUNCAN (BM).

102/2 × 1. *RORIPPA* × *STERILIS* Airy Shaw Calgary Bay, 1966, BMMS (CANNON & GROVES 265). A further five widely scattered localities have been subsequently recorded. New vice-county record.

113/1. *VIOLA ODORATA* L. On roadside bank near cottages at Tobermory, 1970, BMMS (ROBSON). New vice-county record, no doubt arising as an escape from recent cultivation.

154/1. *CHENOPODIUM BONUS-HENRICUS* L. Previously known only from Iona but now recorded from the mainland of Mull. Carsaig, rubbish dump near the shore, 1970, BMMS 4131 (JAMES).

170/4. *OXALIS EUROPAEA* Jord. Naturalised in gravel in front of cottage at Lochdonhead, 1966, U.K. DUNCAN (BM). Also known to us at Salen, 1968, BMMS 3115 (JAMES). New vice-county record.

211/8. *RUBUS SPECTABILIS* Pursh Naturalised in some quantity in S.E. Mull. Kilpatrick crossroads, 1965, KENNETH; roadside at Torosay Castle, 1967, BMMS; and at Lochbuie on the south coast of Mull, 1967, BMMS 2309 (JAMES & U. K. DUNCAN). New vice-county record.

234/1. *MALUS SYLVESTRIS* Mill. Noted without locality by Wilmott (1942) as 'would be N.C.R., needs confirmation'. We have been able to provide this confirmation. Aros House woods, 1967, BMMS (BOWDEN & J. EDMONSTON); also recorded from near Ulva House, 1967, BMMS (BOWDEN & JAMES). New vice-county record.

234/K. *KERRIA JAPONICA* DC. Naturalised in Pennyghael woods, 1968, BMMS 3208 (JAMES). New vice-county record.

239/4 × 5. *SAXIFRAGA* × *URBIUM* D. A. Webb (*S. umbrosa* × *S. spathularis*) Near Tavool House, 1968, BMMS 2302 (JAMES & U. K. DUNCAN); a record of *S. umbrosa* from ruined croft garden, Ulva, 1948, SALZEN, is presumably this hybrid. New vice-county record.

239/6. *SAXIFRAGA HIRSUTA* L. Well established under beech in woods in Torloisk House grounds, 1970, BMMS 4126 (JAMES). New vice-county record.

246/1. *RIBES SYLVESTRE* (Lam.) Mert. & Koch Salen, 1968, M. MULLIN; edge of field near farm, Sunipol, 1968, BMMS; 1970, BMMS 4045 (JAMES & FERGUSON). New vice-county record.

246/2. *RIBES SPICATUM* Robson Grounds of Glen Forsa House, 1967, U. K. DUNCAN (BM). New vice-county record.

246/3. *RIBES NIGRUM* L. Lagganulva, 1967, J. DUNCAN; Aros House woods, 1967, BMMS (BOWDEN & J. EDMONSTON); Tobermory, 1967, BMMS (MELDERIS); near derelict cottage, Kintra, 1970, BMMS 4200 (JAMES). New vice-county record.

271/1. *ASTRANTIA MAJOR* L. Recorded for 'Mull' by Ewing (1890). A modern localised record is: outskirts of Tobermory, 1968, C. A. STACE.

291/1. *CARUM VERTICILLATUM* (L.) Koch Since the publication of a first county record for this species (Cannon & Bangerter 1968), R. W. M. Corner has provided us with an earlier record: Coladoir estuary, 1956, CORNER (BM).

320/1(1). *POLYGONUM AVICULARE* L. *sensu stricto* This species has of course long been known in the aggregate sense, but we now publish records for the species in the strict sense and for an associated segregate. Lochdonhead; Ulva by the pier; Loch Assopol, all 1966, U. K. DUNCAN; Tobermory, 1968, STACE; Staffa, BMMS 3699 (CANNON), det. B. T. Styles. First vice-county record.

320/1(4). *POLYGONUM ARENASTRUM* Bor. Loch Buie shore, 1959, C. W. MUIR-HEAD (E); Loch Peallach, 1967, BMMS 2213 (MELDERIS); Camas an Lagain, 1968, A. J. RICHARDS (OXF). All det. B. T. Styles. First vice-county record.

342/t. *POPULUS TRICHOCARPA* Torr. & Gray Persisting in neighbourhood of Torloisk House, 1970, BMMS 4124 (JAMES). Det. G. A. Matthews. New vice-county record.

343/1. *SALIX PENTANDRA* L. Aros House woods, 1969, BMMS 3610 (JERMY). Conf. A. Neumann. New vice-county record.

364/2. *EMPETRUM HERMAPHRODITUM* Hagerup A. G. Kenneth (*in litt.*) drew attention to the possible occurrence of this species in the saddle between Beinn Fhada and Ben More. Confirmation of its presence on Mull is provided by a specimen from the adjacent Beinn nan Gabhar, 1968, H. A. McALLISTER (BM). It may also occur on Beinn Chreagach Mhor and Bheag as recorded by MULLIN later in 1968, but no specimen is available for critical examination. New vice-county record.

379/1. *VINCA MINOR* L. Included in Appendix II of the *Atlas*, presumably on the basis of the record by G. Ross from Drumfin in his 1878 list. We have recently

recorded another locality, Kellan Mill, 1969, BMMS (JAMES & VICKERY), where it is naturalised on the roadside.

395/1. *PENTAGLOTTIS SEMPERVIRENS* (L.) Tausch Aros House woods, 1966, BMMS (CANNON & GROVES); Iona, 1966, BMMS (JAMES & CANNON); Tobermory, bank opposite cottages, 1970, BMMS 4416 (BANGERTER & KENDRICK). New vice-county record.

400/7. *MYOSOTIS SYLVATICA* Hoffm. Naturalised at Port Uamh Beathaig, 1956, B. FLANNIGAN, and at Kilfinichen, 1968, BMMS 2285 (JAMES & U. K. DUNCAN). First vice-county record.

445/6 $\times$ 7. *MENTHA $\times$ VILLOSA* Huds. (*M. $\times$ niliaca* Juss. ex Jacq.) Carsaig Bay, Innamore Lodge, 1967, A. G. KENNETH & A. McG. STIRLING (BM); Ardnacross, 1968, BMMS 2300 (JAMES & U. K. DUNCAN) and BMMS 3124 (JAMES); Tenga, 1968, BMMS 3190 (JAMES). All det. R. M. Harley. Previously recorded (as *M. alopecuroides* Hull) by J. W. Heslop-Harrison in 1951 from Tiree, but here recorded from the Mull part of v.c. 103. The Carsaig specimen was determined as 'the glabrous domesticated form known as "*M. $\times$ cordifolia*" sensu Graham'.

475/2. *CAMPANULA TRACHELIUM* L. Recorded by Wilmott (1942) as 'near Aros Cottage, (no doubt only garden escape; not previously recorded)'. It has recently been recorded by Mrs J. E. Duncan at what appears to be the same locality, presumably having persisted for the intervening 28 years.

544/2. *CENTAUREA MONTANA* L. Established near derelict cottages at Kintra, 1967, BMMS (CANNON & BANGERTER); also recorded from Tobermory, 1970, BMMS 4415 (BANGERTER & KENDRICK). New vice-county record.

581/1. *NAJAS FLEXILIS* (Willd.) Rostk. & Schmidt Loch Poit na h'I, 1970, U. K. DUNCAN (BM). Conf. J. E. Dandy. Shown in the *Atlas* for the Outer Hebrides, Colonsay and Islay only for the whole of western Scotland. New vice-county record.

589/3. *POLYGONATUM MULTIFLORUM* (L.) All. Naturalised near the graveyard at Calgary Bay, 1969, BMMS 3993 (JAMES). New vice-county record.

593/2. *LILIUM PYRENAICUM* Gouan Naturalised at Torloisk House and reproducing by seed, occurring as an 'epiphyte' on the roots of a large fallen tree, 1969, BMMS 3637 (CANNON & JERMY). New vice-county record.

624/2. *CEPHALANTHERA LONGIFOLIA* (L.) Fritsch We can now report a second new locality in a completely different part of Mull to that previously recorded (Cannon & Bangerter 1968). Kilninian, 1970, BMMS 4263 (MOYES).

631/1. *HAMMARBYA PALUDOSA* (L.) Kuntze Included in the list of Mull plants published in Turner & Finlay (1967), based on a pre-1965 record by Mrs M. Caulfield from Treshnish, but not refound there by our parties despite careful search. We have, however, recently been able to confirm the presence in Mull of this interesting species. South-west of Dalnaha, 1970, BMMS 4455 (JERMY). It has been previously recorded from Coll in v.c. 103 and the adjacent mainland.

633/1. *CORALLORHIZA TRIFIDA* Chatel. Between Dalnaha and Lian Mòr, 1970, BMMS 4372 (ROBSON). Apparently the first record for the Western Isles and the first record since 1930 for the west of Scotland in general. A substantial extension of the known range in this country. New vice-county record. The population, which consisted of about twelve visible plants, was under the cover of an open birch wood on a medium slope facing north-east.

669/2. *GLYCERIA PLICATA* Fr. Calgary Bay in roadside ditch, 1966, BMMS (CANNON & GROVES 274). New vice-county record.

676/11. *POA ANGUSTIFOLIA* L. Melderis has identified a recent collection: Tobermory, 1970, BMMS 4414 (EDDY) as this species. This locality provides a substantial extension of range for this species, as shown by the map in the *Critical Supplement*. New vice-county record.

676/12. *POA SUBCAERULEA* Sm. Now known to be widespread in Mull and the adjacent islands. The first record for our area is Iona, south of the village, 1967, BMMS 72 (CANNON, BANGERTER & SIMS). Also known in v.c. 103 from Tiree.

683/12. *BROMUS THOMINII* Hardouin The records published in Cannon & Bangert (1970), together with the record on which the Mull dot in the *Critical Supplement* is based, are very probably to be referred to *B. × pseudothominii* P. Smith.

683/10 × 13. *BROMUS × PSEUDOTHOMINII* P. Smith (*B. mollis* L. × *B. lepidus* Holmberg) This hybrid was first detected by Melderis in our area from two specimens collected in 1969 and his identifications were subsequently confirmed by Dr P. Smith. Shingle spit at the mouth of the river Bà, 1969, BMMS 3641 (CANNON, JERMY & EDDY); Inch Kenneth, 1969, BMMS 3909 (JERMY). New vice-county record. We now know it to be widespread in scattered localities in northern and western Mull.

REFERENCES

- BRITISH PTERIDOLOGICAL SOCIETY (1970). Meetings 1970. *Newsletter*, **8**: 9.
- CANNON, J. F. M. & BANGERTER, E. B. (1968). Plant records from Mull and the adjacent small islands. *Proc. bot. Soc. Br. Isl.*, **7**: 365–372.
- CANNON, J. F. M. & BANGERTER, E. B. (1970). Plants records from Mull and the adjacent small islands. 2. *Watsonia*, **8**: 145–153.
- DANDY, J. E. (1958). *List of British Vascular Plants*. London.
- EWING, P. (1890). A contribution to the Topographical Botany of the West of Scotland. *Proc. Trans. Nat. Hist. Soc. Glasgow*, New Series, **2**: 309–321.
- GERRANS, M. B. (1960). Notes on the flora of the isle of Mull. *Proc. bot. Soc. Br. Isl.*, **3**: 369–374.
- GUNTHER, R. T. (1945). *Early Science in Oxford. XIV. Life and Letters of Edward Lhwyd*, p. 423. Oxford.
- HESLOP-HARRISON, J. W. (1951). Further observations on the Vascular Plants of the Outer and Inner Hebrides. *Trans. Proc. bot. Soc. Edinb.*, **35**: 415–426.
- LIGHTFOOT, J. (1777). *Flora Scotica*. London.
- MACCULLOCH, J. (1819). *A Description of the Western Isles of Scotland*. London.
- PERRING, F. H. & SELL, P. D., ed. (1968). *Critical Supplement to the Atlas of the British Flora*. London.
- PERRING, F. H. & WALTERS, S. M., ed. (1962). *Atlas of the British Flora*. London.
- POBEDIMOVA, E. G. (1968). Species Novae Generis *Cochlearia* L., *Nov. Syst. Pl. Vasc. (Acad. Sci. U.R.S.S.)*, **5**: 131–139.
- POBEDIMOVA, E. G. (1969). Revisio Generis *Cochlearia* L. 1. *Nov. Syst. Pl. Vasc. (Acad. Sci. U.R.S.S.)*, **6**: 67–106.
- RAY, J. (1724). *Synopsis Methodica Stirpium Britannicarum*, 3rd ed., ed. by J. J. Dillenius. London.
- ROSS, G. (1877). Isle of Mull, Mid Ebudes. *Rep. Bot. Loc. Rec. Club for 1876*: 188–192.
- ROSS, G. (1878). On the flora of Mull. *Trans. Proc. bot. Soc. Edinb.*, **13**: 234–242.
- SIBBALD, R. (1684). *Scotia Illustrata . . . , De Plantae Scotiae*, **1/2**: 18. Edinburgh.
- SMITH, P. (1968). The *Bromus mollis* aggregate in Britain. *Watsonia*, **6**: 327–344.
- TURNER, N. & FINLAY, A. (1967). *The Isle of Mull*. Glasgow.
- WATSON, H. C. (1847–1859). *Cybele Britannica*, **1–4**. London.
- WILMOTT, A. J. (?1913). *The Flora of the Island of Iona (Argyllshire)*. Manuscript in the British Museum (Nat. Hist.) Library.
- WILMOTT, A. J. (1942). v.c. 103. The Island of Mull, in Report on Excursions arranged in 1939. *Rep. botl Soc. Exch. Club Br. Isl.*, **12**: 236–249.

Ludwigia palustris (L.) Ell. in England with special reference to its dispersal and germination

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ABSTRACT

Data are furnished respecting the seed-production and germination of *Ludwigia palustris* (L.) Ell. Its occurrence in England is discussed and the handicaps to its dispersal emphasised.

Ludwigia palustris was first recorded for Britain in 1666 (Raven 1963) and R. Sweet noted it as introduced here in 1776 (Sweet 1827). Borrer found it near Brockenhurst, Hants., in 1843: E. T. Bennet recorded it again in a nearby ditch after an interval of nine years. This area was subsequently searched in vain until, no less than 26 years later, the species was once more discovered there by Bolton King. After a further period of 91 years, I myself found it near Brockenhurst in 1969, in an area repeatedly searched during the previous decade. In another locality, some four miles from Brockenhurst, the species has been present in some quantity over a period of years; so reappearance near Brockenhurst might be due to bird transport or to the effect of the very dry autumnal spell of 1969 upon seed dormant in the mud that then became exposed to air and light. For a period of some years at least this area had been under water, so either source of origin is not improbable.

In various continental Floras *Ludwigia palustris* is cited as a perennial, but Hegi (1926) recognises that it may be either annual or perennial. Babington (1851), Withering (1833) and Townsend (1883, 1904), who probably knew it well in the New Forest, as well as Deakin (1857), all give it annual status. It probably shares with other characteristic 'mud species' the propensity to fruit most freely in proportion to size when growing on mud and then often to behave as an annual (Salisbury 1970). Plants cultivated on mud were found to be either annuals or short-lived perennials. As a partially submerged aquatic, *Ludwigia* is much larger but flowers and fruits far less freely in proportion. It may certainly then perennate in Hampshire but perhaps only when the winter is not severe. Numerous mature plants were seen in two locations in July 1969, of which most were dead or decrepit in late October, although younger plants were flourishing.

Descriptions of the fruits of *Ludwigia palustris* in most Floras are inadequate and even liable to mislead, being perhaps based upon herbarium material. Ripe capsules are slightly conical with a rounded base, frequently almost bell-shaped. They are four-sided, with rounded angles that correspond within to roughly triangular columns of parenchymatous tissue with numerous intercellular spaces largely responsible for the buoyancy of detached fruits. The capsule at maturity is pale yellow with greenish stripes marking the very thin membranous portions of the fruit wall that correspond to the four loculi and potential lines of rupture.

These bands are puckered, perhaps due to pressure from the developing seeds immediately beneath (Fig. 1).

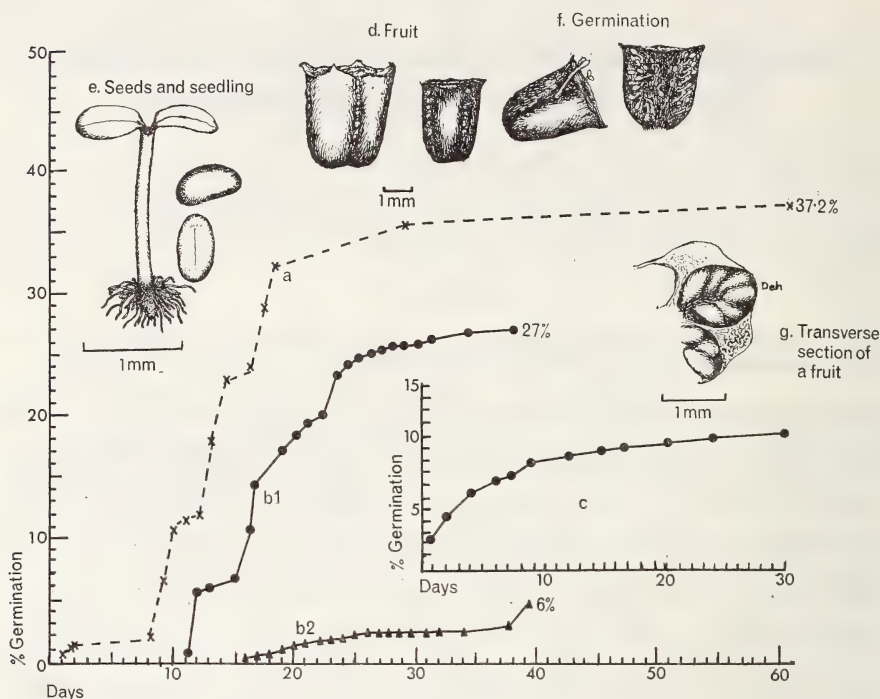


FIGURE 1. Germination of *Ludwigia palustris*. a. Germination of 593 seeds sown on the 24th August and exposed to light. b1. Germination of seeds of another plant also in light. b2. Germination of seeds from plant b maintained in darkness. c. Germination of a sample of 900 seeds at 25°C. Inset are shown: d. fruits as shed; e. seeds and seedling; f. germination within an undehisced capsule after floating in water for two and a half months and a similar capsule split in half to display numerous seedlings within; and g. part of a transverse section of a capsule indicating where dehiscence should occur (Deh).

Material from three separate stations in the New Forest, observed over several seasons, exhibited a range of fruit size from 3×2 mm to 6×3.5 mm. The fruits become detached when ripe and fall on the mud or water surface still intact. In no instance was the fruit found to have dehisced prior to being shed. Mature fruits shaken up in water continue to float, so that water currents are probably the most frequent means of local dispersal. Ultimately the membranous portions of the fruit wall may break down, and the small seeds, if thus liberated, could then be dispersed more widely by adhesion to the feet of mud-frequenting birds. Examination of a large number of specimens, including the largest and smallest found, showed a range in number of contained seeds from 45 to 226. The average was found to be 120 ± 2.7 . The individual seeds have been described as cylindrical but in side view they are seen to present a somewhat bean-like appearance (Fig. 1e). The observed size range was 0.6–0.8 mm in length, by 0.3–0.4 mm in breadth. The average weight, based upon random samples numbering about 3000 seeds from several plants, was 0.000041 gm.

In the dry summer of 1970 one patch of *L. palustris* in the Brockenhurst area

was completely terrestrial. All the plants were small and deeply pigmented. The decussate leaf arrangement, so conspicuous in aquatic specimens, was here obscured largely through internodal growth, so that the leaves approximated to a leaf mosaic in one plane (Fig. 2 A). The leaves were small and exceptionally elliptical with a relatively long and slender stalk (Fig. 2 B). A random sample of capsules from these terrestrial plants revealed an average seed content of 73 (maximum 103). The much lower seed production is not surprising, since these completely terrestrial plants are much smaller than the partially submerged plants growing in shallow water and a typical leaf of the former has only about one-fifth the assimilatory surface of the latter.

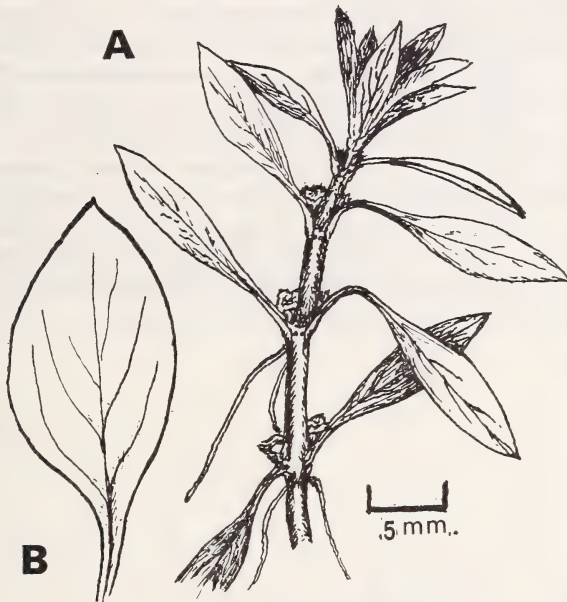


FIGURE 2. A. A terrestrial plant of *Ludwigia palustris* from Hampshire showing narrow leaves in approximately one plane. B. Leaf of aquatic plant from the same locality.

A number of germination experiments have been carried out with seeds from freshly shed fruits; but it must be appreciated that these were removed from the capsules, whereas in nature they would perhaps have remained till the fruit wall ruptured or decayed. These precociously liberated seeds exhibited a marked approach to the quasi-simultaneous type of behaviour that characterises so many 'mud species' (Salisbury 1970), although the total germination of seeds from Hampshire plants has never been high. In one sample of about 600 seeds sown in 1968 only 37.2% germinated, but 80% of these did so within the first ten days (Fig. 1 a). A very small percentage may germinate in darkness (Fig. 1 b2) but the majority do not. In one sample 6% germinated in the dark, but only after 39 days, although about 2% had germinated only a few days later than those in the light.

Freshly shed fruits, which, be it noted, had not become dry, were placed in water on October 16th, exposed to daylight and maintained in fluctuating temperatures which ranged from a minimum of 4.5°C at night to a maximum of

16.4°C in the day. Most fruits were still floating and intact after three months. In most of the capsules some of the seeds had germinated. Seedlings had emerged through the thin parts of the fruit wall (Fig. 1 f) and a fruit split open is figured to display the germinating seeds within. By January 30th the capsules, otherwise unruptured, had produced from 7 to 32 protruding seedlings (average 19.5). A few capsules had however ruptured into two or four segments, liberating seeds of which an appreciable proportion germinated and continued their growth under water, thus emphasising that desiccation is not required to stimulate germination. By the end of January there was a total of 375 seedlings representing a germination of only about 12.5%. Three other samples harvested in mid-October, of 567, 472 and 220 seeds respectively, were also maintained in warm conditions and yielded total germinations of 10.9%, 6.0% and 7.7%. Yet another sample of 594 seeds taken from floating fruits in November yielded under 4%. The contents of nine other capsules numbering over 900 seeds were sown and maintained at a higher temperature of 25°C but the germination, though initially accelerated, only attained 11.3% (Fig. 1 c).

To ascertain if a longer period of ripening was required, seeds were dissected out of undehiscent capsules in March. 2114 were sown, exposed to light at between 19°C and 25°C. Germination began in eight days and continued for thirty-six, attaining a total of 16.9%. So the lapse of time and more prolonged ripening would appear to neither augment nor diminish viability.

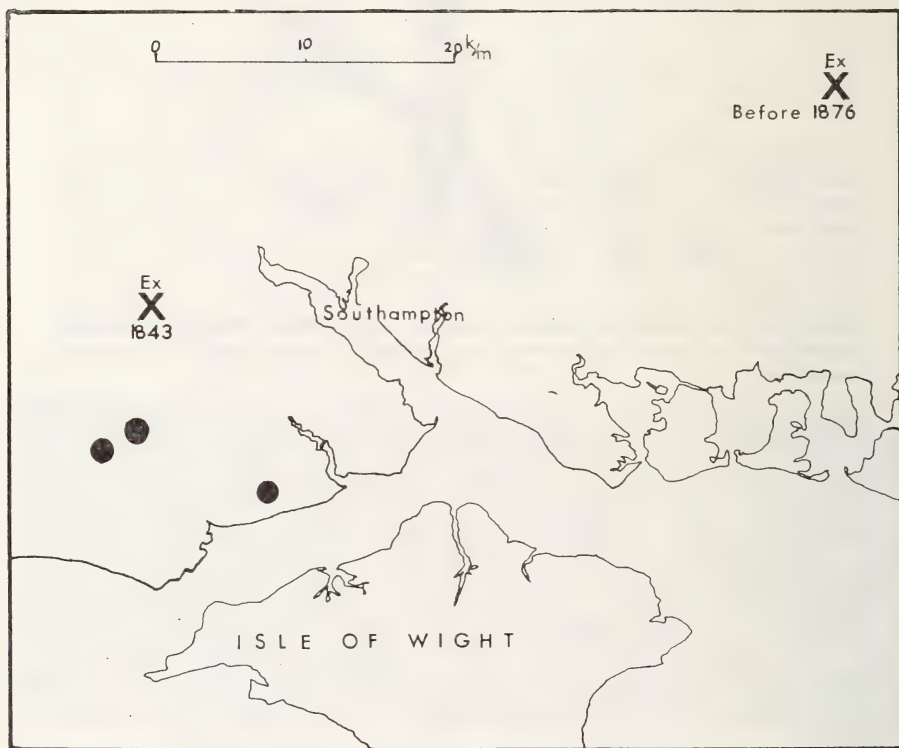


FIGURE 3. Sketch map showing the distribution in Hampshire of localities from which *L. palustris* has been recorded. Ex. probably extinct.

In Britain the capsules obviously fail to dehisce and Dr P. H. Raven states (*in litt.*) that in his experience the capsules 'never dehisce regularly anywhere in the world, and always rot apart'. This failure must greatly handicap dispersal and may in part at least account for its failure to spread in England, although the distribution of *L. palustris* would suggest that climatic conditions are unfavourable. In France, for example, it would appear to have been frequent only in the south (Grenier & Godron 1849). The sketch map (Fig. 3) shows the distribution of all the Hampshire records, which are consistent with the concept of inefficient dispersal.

REFERENCES

- ARNOLD, F. M. (1907). *Flora of Sussex*, 2nd ed., p. 44. London, Arundel & Horsham.
BABINGTON, C. C. (1851). *Manual of British Botany*, 3rd ed., p. 116. London.
DEAKIN, R. (1857). *Florigraphica Britannica*, p. 203. London.
GRENIER, J. C. & GODRON, D. A. M. (1849). *Flore de France*, 1: 585. Paris & Besançon.
HEGI, G. (1926). *Illustrierte Flora von Mittel-Europa*, 5 (2): 804. Munich.
RAVEN, P. H. (1963). The Old World species of *Ludwigia* (including *Jussiaea*), with a synopsis of the genus (Onagraceae). *Reinwardtia*, 6: 327-427.
SALISBURY, E. J. (1970). The pioneer vegetation of exposed muds and its biological features. *Phil. Trans. R. Soc. B*, 259: 207-255.
SWEET, R. (1827). *Hortus Britannicus*, p. 152. London.
TOWNSEND, F. (1883). *Flora of Hampshire*, p. 131. London.
TOWNSEND, F. (1904). *Flora of Hampshire*, 2nd ed., p. 157. London.
WITHERING, W. (1833). *A systematic arrangement of British Plants*, 2nd ed., ed. W. Macgillivray, p. 99. London.

Polypodium australe Fée in Scotland and North-East Ireland

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ABSTRACT

Polypodium australe Fée, the diploid cytodeme of the *P. vulgare* complex in the British Isles, is recorded from Scotland and North-East Ireland for the first time. The known distribution of this species in the British Isles is given, and shows a considerable extension of its northern limit.

In Europe *Polypodium australe* Fée is mainly found in the south and west, with its main distributional area around the Mediterranean basin (Shivas 1961). It shows a similar distribution pattern in the British Isles, where it reaches its northern limit and has been recorded as far north as Westmorland, the Isle of Man, and Sligo and Leitrim in Ireland (Perring & Sell 1968, D. E. Allen *in litt.* 1970, Roberts 1970).

Recently, however, attention has been drawn to herbarium specimens of Scottish *Polypodium* having branched paraphyses in their sori (Synnott 1969). No definite identifications were made as the sporangia on all of them were either undeveloped or contained only empty spores. These specimens have now been re-examined in the light of recent work (Roberts 1970) and three of them have been identified beyond any doubt as *P. australe*. The absence of fully-developed sporangia in two of them and of mature spores in the third is clearly due to the early date at which the fronds had been gathered: July, August and September. The spores of *P. australe* are usually not mature before the second half of October.

A further specimen of this diploid *Polypodium* from a Scottish locality though probably originally cultivated was found among the named varieties of *P. vulgare* agg. in the Neill Fraser collection, Royal Botanic Garden, Edinburgh (E).

Three of the specimens have been identified by a combination of characters in addition to the presence of branched paraphyses. In the fourth (from Portincross, Ayr) only two fragments of paraphyses were seen and no sporangium characters could be observed because of the immature state of the sori. Identification of this specimen was based mainly on frond and rhizome-scale characters, but was confirmed by measurements of the length of the stomatal guard cells. The latter is a useful accessory diagnostic character whose value was pointed out by Benoit (1966), but was inadvertently not mentioned in a former note by one of us (Roberts 1970).

These specimens attest three definite new vice-county records for a species not recorded previously from Scotland, and extend the northern limit of *P. australe* in the British Isles by over a hundred miles. They also suggest that the report of

'*P. vulgare* var. *cambricum*' 'from Braid Hill, near Edinburgh', mentioned by Moore (1859), may indicate yet another Scottish locality for this species.

1. Colvend Coast, Kirkcudbright. W. G. Johnstone. Sept. 1850. Growing scarcely out of the reach of the sea spray. (E)

2. Portincross, Ayr, v.c. 75. 7 Aug. '96. Woods. A.S. [A. Somerville]. (E)

3. Cult. D.N.F. [D. Neill Fraser] Oct. 1877, from plant from Braxfield, Lanark. (E). (Probably cultivated at Braxfield.)

4. Aberdour woods, Co. Fife. July 1859. Ex herb. W. R. McNab. (DBN)

The reference to Argyllshire (Synnott 1969) is an error. It was intended to refer to the Ayrshire specimen from Portincross.

There are four Antrim specimens of *P. australe* in the herbarium of the National Botanic Gardens, Glasnevin (DBN). These, from some of the localities cited under '*P. vulgare* var. *semilacerum*' by Praeger (1938, p. 280), are the first records for North-East Ireland:

1. Garron Point, 31st July 1884, R. Ll. Praeger.

2. Knockagh, 1889, R. Ll. Praeger.

3. Redhall, 1887, R. Ll. Praeger.

4. Glenoe [no date, but probably c. 1880], R. P. Vowell.

It is likely that his records from the south end of Gobbins, the right branch of Woodburn Glen, and Deerpark on Cave Hill are also based on diploid plants.

A considerable number of the specimens in the Neill Fraser collection proved to be *P. australe*. Unfortunately only a few of them are localized, but two of these attest further new vice-county records: these are for Worcester, v.c. 37 (Bewdley, 23 Oct. '67, J. E. Mapplebeck) and Cheshire, v.c. 58 (Macclesfield, July 1868, E. J. Lowe).

All of the above records are included in the up-dated distribution map, Fig. 1.

In the British Isles *P. australe* clearly has a much narrower ecological tolerance than either *P. vulgare* L. or *P. interjectum* Shivas. It is found almost exclusively on circum-neutral soils of pH mostly 6.4 to 6.9 (Hughes 1969), and prefers a well-drained substratum in sheltered situations. Such conditions occur most frequently on cliffs of Carboniferous limestone, on old mortared walls, and occasionally on cliffs of other rocks which are locally base-rich, or whose crevices receive an adequate supply of lime from wind-blown shell sand. In limestone districts *P. australe* is sometimes found as an epiphyte on trees—particularly on *Quercus* and *Sambucus nigra*.

It is possibly significant that all of the Scottish localities listed above are either on or near areas of Carboniferous limestone, and the Antrim localities on or close to the outcrops of Cretaceous strata.

In North Wales *P. australe* often grows in small, isolated patches, many of them occupying only a few square yards, and it is easily overlooked. Doubtless the same is also true of it in Scotland and North-East Ireland, and this probably accounts for the lack of previous records of the diploid species from both of these regions.

We wish to thank Dr F. H. Perring, of the Biological Records Centre, for producing the up-dated distribution map; the Regius Keeper of the Royal Botanic Garden, Edinburgh, and the Director of the National Botanic Gardens, Glasnevin, Dublin, for the generous loan of herbarium material; and Miss C. W. Muirhead for her ready assistance.

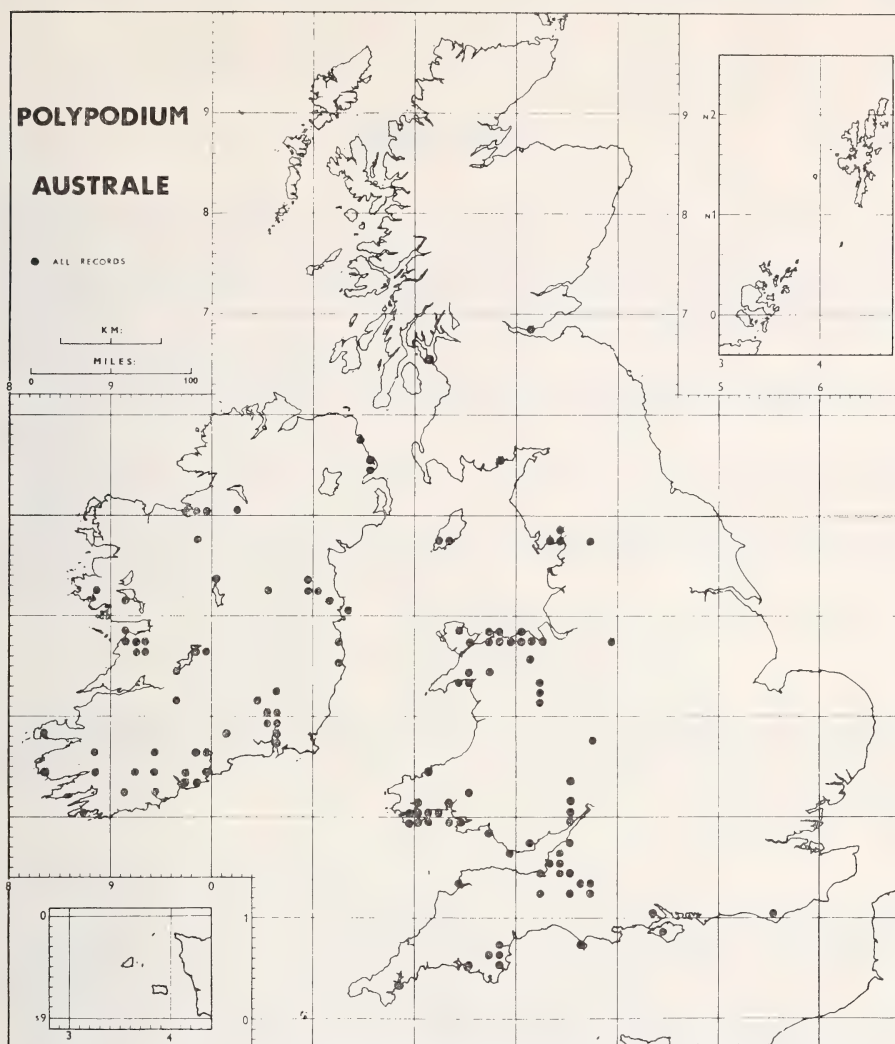


FIGURE 1. Up-dated distribution map of *Polypodium australe* in the British Isles, produced by the Biological Records Centre, Monks Wood, Abbots Ripton, Huntingdon.

REFERENCES

- BENOIT, P. M. (1966). Some recent work in Wales on the *Polypodium vulgare* aggregate. *Br. Fern Gaz.*, **9**: 277-282.
- HUGHES, W. ELFYNN (1969). The distribution of *Polypodium vulgare* L. subspecies *serratulum* Arcangeli in North Wales. *Nature Wales*, **11**: 194-198.
- MOORE, T. (1859). *A Popular History of the British Ferns and the Allied Plants*, 3rd ed. London.
- PERRING, F. H. & SELL, P. D., ed. (1968). *Critical Supplement to the Atlas of the British Flora*. London.
- PRAEGER, R. LI. (1938). *A Flora of the North-East of Ireland*, 2nd ed. Belfast.
- ROBERTS, R. H. (1970). A revision of some of the taxonomic characters of *Polypodium australe* Fée. *Watsonia*, **8**: 121-134.
- SHIVAS, M. G. (1961). Contributions to the cytology and taxonomy of species of *Polypodium* in Europe and America, I: Cytology; II: Taxonomy. *J. Linn. Soc. (Bot.)*, **58**: 13-25, 27-38.
- SYNNOTT, D. M. (1969). Evidence of *Polypodium australe* Fée in Scotland. *Trans. Proc. bot. Soc. Edinb.*, **40**: 623-624.

Short Notes

173. ACER—Unusual fruits.

A number of specimens of *A. pseudoplatanus* growing in Wollaston, Northants (v.c. 32) were seen between 1967 and 1970 bearing some fruits with more than the normal two samaras. The proportion of fruits with three or more samaras varied widely from tree to tree, about half having none, while some had 20-30%. These latter had some with four and occasionally five samaras.

The individual samaras are the same as on normal fruits except for a slight pinching at the base, and the angle between the spine of the wing and the axis of the fruit is normal.

In flower this form can be recognised by the number of stigmas, and at later stages by the embryonic wings.

Similar trees have also been found in various other parts of Northants (v.c. 32) and in Bedfordshire (v.c. 30). In addition to *A. pseudoplatanus*, multiple samaras have been found in the following species of *Acer*:

<i>A. campestre</i> L.	Wollaston (v.c. 32)
<i>A. cappadocicum</i> L.	Wellingborough (v.c. 32)
<i>A. platanoides</i> L.	Kew Gardens (v.c. 17)

Although specimens with three samaras have been recorded occasionally before, Dr N. K. B. Robson tells me that there appear to be no records of specimens with four or five samaras.

S. L. M. KARLEY

370/2. *LYSIMACHIA NUMMULARIA* L.—A leuco-anthocyanin.

Portions of the stem and leaves of *Lysimachia nummularia* when boiled in dilute (2N) hydrochloric acid give a red pigment showing the usual reactions for anthocyanidins. Anthocyanin pigments (anthocyanidins combined with sugars), are well known for their role in causing most red, blue and violet colours in plants.

The pigment obtained was red in acid solutions (blue in alkalis), from which it can be extracted with amyl alcohol and toluene/cyclohexanol and finally crystallised from dilute hydrochloric acid as red prisms. Its absorption spectrum was comparable to those of anthocyanidins.

The small traces of red pigment sometimes observed in the stem of *Lysimachia* are quite insufficient to account for the large amount of red pigment obtained when stem material is boiled in hydrochloric acid and it is evident that most of the pigment was originally present in the plant in a colourless form. Modified anthocyanins of this type are referred to as leuco-anthocyanins and a number of plants possessing pigments in this form have been reported (Bate-Smith & Lerner 1954). *Lysimachia nummularia* forms an addition to the present list.

ACKNOWLEDGMENTS

I am grateful to Dr R. M. Acheson (Oxford) for a sample of pelargonidin and to Mr A. S. Robinson (Nuneaton Technical College) and the National Coal Board for spectrometer facilities.

REFERENCE

- BATE-SMITH, E. C. & LERNER, N. J. (1954). Leuco-anthocyanins, 2. Systematic Distribution of Leuco-anthocyanins in Leaves. *Biochem. J.*, **58**: 126-132.

J. H. FIELD

472/1. *PLANTAGO MAJOR* L.—Spray induced abnormalities.

In 1968 a colony of *Plantago major* L. in Wollaston, Northants (v.c. 32) was observed to contain a number of fasciated inflorescences and funnel-leaves. Some of the inflorescences were fasciated to a remarkable extent, and I have not heard of funnel-leaves elsewhere in this species.

The fullest extent of fasciation found was in the form of a complete tube of about 1 cm diameter branching a little at the top into discrete spikes. The upper part of the stem was closely covered with flowers, on both inner and outer surfaces.

The lower part of the stem was split open where the later leaves and inflorescences had broken through.

The funnel leaves were of approximately normal size, slightly asymmetrical, with a tubular stem and the blade forming a complete goblet-shaped funnel. Each plant bearing such a leaf was dissected, and in each case was found to have a ring fasciated inflorescence (tubular) in its axil. As they developed these soon broke through the side of the stalk tube at the base.

Enquiries revealed that the adjacent field had been sprayed with MCPA (4 Chloro-Tolyl Oxy-Acetic Acid) plus 2% 2, 4, D.B. No plant was found with more than one abnormal leaf and inflorescence, indicating the probability of an external, once-only cause.

S. L. M. KARLEY

Plant Records

Records for publication must be submitted in the form shown below to the appropriate vice-county Recorder (*Watsonia*, 8: 435-447 (1971)) and *not* to the Editors.

Records are arranged in the order given in the *List of British Vascular Plants* by J. E. Dandy (1958) and in his subsequent revision (*Watsonia*, 7: 157-178 (1969)). With the exception of collectors' initials, herbarium abbreviations are those used in *British Herbaria* by D. H. Kent (1958).

The following signs are used:

* before the record: to indicate a new vice-county record.

† before the species number: to indicate that the plant is not a native species of the British Isles.

† before the record: to indicate a species which, though native in some parts of the British Isles, is not so in the locality recorded.

[] enclosing a previously published record: to indicate that the record should be deleted.

4/9 × 5. *EQUISETUM* × *LITORALE* Kühlew. ex Rupr. *57, Derbys.: Morley Moor, GR 43/38.41. Old claypits at former brickworks. A. Lee, 1970, field record.

21/3. *DRYOPTERIS ABBREVIATA* (DC.) Newm. *3, S. Devon: between Bone Hill and Moreton Hampstead, GR 20/7.8. H. V. Corley & K. Stevens, 1970, BM, det. A. C. Jermy.

24/2. *THELYPTERIS PALUSTRIS* Schott 35, Monmouth: acid bog, Pont-y-Spig, 4 miles west of Llanvihangel, GR 32/28.22. L. E. Whitehead, 1970, NMW. Rediscovery of the 1st and only record.

25/1a. *POLYPODIUM AUSTRALE* Fée *37, Worcester; *58, Cheshire; *73, Kirkcudbright; *75, Ayr; *77, Lanark; *85, Fife; *H39, Antrim (*Watsonia*, 9: 39 (1972)).

†70/2. *SINAPIS ALBA* L. *103, Mid Ebudes (*Watsonia*, 9: 29 (1972)).

77/1. *CAKILE MARITIMA* Scop. 83, Edinburgh: shore at Cramond, GR 36/19.76. E. P. Beattie, 1956, E. 2nd record.

†90/2. *BUNIAS ORIENTALIS* L. 83, Edinburgh: Edinburgh, GR 36/22.70. Rough ground by Union Canal. O. M. Stewart, 1966, E, det. C. W. Muirhead. 2nd record.

94/4. *DRABA MURALIS* L. *82, Haddington: near West Saltoun, GR 36/45.66. Hedgebank at old Saltoun Station. E. Durie, 1970, E.

95/2. *EROPHILA SPATHULATA* Láng *103, Mid Ebudes (*Watsonia*, 9: 29 (1972)).

102/2 × 1. *RORIPPA* × *STERILIS* Airy Shaw *103, Mid Ebudes (*Watsonia*, 9: 29 (1972)).

†111/1. *DESCURAINIA SOPHIA* (L.) Webb ex Prantl 57, Derbys.: Cromford, GR 43/29.57. Disturbed ground by roadworks. M. J. Burnhill, 1970, field record. 1st record for over 50 years.

115/6 × 5. *HYPERICUM* × *DESETANGSII* Lamotte *66, Durham: Pittington, GR 45/33.44. Old colliery workings on magnesium limestone. A. Todd, 1968, herb. G. G. Graham 3947, conf. N. K. B. Robson.

136/3. *SAGINA MARITIMA* Don *83, Edinburgh: shore, Cramond Island, GR 36/1.7. E. P. Beattie, 1952, E. Seafield, Leith Docks, GR 36/28.76. Dry ground behind sea wall. E. P. Beattie, 1968, E. 2nd record.

†MESEMBRYANTHEMUM CRASSIFOLIUM L. *1, W. Cornwall: walls at Porthleven, GR 10/62.25. L. J. Margetts, 1969, field record.

†154/13. *CHENOPODIUM HYBRIDUM* L. *44, Carmarthen: Ferryside, GR 22/36.10. Shrubbery by car park. J. Palmer, 1970, field record.

159/1. *SALSOLA KALI* L. *83, Edinburgh: shore at Seafeld, Leith, GR 36/28.75. O. M. Stewart, 1963, field record.

†168/3. *GERANIUM ENDRESSII* Gay *2, E. Cornwall: near Kit Hill, Callington, GR 20/3.7. I. Nicholson, 1968, field record.

†168/3 × 4. *GERANIUM ENDRESSII* Gay × *G. VERSICOLOR* L. *82, Haddington: dunes at Gosford, Longniddry, GR 36/44.77. J. Milne, 1955, E, det. D. McClintock.

†168/I. *GERANIUM IBERICUM* Cav. *82, Haddington: Longniddry, GR 36/44.77. Established on wooded area of sand dunes for at least 16 years. J. Milne, 1955, E, det. D. McClintock.

169/3 × 4. *ERODIUM CICUTARIUM* (L.) L'Hérit. × *E. GLUTINOSUM* Dumort. 44, Carmarthen: dunes at Towyn Burrows, Pembrey, GR 22/36.04. I. M. Vaughan, 1970, NMW, det. P. Benoit. 2nd record.

†171/3. *IMPATIENS PARVIFLORA* L. 83, Edinburgh: Corstorphine Hill, Edinburgh, GR 36/20.74. M. Mackie, 1970, E. 2nd record and 1st post-1930 record.

†183/2. *LUPINUS ARBOREUS* Sims 83, Edinburgh: railway cutting, Craiglockhart, Edinburgh, GR 36/23.71. O. M. Stewart, 1967, field record. 2nd record.

†207/5. *LATHYRUS TUBEROSUS* L. *1, W. Cornwall: railway bank, Angarrack, near Hayle, GR 10/58.38. P. Wickham, 1968, field record.

212/11. *POTENTILLA TABERNAEMONTANI* Aschers. *66, Durham: Hart Warren and Station, GR 45/48.36. Sand dunes and cliffs on magnesium limestone. D. J. Bellamy *et alia*, 1969, field record, 1970 material in herb. G. G. Graham 3995.

†224/o. *ACAENA OVALIFOLIA* Ruiz & Pav. *82, Haddington: Gullane, GR 36/47.83. Several colonies on dunes. E. P. Beattie, 1956, E. Long established.

225/1 × 8. *ROSA ARVENSIS* Huds. × *R. CANINA* L. *47, Montgomery: Gregynog Hall, Newtown, GR 22/08.96. Scrub by oakwood. I. M. Vaughan, 1970, NMW, det. R. Melville.

225/12 × 13. *ROSA SHERARDII* Davies × *R. VILLOSA* L. *44, Carmarthen: roadside hedge, 1 mile north of Llandovery, GR 22/76.36. I. M. Vaughan, 1970, NMW, det. R. Melville.

†235/3. *SEDUM SPURIUM* Bieb. *83, Edinburgh: railway embankment near Gorebridge, GR 36/34.60. E. P. Beattie, 1967, E. Blackford Quarry (disused), GR 36/25.70. O. M. Stewart, 1968, E, det. C. W. Muirhead. 2nd record.

246/3. *RIBES NIGRUM* L. †*103, Mid Ebudes (*Watsonia*, 9: 30 (1972)).

306/1. *LIGUSTICUM SCOTICUM* L. *83, Edinburgh: Cramond Island, GR 36/19.78, and Seafeld, Leith, GR 36/28.75. Both E. P. Beattie, 1966, E. 1st and 2nd records respectively.

320/1/1. *POLYGONUM AVICULARE* L. *sensu stricto* *103, Mid Ebudes (*Watsonia*, 9: 30 (1972)).

320/1/4. *POLYGONUM ARENASTRUM* Boreau *103, Mid Ebudes (*Watsonia*, 9: 30 (1972)).

343/1. *SALIX PENTANDRA* L. *103, Mid Ebudes (*Watsonia*, 9: 30 (1972)).

359/3. *PYROLA ROTUNDIFOLIA* L. *106, E. Ross: Nigg, near Tain, GR 28/8.7. A. Gordon, 1970, herb. A.G., det. U. K. Duncan.

364/2. *EMPETRUM HERMAPHRODITUM* Hagerup *103, Mid Ebudes (*Watsonia*, 9: 30 (1972)).

370/2. *LYSIMACHIA NUMMULARIA* L. *80, Roxburgh: St Boswells, GR 36/59.30. Boggy bed of old curling pond. R. W. M. Corner, 1950, field record.

385/3 $\times$ 4. *GENTIANELLA AMARELLA* (L.) Börner $\times$ *G. ANGLICA* (Pugs.) E. F. Warburg
SUBSP. *CORNUBIENSIS* Pritchard *1, W. Cornwall: Gear Sands, Perranporth, GR
10/77.55. Large hybrid swarm on fixed dunes. L. J. Margetts, 1966, field record, det.
N. Pritchard.

420/3. *LINARIA REPENS* (L.) Mill. *83, Edinburgh: Davidson's Mains, Edinburgh,
GR 36/21.77. On disused railway line. E. P. Beattie, 1962, E. Entrance to Braidhills
Golf Course, GR 36/24.70. E. P. Beattie, 1967, E. 2nd record.

420/3 $\times$ 4. *LINARIA* $\times$ *SEPIUM* Allman *66, Durham: Piercebridge, GR 45/21.16.
Railway embankment, with parents. M. Burnip, 1970, herb. G. G. Graham, det. F. H.
Perring.

430/2 $\times$ 3. *VERONICA ANAGALLIS-AQUATICA* L. $\times$ *V. CATENATA* Pennell *66,
Durham: roadside stream at Piercebridge, GR 45/20.15. M. Burnip, 1970, herb. G. G.
Graham, det. F. H. Perring.

430/3. *VERONICA CATENATA* Pennell *57, Derbys.: gravel pit, Egginton, GR
43/27.27. R. H. Appleby, 1970, field record. Morley Moor, GR 43/38.41. A. Lee & K.
Hollick, 1970, field record. 2nd record.

436/1. *ODONTITES VERNA* (Bellardi) Dumort. SUBSP. *VERNA* 2, E. Cornwall: arable
land, Fentongollan, near Tregoney, GR 10/86.43. B. Garratt, 1969, field record.
2nd record.

†455/1. *SALVIA VERTICILLATA* L. *57, Derbys.: Clay Mills, near Burton-on-Trent,
GR 43/27.26. Waste ground by railway. M. Smith, 1970, DBY, det. D. McClintock.

473/1. *LITTORELLA UNIFLORA* (L.) Aschers. *84, Linlithgow: Beecraigs Reservoir,
near Linlithgow, GR 36/01.74. E. P. Beattie, 1967, E.

485/2. *GALIUM BOREALE* L. *102, S. Ebudes: Isle of Scarba, GR 17/6.0. Top of
waterfall on west side. A. A. Slack, 1969, field record.

487/1. *SAMBUCUS EBULUS* L. *82, Haddington: Castle Mains Farm, Dirleton,
GR 36/51.83. Roadside verge behind farm. E. P. Beattie, 1969, E.

497/1. *DIPSACUS FULLONUM* L. *80, Roxburgh: waste ground near Lumber Yard
curling ponds, St Boswells, GR 36/59.30. R. W. M. Corner, 1950, field record. Still
there.

506/4 $\times$ 7. *SENECIO* $\times$ *LONDINENSIS* Lousley *66, Durham: near Ryton railway
station, GR 45/15.65. On railway embankment with parents. G. G. & P. S. Graham,
1967, herb. G. G. G., det. J. E. Lousley.

509/1. *PETASITES HYBRIDUS* (L.) Gaertn., Mey. & Scherb. *84, Linlithgow:
marshy ground, Hopetoun Estate, South Queensferry, GR 36/09.79. Female. E. P.
Beattie, 1958, E. Hopetoun Estate, South Queensferry, GR 36/07.79. Bank of Abercorn
Burn. Female. E. P. Beattie, 1966, E. 2nd record. 1st and 2nd records respectively for
female plants.

†509/4. *PETASITES FRAGRANS* (Vill.) C. Presl *111, Orkney: Pickaquoy, Kirkwall,
GR 57/44.11. Waste ground by roadside. E. R. Bullard, 1971, E. Confirmation of
unpublished 1st record of 1950.

535/6. *ARTEMISIA ABSINTHIUM* L. 82, Haddington: waste ground, Dunbar, GR
36/65.78. O. M. Stewart, 1970, field record. 2nd record.

555/1. *MYCELIS MURALIS* (L.) Dumort. *1, W. Cornwall: near Point, Restronguet,
GR 10/8.3. F. G. Fuller, 1968, field record.

†570/1. *ELODEA CANADENSIS* Michx. *106, E. Ross: Loch Kinellan, near Strath-
peffer, GR 28/47.57. U. K. Duncan, 1970, herb. U. K. D.

†571/1. *LAGAROSIPHON MAJOR* (Ridl.) Moss *57, Derbys.: near Black Rocks,
Cromford, GR 43/29.56. Concrete tank by disused railway. M. Carr, 1967; 1970
material leg. K. Hollick, DBY.

581/1. *NAIAS FLEXILIS* (Willd.) Rostk. & Schmidt *103, Mid Ebudes (*Watsonia*, 9: 31 (1972)).

605/4. *JUNCUS COMPRESSUS* Jacq. *66, Durham: Eggleshope Beck, GR 35/98.28. Margin of upland stream, 330m. B. Burnip, 1970, herb. G. G. Graham, det. F. H. Perring.

605/12. *JUNCUS FILIFORMIS* L. †*66, Durham: Tunstall reservoir, GR 45/06.41. Alluvial mud of inflow, often submerged, 229m. M. Burnip, 1970, herb. G. G. Graham 4061, LTR, det. T. G. Tutin.

607/5. *ALLIUM VINEALE* L. 82, Haddington: banks of Biel Burn, West Barns, Dunbar, GR 36/65.78. E. P. Beattie, 1968, E. 2nd record.

625/1. *EPIPACTIS PALUSTRIS* (L.) Crantz 1, W. Cornwall: dune slacks, Penhale Sands, GR 10/77.57. G. Allsop, R. Gomm & L. J. Margetts, 1967, field record. 2nd record.

631/1. *HAMMARBYA PALUDOSA* (L.) Kuntze 2, E. Cornwall: bog pools, Crowdy Marsh, Bodmin Moor. R. Gomm, 1967, field record. 2nd record.

633/1. *CORALLORHIZA TRIFIDA* Chatel. *103, Mid Ebudes (*Watsonia*, 9: 31 (1972)).

640/4. *OPHRYS INSECTIFERA* L. 66, Durham: Castle Eden Dene, GR 45/4.3. J. B. Frankton, 1970, field record. 2nd confirmed record and 1st for nearly 100 years.

642/4. *ORCHIS USTULATA* L. 66, Durham: Hart Station, GR 45/4.3. P. Appleyard *et alia*, 1969, field record; photographs in DHM. 1st record for over 100 years.

642/7. *ORCHIS MASCULA* (L.) L. 83, Edinburgh: Newtongrange, GR 36/35.63. Grassy bank near old lime workings. E. P. Beattie, 1970, E. 2nd record.

643/1 × 4. *DACTYLORHIZA FUCHSII* (Druce) Soó × *D. PRAETERMISSA* (Druce) Soó *1, W. Cornwall: wild garden, St Ives, GR 10/51.40. L. Larking, 1968, field record, det. P. F. Hunt.

650/2. *LEMNA TRISULCA* L. *2, E. Cornwall: Moorswater, Liskeard, GR 20/2.6. J. Paton, 1966, field record.

663/36. *CAREX CARYOPHYLLEA* Latourr. *106, E. Ross: Loch Morie, Kildemorie Forest, GR 28/52.76. In short turf by loch. U. K. Duncan, 1970, herb U.K.D.

663/69. *CAREX ELONGATA* L. H39, Antrim: wet woodland, Farris Bay, Lough Neagh. J. Harron, 1971, BM. Confirmation of 1st (pre-1930) and only record.

669/2. *GLYCERIA PPLICATA* Fr. *103, Mid Ebudes (*Watsonia*, 9: 31 (1972)).

669/4. *GLYCERIA MAXIMA* (Hartm.) Holmberg *2, E. Cornwall: dried-up lake, Inny Foot, Tamar valley, GR 20/37.77. L. J. Margetts, 1970, field record.

670/7. *FESTUCA JUNCIFOLIA* St-Amans *83, Haddington: sand dunes, Gullane, GR 36/49.83. M. P. Mackie, 1966, E, det. C. W. Muirhead.

676/3. *POA BULBOSA* L. *1, W. Cornwall: Lelant, GR 10/54.38. Path over fixed dunes. L. J. Margetts, 1967, K, det. C. E. Hubbard.

676/11. *POA ANGUSTIFOLIA* L. *103, Mid Ebudes (*Watsonia*, 9: 31 (1972)).

683/10 × 13. *BROMUS MOLLIS* L. × *B. LEPIDUS* Holmberg *103, Mid Ebudes (*Watsonia*, 9: 32 (1972)).

684/2. *BRACHYPODIUM PINNATUM* (L.) Beauv. *2, E. Cornwall: cliff-path, St Mawes, GR 10/84.32. B. Garratt, 1969, field record.

700/1. *CALAMAGROSTIS EPIGEJOS* (L.) Roth *86, Stirling: roadside verge near Skinflats, GR 26/91.82, and waste ground, Grangemouth Docks, GR 26/94.83. Both E. P. Beattie & C.S.S.F. party, 1969, E. 1st and 2nd records.

Book Reviews

Plants of Pembrokeshire. T. A. Warren Davis. Pp. 82. West Wales Naturalists' Trust, 4 Victoria Place, Haverfordwest, 1970. Price 55p.

This excellent county list is in effect a trailer for a Flora of Pembrokeshire which Mr Warren Davis proposes to publish in about 1974. It is to be hoped that his proposed Flora will reap a rich harvest from the stimulus provided by the already considerable amount of information in these 82 pages. 941 orthodox species are listed; the only previous list for the county, that of Mrs F. L. Rees in 1950, had 740 species. Mr Warren Davis appeals for both field and herbarium records. About two-thirds of the 5 km squares are described as having been 'fairly well covered'; it is a pity that the under-worked ones were not indicated on the map, but one assumes that they are mostly inland squares to the north and east.

Introductory sections include a page on climate and geology, three pages on habitats and plant distribution, a page on the history of local botanical exploration (nothing before 1848 is mentioned here or in the bibliography), and a page on the Tenby Daffodil. The systematic list gives for each species the number in Dandy's list, Latin and English (but unfortunately not Welsh) names, a brief habitat summary (perhaps too condensed for clarity in some cases), and a distributional phrase or, for species with 6 or fewer records, a list of localities with 5 km square references. For old records confirmation, and for recent records which are the only ones for that species for the county, the date and recorder, are indicated. One map shows the 5 km squares, another the distributions of *Polypodium australe*, *Hypericum undulatum*, *Genista pilosa* and *Bromus ferronii*. Eight good but muddily reproduced photos of characteristic species are included; in every other respect the layout is a model of economy and clarity, and the cover design is striking and apt.

I urge readers who have visited Pembrokeshire to buy this list and to search through their old notebooks, and those who are about to visit it to use the list as a guide to their excursions, and to communicate their findings to Mr Warren Davis. There are records of *Dryopteris aemula*, *Viola reichenbachiana*, *Callitriche platycarpa*, *Polygonum raii*, *Zannichellia*, *Coeloglossum* and many others to be confirmed, puzzles such as the apparent rarity of *Mentha arvensis* to be solved, and much ground to be covered.

A. O. CHATER

Watsonian Vice-counties of Great Britain. J. E. Dandy. Pp. 38 + 2 maps. The Ray Society, London. 1969. Obtainable from Johnson Reprint Co., Berkeley Square House, Berkeley Square, London, W.1. Price: with flat maps and booklet, £1.00; with folded maps, booklet and slipcase, £1.50.

This is a landmark in the study of natural history in the British Isles. For good or ill H. C. Watson launched in 1852 the vice-comital system of recording choosing the then existing geographical counties as his units. To remedy to some extent great differences in size Watson divided some of the larger counties and joined some small ones with others. This resulted in a system with which botanists, conchologists and isolated workers in other branches of natural history have lived for well over a century and there are some excellent reasons, so well examined by Mr Dandy, why it should not be changed. 112, the number of vice-counties in Great Britain (Watson had less concern with Ireland), has assumed an almost magical significance.

The Watsonian system met its first major difficulty in the years immediately following the Local Government Act of 1888, which created new administrative counties and county boundaries. Some large counties were divided but in a different manner from

that adopted by Watson and the new administrative counties had in many cases boundaries of the units of local government which did not coincide with those of the geographical counties. Often enough the differences were so slight that at most they would affect a few records here and there. The vast majority of naturalists just assumed that the new counties which were shown on maps, for few others could have any interest in the old boundaries, were the vice-counties. This is shown clearly in an examination of *Local Floras* published since 1900. To many of us it is a matter of small consequence but to Mr Dandy, with whom I completely agree, it is serious. If we are to retain the Watsonian system as a basis for our continuity of records we must keep to the old boundaries and to Watson's divisions. It is high time that we ceased to play about with the system. But here was a difficulty for so far we have had no reliable maps to help us to know the limits of the vice-counties. This is now remedied.

Let no one imagine that Mr Dandy's task has been a simple one. I went through the tedious process of checking the boundaries of just two vice-counties. To have tackled the whole of the British Isles would have deterred any of us but Dandy! As a result of his research, the important decisions he had to make and, above all, his care, we may at last have complete confidence that here the boundaries are correctly shown.

The result is pleasing indeed since the two maps are uniform with the Ordnance Survey's already popular 10 miles to 1 inch geological, historical and route-planning series. The Ray Society is to be congratulated on having come to an agreement with the Ordnance Survey to print the maps. Without this happy arrangement its task would have been difficult. The maps are in plain outline with the vice-county boundaries and numbers printed in red. In many cases the vice-county boundaries coincide with the administrative county boundaries which are also shown. It is to be hoped that those who use the maps will realise that the latter are shown as they were in 1962—for instance Greater London and Teesside are not shown and Peterborough is shown to be still in Northamptonshire. So quickly do county boundaries change. Failure to recognise this could lead us into the difficulties from which these maps should rescue us.

Apart from the vice-county boundaries, time may prove that the only other permanent feature shown on the maps is the National Grid, the ten-kilometre lines of which are clearly indicated. The use of the grid is so far the only serious alternative to vice-comital recording but without doubt the grid will become the safest guide to the correct use of the Watsonian system. If a ten-kilometre grid square on these maps is not intersected by a red line, one can now for the first time safely attribute any records from that square to its appropriate vice-county. In cases where the ten-kilometre squares are partly in two or more vice-counties reference may need to be made to Mr Dandy's booklet, which solves many difficulties. Closer research will, however, be necessary in very many cases. I cross swords with Mr Dandy only on one apparently minor item: he contends that the vice-county boundaries are often related to physical features which can be seen in the field. This is certainly the case when they coincide with the administrative county boundaries but surely not so otherwise. Is it not very often for this reason that the boundaries were changed?

The price of the maps is fortunately astonishingly low so that no one can excuse himself for not having them. They are essential to us all whether or not we like the Watsonian system. Constant reference to them will be necessary in checking old records and by those who in these days prefer to use only the grid to make sure that others have not put their records into wrong vice-counties. The maps are in two forms. The flat maps will be most useful to institutions and museums, any of which having the slightest natural history connections should not be without them. They are, however, not to be recommended to the vast majority of us who would be advised to have the folded maps with the slipcase—it is a pity that this was not made of stronger material—if only to be sure that the all-important explanatory booklet is always with the maps.

Gibraltar Walks and Flowers. Botanical consultant Anthony P. Hamilton. Flower drawings Elaine Hempelman. Pp. 36. The Gibraltar Tourist Office, London. 1970. Available from The Gibraltar Tourist Office, 15 Grand Buildings, Trafalgar Square, London W.C.2. Price 25p + 5p postage.

The three square miles of Gibraltar, on which grow almost 600 species, have for a long time needed a pocketable Flora. This handbook, which deals with the most striking plants, underlines the interest of the plant life of 'the Rock' and for a short visit is invaluable, especially in the detailed botanical walks it suggests. The notes which form the bulk of the booklet describe 60 of the plants, usually three to a page, in a rather journalistic style which occasionally so compresses information as to mislead. 28 plants are illustrated by adequate line drawings. At the price this is a bargain; it is to be hoped that it will lead the way in a new field of tourist literature.

LORNA F. FERGUSON

Studies in the Vegetational History of the British Isles. Edited by D. Walker and R. G. West. Pp. 266. Cambridge University Press. 1970. Price £8-00.

The *Festschrift* is not a commonplace part of the British academic tradition, so the publication of such a volume in this country is a cause for remark. This book is a welcome tribute to the affection, respect and enthusiasm that Professor Sir Harry Godwin has inspired in a long succession of students and colleagues. The idea of a volume of essays in his honour was surely not unconnected with the international outlook and contacts which have been so characteristic of the Sub-department of Quaternary Research of which he was the founder.

Of the eleven essays in these *Studies*, four in particular epitomise progress and the changing pattern of interest in quaternary research since Sir Harry's own *The History of the British Flora* was published 14 years ago. Dr R. G. West contributes a brief introductory summary of the main features of Pleistocene history. Dr J. J. Donner brings much evidence from radiocarbon dating to the intricate and controversial subject of Late- and Post-glacial land- and sea-level changes in Scotland. Contributions by Dr A. G. Smith and Dr Judith Turner reflect the growing realisation that we may have to look for important, if subtle, effects of man much more widely and at much earlier periods than hitherto, and the growing interest in the detailed interpretation of the more recent parts of the pollen record in terms of developing human cultures. Two papers look generally at the ecological history of particular places: a big regional synthesis of data on the Lake District and its surroundings by Dr W. Pennington, and a short account of Bleham Bog by Prof. F. Oldfield. The two papers by Miss R. Andrew and Mrs C. A. Dickson, on identification of plant micro- and macro-fossils respectively, are based on long experience and well supplied with references, and should be widely useful.

Many ecologists will read and re-read Prof. D. Walker's discussion of the stratigraphical evidence of sequences and rates in Post-glacial hydroseres. The commonest sequence found was: micro-organisms or submerged macrophytes—floating-leaved macrophytes—reedswamp—fen—fen carr—bog. However, in 54% of the sites examined succession followed other courses. In particular, direct transitions from reedswamp to swamp carr, and from reedswamp, swamp carr and fen to bog, are all frequent. Most of the hydroseres passed through a reedswamp stage, and almost all terminated in bog ('It is not stretching the evidence too far to claim that *throughout the British Isles* the true 'climax' of an initially topogenous hydrosere is not a terrestrial woodland but an ombrogenous bog . . .'). Estimates of accumulation rates based on pollen-zone boundaries and radiocarbon-dated horizons give a wide range of figures, whose most striking feature is the lack of evidence of any substantial difference in the rate of accumulation of different kinds of organic deposits; of all the samples recorded, 78% give rates between 21 and 80 cm per 1000 years. Prof. Walker's main conclusions are

unassailable. Although (and partly because) there are points of detail about which one might feel sceptical, his paper poses a whole range of challenges to the student of mire ecology.

Finally, there are two phytogeographical papers. The cautious discussion by Prof. G. F. Mitchell and Prof. W. A. Watts of the possible history of the Ericaceae along the west coast of Europe during the Quaternary shows that a solution of the tantalising problem of the Hiberno-Lusitanian distributions remains a challenge for the future. Perhaps the contribution which will be of widest interest of all to readers of *Watsonia* is the paper by Miss Ann Conolly and Dr Eilif Dahl on 'Maximum summer temperature in relation to the modern and Quaternary distributions of certain arctic-montane species of the British Isles.' The authors' maps make a good case for the proposition that the distributions of such species as *Juncus trifidus* and *Loiseleuria procumbens* are limited by intolerance of high summer temperatures (parenthetically, one may add that such bryophytes as *Anastrophyllum donianum* and *Plagiochila carringtonii* show correlations at least as good as a number of the vascular plants considered here). In general, temperature limits in the Scottish Highlands and in the Irish mountains are similar, but are on average about 3°C. lower than those observed for the same species in Scandinavia; a number of species show substantially higher temperature limits in North Wales and northern England than in Scotland. Taking the results at their face value in relation to sub-fossil records leads to palaeoclimatic conclusions broadly consistent with the evidence from other sources. The authors' hypothesis accounts reasonably well for the selection of Scandinavian mountain species found in the British Isles, and for a number of features of their ranges in these islands—including the sparse occurrence of arctic-montane species in the small and scattered high mountain areas of Ireland and their absence from other outlying upland areas which should now be suitable for them but which would be expected to have become too warm during the post-glacial climatic optimum. The physiological ecologist will want to seek experimental evidence that the distribution patterns do in fact reflect summer temperature limitation and to define more precisely the factors involved, while the genecologist and phytogeographer will be intrigued by the apparent differences in tolerance shown by different populations of the same species and will wish to examine and interpret these in terms of evolutionary or migrational history. What is the meaning of the difference between the behaviour of *Dryas* in the Burren, or of *Kobresia* in Teesdale, and their behaviour elsewhere?

One's pleasure in a well-produced book is tinged with regret that it could not have been produced at a price more readily within the reach of the honours undergraduate or young research worker. I suspect (and certainly hope) that many library copies will become well thumbed.

M. C. F. PROCTOR

Obituary

ERIC O. CALLEN
(1912 – 1970)

Eric O. Callen, Associate Professor in the Department of Plant Pathology at Macdonald College of McGill University, Montreal, died of a heart attack on August 22nd, 1970, while on an archaeological expedition in the Andes Mountains of Peru. He was searching for coprolites which would provide more information for his study of the food habits of the native peoples who inhabited those regions in prehistoric times.

Dr Callen was born in 1912 and received his early education at George Heriot's School in Edinburgh. He received the B.Sc. (Honours) degree in 1936, and the Ph.D. in 1939, both from the University of Edinburgh, where his research was largely mycological. He was a silver medallist in languages at school. This ability was put to use during the second world war, when he worked in the Intelligence Service.

Dr Callen came to McGill University in 1947, when he was appointed to the teaching staff of the Department of Plant Pathology at Macdonald College. Although his teaching covered a very broad spectrum of the biological sciences, his main interest and major research activity was in the realm of plant taxonomy. His early interests were in the taxonomy of the genus *Lotus* (Leguminosae) but in later years he devoted himself primarily to the taxonomic aspects of Ethnobotany.

It was largely because of his pioneering work in the development of methods for the identification of both plant and animal materials in coprolites that Dr Callen was elected Secretary to the Council for Canadian Archaeology at its founding meeting in 1965, and to his appointment as Chairman of the Coprolite Analysis Symposium for the annual meetings of the Society for American Archaeology, in Mexico, 1970. Just prior to these meetings he had also been appointed Consulting Scientist to the Ayacucho Archaeological Botanical Expedition in Peru. He was working in this latter capacity, in the high altitudes of the Andes, at the time of his death. His results have greatly extended modern knowledge of prehistoric diets in the Americas, of the use and domestication of wild plants by primitive peoples, and of the beginnings of Agriculture.

He was elected a Fellow of the Botanical Society of Edinburgh, and a Fellow of the Linnean Society of London; he held memberships in a number of scientific societies besides the B.S.B.I., including the British Mycological Society, the Society of American Archaeologists and the International Association of Plant Taxonomists.

For his academic and research achievements, and for devotion to his students and to his work, Eric Callen will long be remembered.

W. F. GRANT

Reports

ANNUAL GENERAL MEETING, MAY 8TH, 1971

The Annual General Meeting of the Society was held at the Department of Biology of the University of York, by kind permission of Professor M. H. Williamson, on Saturday 8th May, 1971 at 12 noon.

Mr E. Milne-Redhead (President) was in the Chair and 56 members were present.

The President opened the meeting by expressing thanks on behalf of the Society to Professor Williamson for making the facilities of his Department available for the meeting and to Mr D. H. Adams for organising the programme.

The Minutes of the last Annual General Meeting as published in *Watsonia*, Volume 8, Part 3, pages 329-331, were adopted.

REPORT OF COUNCIL

The Report together with the Accounts for the year 1970 had been circulated to all members. There being no queries, the Report was adopted on the motion of Professor D. H. Valentine, seconded by Dr F. H. Perring and carried unanimously.

ELECTION OF PRESIDENT

Mr D. McClintock had been nominated by Council. Mr Milne-Redhead said that Mr McClintock was so well known and had done so much for British botany that he needed no further introduction. The Chairman proposed that Mr McClintock be elected and the proposal was carried unanimously. At this point Mr McClintock took the Chair. Having thanked the Meeting, he said Mr Milne-Redhead had made a very good President and done much for the Society, particularly in the field of conservation, during his term in office and Mr McClintock hoped that he could live up to the standard set by the retiring president.

ELECTION OF OFFICERS

The President said how fortunate the Society was that Professor J. Heslop-Harrison had agreed to be nominated as a vice-president. Professor Heslop-Harrison was shortly to become the new director of Kew and it was most important that the close association between the Society and the Royal Botanic Gardens should be maintained. This election together with the re-election of Mr J. E. Lousley and Dr F. H. Perring was carried unanimously.

Dr I. K. Ferguson was unanimously re-elected as General Secretary.

The President said that Mr J. C. Gardiner wished to retire after serving for the remarkably long and valuable period of 13 years as Honorary Treasurer. The Society had been fortunate in finding a very able successor, Mr M. Walpole, and proposed his election which was carried unanimously.

Mr Milne-Redhead then spoke from the floor thanking Mr Gardiner for his long and valuable service mentioning especially the great energy and enthusiasm Mr Gardiner had put into the defence of Teesdale, raising the immense sum of almost £25,000. He took great pleasure in presenting a small Address containing the signatures of many of the members as a token of the Society's appreciation for all Mr Gardiner had done.

Mr Gardiner in replying thanked everybody for their kindness and said how much he had enjoyed serving the Society and expressed his willingness to help in any way he could in the future.

Mr E. F. Greenwood, Dr G. Halliday and Dr N. K. B. Robson were unanimously re-elected as Honorary Editors. Dr M. C. F. Proctor had expressed a wish to retire as an Honorary Editor. Dr C. A. Stace had been nominated by Council as the fourth Honorary Editor and Dr Stace's election was carried. The President on behalf of the Society thanked the Editors for their hard work during the year.

The Council had nominated Mrs M. Briggs for re-election as Honorary Meetings Secretary. In proposing Mrs Briggs's re-election the Chairman said how very important Mrs Briggs's work is in organising meetings and how fortunate the Society was in having such an able person. Mrs Briggs's re-election was carried unanimously.

Mrs J. G. Dony had been nominated for re-election as Honorary Membership Secretary and the Chairman spoke of Mrs Dony's sterling work carried out with complete accuracy which was such a great financial saving to the Society. Mrs Dony's re-election was carried unanimously.

ELECTION OF NEW MEMBERS TO COUNCIL

In accordance with Rule 10 Mrs B. H. S. Russell, Dr H. J. M. Bowen and Mr J. F. M. Cannon retired. Mr D. McClintock had been elected President thereby leaving an additional vacancy on Council. Four nominations had been received: Mr P. C. Hall, Professor V. H. Heywood, Dr C. T. Prime and Miss D. W. Fawdry and these were elected.

ELECTION OF HONORARY MEMBERS

The election of Mr E. Milne-Redhead, Mr J. C. Gardiner and Dr M. C. F. Proctor as Honorary Members was proposed by Council. Mr McClintock in proposing that the Meeting approve these nominations said that all three had done invaluable service for the Society over a large number of years far more than he could enumerate at a short meeting. The election of all three as Honorary Members was unanimously carried.

ELECTION OF HONORARY AUDITORS

In proposing Council's recommendation to re-elect Messrs Price, Waterhouse & Co., the President said how fortunate the Society was to have such a distinguished firm of auditors and expressed the Society's gratitude for their services. Their election was duly carried.

ANY OTHER BUSINESS

Dr M. E. Bradshaw made two proposals:

1. That a letter be sent to the Tees Valley and Cleveland Water Board recognising the efforts made by the Water Board, the Consulting Engineers and the Contractors to keep to a minimum damage to the vegetation and rare species on Widdybank Fell during the construction of the Cow Green Reservoir; also thanking them for their helpfulness to botanists working in the area and for their assistance in the provision of amenity facilities for all visitors.
2. That a letter be sent to Mr T. Buffey, the Site Research Officer, in appreciation of all his work in looking after the interests of the botanists and the conservation of the Teesdale vegetation and flora during the construction of the Cow Green Reservoir.

Mr E. Milne-Redhead seconded these proposals and the Meeting gave them its approval. The President instructed the General Secretary to write to the persons mentioned above.

There being no further business, the Meeting closed at 12.35 p.m.

I. K. FERGUSON

REPORT OF THE NORTH-EAST REGIONAL MEETING

A meeting of members resident in the North-East Region was held at the Department of Biology of the University of York, immediately following the Annual General Meeting. There were 21 members present. Dr M. E. Bradshaw proposed that the President take the Chair and this was seconded by Miss C. M. Rob.

One nomination had been received for North-East Regional representative on Council and that was Dr G. A. Swan. The President proposed the election of Dr Swan and this was carried.

There being no further business the meeting closed.

I. K. FERGUSON

COMMITTEE FOR THE STUDY OF THE
SCOTTISH FLORA

SIXTEENTH ANNUAL REPORT TO 31ST DECEMBER 1970

The Committee met twice in Perth and twice in Edinburgh and arranged an Exhibition Meeting at the University of Glasgow (by kind permission of the Regius Professor of Botany). Ten field meetings were included in the Scottish programme for the year.

The Exhibition Meeting was held on Saturday 7th November, 1970 and about sixty people were present. The following exhibits were shown: rare plants survey (Biological Records Centre, The Nature Conservancy); Scottish nitrogen-fixing plants (Professor G. Bond); the C.S.S.F. Inverness-shire survey (C.S.S.F. Organising Committee); a puzzling *Ulex* from Scotland (Miss E. R. T. Conacher); *Cryptothallus mirabilis* (Dr J. H. Dickson); leaf and stem characters in *Rhododendron* (A. G. Kenneth); some west of Scotland *Taraxacum* species (A. G. Kenneth and A. McG. Stirling); plants from the Tirol with Scottish associations (R. Mackechnie); two alien mosses from the plant houses, Glasgow Botanic Gardens (F. G. Rodway); aliens from imported seeds and grain (F. G. Rodway and A. McG. Stirling); coprophilous ascomycetes of Scotland (I. Roy); Kindrogan Field Studies Centre (Scottish Field Studies Association); *Rhynchosinapis monensis* from Linlithgow (Mrs O. M. Stewart); plants from the Tirol (A. McG. Stirling); a hybrid *Senecio*—*S. × londinensis*—new to Scotland (A. McG. Stirling); wool aliens from the Tweed valley (Miss M. McC. Webster). After tea Mr R. Mackechnie described the planned five-year C.S.S.F. survey of Inverness-shire; Miss E. P. Beattie and Mr A. A. P. Slack indicated the detailed programmes to be carried out in the vice-counties 96 and 97 respectively during the next two or three years and Mr R. Goodier, Regional Officer, East Scotland, Nature Conservancy discussed conservation aspects of botanical recording in Inverness-shire. Following a buffet supper in the University Refectory colour transparencies of C.S.S.F. field meetings held during 1970 were shown by Miss E. R. T. Conacher, B. W. Ribbons, F. G. Rodway, J. Grant Roger, A. A. P. Slack, Mrs A. H. Somerville, A. McG. Stirling and Dr R. Thomas.

Of the ten field meetings in the programme, three were cancelled (Bennane Head, Ayrshire, Arrochar and the B.S.E. Cryptogamic meeting to Lawers); one to Meall Gheordie, Perthshire was arranged by the Alpine Botanical Secretary of the B.S.E. (for report see *Trans. Proc. bot. Soc. Edinb.*, 41 (2)). The other meetings were held in the Isle of Bute (23–25 May) led by Miss D. N. Marshall (17); at Glendaruel, Argyll (14 June) led by H. A. McAllister (8); at Easter Inch and Tailend Mosses, West Lothian (5 July) led by Miss E. P. Beattie (4); at Fort William (11–18 July) led by A. A. P. Slack (10); in the Tirol (3–13 August) led by B. W. Ribbons (17) and at Kindrogan Field Centre (5–12 August) led by A. C. Jermy (3) (junior meeting). The attendance figures are given in brackets. Reports of these meetings will appear in *Watsonia* and in the publications of the Botanical Society of Edinburgh.

The Council of the B.S.E. elected Mr J. Grant Roger to replace Miss Ann W. Deans as a member of the Committee. The eight elected members appointed Miss E. R. T.

Conacher, Dr H. A. P. Ingram and Mr A. W. Robson to serve as members for the calendar year 1971. Mr R. Mackechnie was appointed Chairman, Mr B. W. Ribbons, Honorary Secretary; Mrs A. H. Sommerville, Honorary Treasurer; Mr A. McG. Stirling, Honorary Field Secretary, and the Chairman, a member of the B.S.B.I. Records Committee for 1971. The Chairman was represented at B.S.B.I. Records Committee by Mr Ribbons on 10th March, 2nd June and 29th September and, as Regional Representative, at B.S.B.I. Council by Mr Ribbons on 3rd March and 17th November and by Mrs Sommerville on 9th May. The Honorary Secretary attended a meeting to consider lists of plants 'not to be interfered with' on 3rd November.

Proposals for the exploration of the flora of Inverness-shire were accepted and an Organising Committee was appointed. This met once and afterwards a five-year survey of the flora of Inverness-shire was launched. A field meeting was held in the Fort William area. The Survey was brought to the notice of a large number of people through the agency of society news letters and specific offers of assistance were received from organisations and individuals. Plans were made for searching appropriate publications for Inverness-shire records, and for the examination of public and private herbaria. Further offers of help either in the field or otherwise will be welcomed by the Convener of the Organising Committee, Mr R. Mackechnie, 9 Skirving Street, Glasgow, S.1.

The list of Recorders for Scottish vice-counties was kept under review and recommendations were made to the B.S.B.I. Comments were sent to the working party preparing the Wild Plants Protection Bill and it was learnt with regret that the Working Party had decided to omit Scotland from the Bill. The Committee co-operated with the B.S.B.I. in organising the Conference for Recorders in Edinburgh on 5th-6th September. Detailed comments were prepared on the proposed list of English names of plants and at the request of the B.S.B.I. the Committee began the preparation of lists of rare Scottish plants and of 'plants not to be interfered with'. Information on Scottish Floras in preparation was compiled. Numerous administrative and other matters including the misspelling of Scottish place names in publications have been discussed with the officers and councils of the two societies.

The accounts showed a deficit of £31.71 (£31.14.2d.) and this amount has been refunded in equal sums by the two sponsoring societies.

The Committee wishes to express thanks to Miss Beattie for her work as Honorary Field Secretary during the year, to Dr F. H. Perring, Honorary Secretary of the B.S.B.I. Records Committee, who attended one of the meetings of the Committee, to the officers of the sponsoring societies, to the leaders of the field meetings and to other members and friends who helped the Committee during the year.

B. W. RIBBONS

EXHIBITION MEETING, 1970

The annual Exhibition Meeting was held at the Department of Botany, British Museum (Natural History), London, S.W.7, on Saturday 28th November from 12 noon to 5.30 p.m.

VERONICA HEDERIFOLIA AGG. IN WALES

Dried specimens and vice-county distribution maps were exhibited to illustrate the occurrence in Wales of two of the segregates of *Veronica hederifolia*—the common pale-lilac-flowered tetraploid *V. sublobata* M. Fischer and the more local blue-flowered hexaploid *V. hederifolia* L. *sensu stricto*. This is the subject of a Short Note which has already been published (*Watsonia*, 8: 399 (1971)).

P. M. BENOIT

MULL — FROM FLORA TO FLORA

The first stage of the British Museum (Natural History) Department of Botany Mull Survey Project's five years of fieldwork was completed this autumn (1970). The exhibit illustrated the way in which data collected from the field, the herbarium and the literature are being processed. From the consolidated record files a data sheet is prepared for each species. This consists of a digest of all known information relevant to its occurrence in our area. The data sheets are then circulated to colleagues and to collaborators outside the Museum for criticism and further comments. At the present time, sheets have been prepared and are in circulation for three-quarters of the vascular plant species. By this means we hope to make the best possible use of all available knowledge and experience, both from our own staff members and also from our many helpers elsewhere. An example was shown of a possible format for the final manuscript, which in due course will be prepared from the data sheets. Progress in the account of the vascular plants is paralleled by work on the other plant groups and will lead to a published account of the total flora of Mull.

BRITISH MUSEUM (NATURAL HISTORY), DEPARTMENT OF BOTANY

SCANNING ELECTRON MICROSCOPE PHOTOGRAPHS OF
SAXIFRAGE SEEDS

Scanning electron microscope photographs were exhibited of seeds of ten *Saxifraga* species to show characters of the entire seed and seed-surface at a range of low and high magnifications. The latter reveal features not previously seen, the taxonomic value of which has yet to be fully assessed.

Saxifraga stellaris L. has uniform seeds closely similar within any one collection and with only minor variation in fine detail among seeds of different provenance.

S. oppositifolia L. and *S. rivularis* L. seeds vary considerably. There is variation over a single seed-surface and from seed to seed, both within any one collection and especially from different regions; collections of *S. oppositifolia* from the Pyrenees are quite distinct.

Surface protuberances on seeds of *S. aizoides* L. range from spines to low domes; the extremes show some geographical localization.

Seeds of *S. rosacea* Moench, *S. hypnoides* L. and *S. cespitosa* L., also those of *S. granulata* L. and *S. tridactylites* L., are tuberculate. Newly-seen detail apparently distinguishing these species needs to be confirmed from further samples. Fossil seed of *S. granulata* L. corresponds very closely with modern material.

A. P. CONOLLY

JUNCUS ALPINOARTICULATUS CHAIX IN SOUTHERN SCOTLAND

This species is now known from many localities in Roxburghshire (v.c. 80) and Selkirkshire (v.c. 79), being recorded from 8 contiguous 10 km grid squares. The record from Loch Grennoch in Kirkcudbrightshire (v.c. 73) is considered dubious. *J. alpinoarticulatus* is found in strongly basic habitats from 625–1150 ft above sea-level. A list of associated species was given and it was noted that *Equisetum variegatum* and *Tofieldia pusilla* were absent. Specimens of *J. alpinoarticulatus* and *J. articulatus* were shown to demonstrate the differences between them.

The Hawick and Selkirk districts must now be considered as one of the headquarters for *J. alpinoarticulatus* in the British Isles.

R. W. M. CORNER

CORNUS POLLEN

The genus *Cornus* has been delimited in different ways by various workers, some accepting the genus in a broad sense and dividing it into subgenera and sections,

others segregating these groups as distinct genera as E. F. Warburg in Clapham, Tutin & Warburg and in Dandy's *Check List*.

Chao (*Taiwania*, 5: 93-106 (1954)) suggests that the pollen morphology of *Cornus* 'reveals that they form a homogenous group of plants'.

Scanning electron micrographs of the pollen of the three British representatives of the segregate genera from *Cornus sensu lato* (*Cornus mas* L., *Swida sanguinea* (L.) Opiz and *Chamaepericlymenum suecicum* (L.) Graebner) and three other representatives from outside the British Isles (*Afrocrania volkensii* (Harms) Hutchinson, *Bothrocaryum alternifolium* (L.) Pojarkova and *Benthamidia nuttallii* (Audubon) Moldenke) were exhibited. This revealed that the genus *Cornus sensu lato* can be divided into groups on the basis of pollen characters and these groups correspond quite closely with the sections, subgenera or segregate genera already recognised. Pollen morphology thus provides an additional character to support the existing classification.

I. K. FERGUSON

ERIOCAULON AQUATICUM ON ARDNAMURCHAN

The exhibit is the subject of a Short Note which has already been published (*Watsonia*, 8: 400-401 (1971)).

I. K. & L. F. FERGUSON & G. HALLIDAY

PROGRESS IN RECORDING THE FLORA OF NORTHAMPTONSHIRE

This exhibit showed by a coloured map the number of species recorded in each of the 5 × 5km squares in the last three years in the county and the Soke of Peterborough. There was also an example of the special recording sheet filled in for one of the squares.

J. GENT & A. ROBINSON

THE DISTRIBUTION OF CHROMOSOME RACES OF *RANUNCULUS FICARIA* L. IN THE BRITISH ISLES

Photographs of mitotic metaphase chromosome preparations of diploid (with and without B-chromosomes), triploid and tetraploid *Ranunculus ficaria* were exhibited. The distribution of these chromosome types, based on a cytological examination of 873 individuals drawn from 237 populations in the British Isles was exhibited. The maps showed that: the diploids occur throughout the British Isles; the tetraploids are commoner in the East; the triploids are scattered and uncommon (except perhaps in Ireland); the diploids with B-chromosomes are common only in southern England. Regions from which more chromosome counts are required include the Midlands, northern England, Scotland and Ireland. The exhibit cautioned against the casual identification of these chromosome races on field or herbarium material. Correct determination of polyploidy from morphological features requires considerable care and experience. The help was acknowledged of numerous professional and amateur botanists without whose assistance the survey would have been even more incomplete.

J. J. B. GILL, B. M. G. JONES, C. J. MARCHANT, J. MCLEISH & D. J. OCKENDON

OAK WOODLAND IN THE ISLE OF MAN

The Field Section of the Isle of Man Natural History and Antiquarian Society displayed data connected with their research on the possibility of the survival of native woodland in the Isle of Man. These included a map showing the distribution of isolated trees, and groups of trees, likely to be descended from native stock, a study of the Santon Gorge area and a graph demonstrating that, as in Scottish material, the trees

showed a petiole-length intermediate between *Quercus robur* and *Q. petraea*. The exhibit was completed with herbarium sheets (or Xerox copies of these) of samples from the gathering made for the study of leaves. This research is continuing.

L. S. GARRAD

SPORE FORMS IN THE *CYSTOPTERIS FRAGILIS* COMPLEX

A spore survey of all the British *Cystopteris fragilis* specimens in the British Museum Herbarium showed an oval non-spiny spore form to be present in two localities in Westernness, v.c. 97 (Ardgour, Strontian River valley, Cannon & Kendrick 66; Glen Loy, E. K. Horwood s.n.) and one in Forfar, v.c. 91 (Den of Balgarvies, Agnes Carnegie s.n.).

Scanning electron micrographs of these spores were shown together with those of typical spiny-spored *C. fragilis* and rugose *C. dickieana* from near Aberdeen and *C. dickieana* (*C. baenitzii* Dörfler) from Norway. Fine surface structure seen at 5000 magnifications showed a granular texture on the oval and rugose spores suggesting that the former spore type lacked the shrinkage, and therefore rugose appearance, of typical *C. dickieana*.

Further work is continuing and living material (or viable spores) of any non-spiny form will be welcome. The survey was carried out by one of us (L.H.) during the tenure of a Vacation Studentship at the Museum.

A. C. JERMY & L. HARPER

GAUDINIA FRAGILIS

This exhibit listed the known records in Britain for this Mediterranean grass. The exhibit was particularly concerned with its rediscovery in the Grande Mare area of Guernsey and also in native turf in the north of the island. A fuller account will be appearing shortly.

D. McCLINTOCK

NEW ZEALAND *EPILOBIUM* SPECIES IN THE BRITISH ISLES

Pressed and living specimens were exhibited of five *Epilobium* taxa naturalised in the British Isles from New Zealand. A fuller account will be appearing shortly.

D. McCLINTOCK

HOW MANY SEEDS?

Verbascum virgatum is a weed in my garden at Bracken Hill, Platt, Kent. One plant in 1970 had a total length of stem and branches of 71 ft and at least 1352 fertile capsules. These contained between 18 and 380 seeds each. The total seed production must therefore have been at least a quarter of a million.

D. McCLINTOCK

THE GUERNSEY FLORA 1970

The exhibit consisted of 30–40 sheets of noteworthy records for the Guernsey flora in 1970. The majority came from the Society's visit in June 1970 (*Watsonia*, 8: 428–429 (1971)). Several were added subsequently by residents or visitors, ending with a special trip in mid-November primarily to map *Arum italicum*. Depending on assessments of status, some 15 species were added to the island's tally during the year, following an equally successful crop in 1969. In addition, some old written records, of varying

value, were unearthed; several corrections and additions were made from a reconsideration of specimens in the Herbarium at St Peter Port and other specimens discovered elsewhere. The riches of the island's flora seem by no means to be yet fully known.

D. McCLINTOCK

EXPERIMENTAL SYNTHESIS OF THE ALLOPOLYPLOID *POTENTILLA ANGLICA* LAICH

The theory that *Potentilla anglica* arose as the allopolyploid between *P. erecta* (L.) Räusch. and *P. reptans* L. is not new, but confirmation has been very difficult to obtain due to the repeated failure of crosses between the putative parents. The exhibit demonstrated the experimental synthesis of the allopolyploid which was finally achieved in 1970.

Herbarium specimens were shown of the parental species *P. erecta* and *P. reptans* (both tetraploid, $2n = 28$) and wild *P. anglica* (octoploid, $2n = 56$). A chart demonstrated the colchicine-induced chromosome doubling of the tetraploids followed by hybridization which gave a progeny of experimental allopolyploids ($2n = c56$). A herbarium specimen of one of these was shown, together with a photograph of a root-tip mitosis. The plant was hypo-octoploid ($2n = 53$) and closely resembled wild *P. anglica*. Photographs of pollen showed that 'synthetic *P. anglica*' was similar to the wild species in pollen grain size and stainability. Its fertility and self compatibility were demonstrated by herbarium specimens of four offspring from a progeny resulting from controlled self-pollination.

B. MATFIELD

TETRAD MAPPING OF THE KENT FLORA

The Kent Field Club is to map the vascular plants of the county on a tetrad basis during the period 1971–1975 inclusive. This exhibit showed what preparations have been made in readiness for this scheme. A booklet containing instructions and keys to critical groups has been prepared and this together with a provisional list of the vascular plants recorded from Kent is to be sent to each helper. Special recording cards have been prepared specifically for the Kentish flora. Helpers will send in their recording cards once a year to Maidstone Museum, where the records will be transferred to a master set of cards. From here the records will be plotted on species maps, an example of which was also displayed. The eventual form of publication has as yet not been decided.

The exhibit also contained examples of some of the more rare and interesting plants to be found in Kent.

E. G. PHILP

CHROMATOGRAPHY OF *LIMONIUM* SPP. (THE SEA LAVENDERS)

The methods by which certain substances (flavonoids) are extracted by chromatography of leaf material of *L. vulgare*, *L. humile* and *L. binervosum* were demonstrated. Specimen chromatograms of the three species, treated with developer, and illuminated with ultra-violet light, were displayed.

Studies of several populations of each of the three species revealed that there were in all 42 spots which could reliably be used for species comparisons. Of these 42 spots, 23 are common to each of the three species, 9 more are found in *L. binervosum* only, and the remaining 10 are common to both *L. vulgare* and *L. humile*, but absent in *L. binervosum*. There were no spots found which reliably separated all populations of *vulgare* from all populations of *L. humile*. The results so far therefore indicate that in

terms of flavonoids, *L. vulgare* and *L. humile* populations are chromatographically indistinguishable as far as strong, reliable spots are concerned.

At Keele, the methods demonstrated are being used to investigate any genetic variation that may arise within and between populations of the three *Limonium* species as a result of the different reproductive method adopted by each species.

L. R. STAINES

IS *STACHYS* $\times$ *AMBIGUA* SM. ALWAYS DISTINGUISHABLE?

Stachys ambigua Sm. is considered to be a hybrid between *S. palustris* L. and *S. sylvatica* L. Comparisons of herbarium material reveal an overlap in leaf morphology between *S. ambigua* and *S. palustris*, while *S. sylvatica* appears to be distinct.

Scatter diagrams, using lamina breadth/length and petiole/total leaf-length as axes, were prepared from four localities in Britain and presented for comparison. In three populations it was possible to detect the presence of three distinct taxa but at the fourth locality—Billown Mooar in the Isle of Man—there was an overlap between *S. palustris* and *S. ambigua*. In many localities, plants referable to *S. $\times$ ambigua* occur in the absence of one or both parents.

Photographs of pollen were exhibited to show that pollen inviability is an unreliable character for identification. Some plants with the morphological range of *S. palustris* were shown to have a high percentage of inviable pollen while others in the morphological range of *S. ambigua* exhibit a high percentage of viable pollen.

C. C. WILCOCK

The following also exhibited.

- | | |
|---|---|
| P. J. BOYLE | <i>Spartina</i> M 9 |
| M. BRADSHAW | Research in Upper Teesdale |
| BRITISH MUSEUM (N.H.) | DEPARTMENT OF BOTANY Publications of interest to members |
| B. S. BROOKES | Kindrogan Field Centre |
| R. M. BURTON & E. J. CLEMENT | Plants of south-west Spain |
| E. J. CLEMENT | Some alien grasses |
| COMMITTEE FOR THE STUDY OF THE SCOTTISH FLORA | C.S.S.F. Inverness-shire project |
| Mrs R. DUDLEY-SMITH | North Gloucestershire Naturalists' Society—botanical recording |
| Mrs B. EVERARD | (a) Original paintings (Europe) for <i>Wild Flowers of the World</i> , Ebury Press and Michael Joseph |
| | (b) Botanical paintings 1970 |
| Mrs A. N. GIBBY | Some botanical postage stamps |
| N. HAMILTON | British rare species survey |
| F. N. HEPPER | Drawings of plants of Bible lands |
| P. R. KNIPE | Progress on the new Buckinghamshire Flora |
| Y. MOSCATI | Stamps in European Conservation Year 1970 |
| F. H. PERRING | Mistletoe Survey |
| G. F. PETERKEN | Holly Survey |
| H. E. W. SELBY | Experimental conservation mounting |
| F. M. TAYLER | False colour photography—toy or tool? |
| P. J. O. TRIST | (a) Vegetative proliferation of grasses |
| | (b) <i>Arrhenatherum elatius</i> vars. |
| S. M. WALTERS & P. F. YEO | The role of Botanic Gardens in Nature Conservation |
| E. D. WIGGINS | Some British rarities or near relatives growing abroad |
| Mrs L. WISHART <i>et alia</i> | Conservation 1970 |

From 4.30 p.m. the following members gave short lectures and showed colour slides in the Lecture Hall.

J. E. LOUSLEY	Some flowers of a London common
M. H. MANNERING	Studies of dodder on gorse and ling
R. MAYCOCK	Selected plants from the Buckinghamshire flora
P. G. SHEARSBY	Some North American wild flowers
F. M. TAYLER	Guernsey plants, B.S.B.I. field meeting 1970
G. TUCK	B.S.B.I. field meeting in Switzerland 1970

FIELD MEETING, 1970

ITALY AND AUSTRIA

TIROL. 2ND – 14TH AUGUST

This, the third overseas meeting organised by the C.S.S.F., occupied five days of glorious weather in Italy followed by five days in Austria where the weather was not quite so good. The party was drawn from England and Scotland; it numbered 14 in Italy and 15 in Austria and was accompanied throughout by Dr Helmut Gams, Professor of Botany in the University of Innsbruck. Professor Gams was a guide, philosopher and friend in the truest sense to each member present and the leader is especially deeply in his debt for advice freely given before and during the meeting.

A short meeting was held in Corvara-in-Badia, in the midst of the Dolomites, where members had found accommodation in various hotels and guest houses, on the evening of Sunday 2nd August. Professor Gams proposed setting off at 8 o'clock the following day for a short canter (or a chair lift) to Col Alt, a small eminence standing at 1983 m above Corvara. On Monday morning the party eventually met together on the southern, mainly acid, slopes of Col Alt where those new to the Alps saw, when they were able to deflect their eyes from the magnificence of the mountain scenery, many of the common species, among the most conspicuous of which were *Aster alpinus*, *Alnus viridis*, *Horminium pyrenaicum*, *Hypochaeris uniflora*, *Cirsium spinosissimum*, *Tofieldia calyculata*, *Adenostyles alliariae*, *Orobanche reticulata*, *Allium schoenoprasum*, *Nigritella nigra* and the leaves of *Anemone (Pulsatilla) alpina* subsp. *sulphurea* and *Colchicum alpinum*. It was thrilling to see, so far from home, such British species as *Botrychium lunaria*, *Minuartia verna*, *Moneses uniflora*, *Pyrola rotundifolia* and *P. minor*, *Kobresia simpliciuscula*, *Gentiana nivalis*, *Melampyrum sylvaticum*, *Veronica fruticans*, *Homogyne alpina*, *Rubus saxatilis*, *Ajuga pyramidalis*, *Helianthemum chamaecistus* and, now extinct in Britain, *Trichophorum alpinum*.

Tuesday 4th August was devoted, in superb weather, to a circular tour in the cars with stops at four road summits. At Passo di Campolongo (1875 m) a brief halt showed *Saxifraga squarrosa*, *Epilobium alpinum*, *Thalictrum aquilegifolium* and *Heliosperma quadrifidum* at the foot of a roadside cliff. After descending to Arabba and climbing to 2242 m at Passo Pordoi, Professor Gams immediately set off over the rocks on the eastern side of Sass Bece, pointing out in rapid succession and among many others, *Poa alpina* var. *vivipara*, *Globularia cordifolia*, *Potentilla nitida*, *Geum montanum*, *Leontopodium alpinum*, *Saxifraga moschata* and, hiding deeply in a rock crevice, the rare *Asplenium seelosii*. The road from Pordoi zig-zags down and up again to 2218 m at Passo di Sella, where below the fantastic Funffinger Spitzen members lunched and then examined the grey-white rocks (a triassic marine loam with volcanic ash), interspersed with dark green bushy trees of *Pinus cembra*. Among the species seen for the first time during the meeting were *Rhododendron intermedium* (*ferrugineum* × *hirsutum*), *Linaria alpina*, *Valeriana elongata*, *Ligusticum mutellinoides* and *L. mutellina*, *Euphrasia minima*, *Carex mucronata* and *C. firma*, *Viola biflora* and the familiar *Astrantia major*.

and *Bartsia alpina*. The final sortie was at Passo Gardena where, in the continuing heat, not all the members of the party were fit enough to follow Professor Gams up a steep path northwards. Those who did were rewarded by their first sight of the woody *Senecio abrotanifolius* (much better specimens of which were to be seen later in the Austrian Tirol), *Trisetum distichophyllum*, *Papaver rhaticum* and *Gymnadenia odoratissima*, as well as the familiar *Potentilla crantzii*.

A circular tour eastwards of Corvara with most of the time spent near Passo Falzarego occupied Wednesday. The roadside cliffs below Falzarego had *Campanula linifolia*, *Dianthus sylvestris* and the somewhat grotesque Devil's Claw, *Phyteuma comosum*, in a rock crevice rather uncomfortably high up for photography. From Falzarego Professor Gams conducted a scramble along the species-rich lower slopes of Sasso di Stria, ending near a large patch of unmelted snow at an altitude of about 2150 m. Here grew *Soldanella alpina* in blue and white forms, *Pinguicula alpina*, *Gentiana bavarica*, *Anemone baldensis*, *Doronicum cordatum*, *Woodsia alpina*, *Primula auricula* and *Arabis pumila*. On the way up to the snow, flowering specimens of *Clematis alpina*, *Lilium martagon*, *Rhodothamnus chamaecistus*, *Primula farinosa* and *Viola biflora* were among those which gave enjoyment to the photographers. Lunch was taken after a short journey by road, beside the quiet Lago di Valparola. The descent to S. Cassiano was broken at Eisenofen, where *Juniperus intermedia*, *Salix elaeagnos*, *Prunella grandiflora* and *Thesium alpinum* were among the woodland and bog species noticed. The excursion ended with a walk up into the woodland above Corvara where *Cirsium erisithales*, *Festuca heterophylla*, *Polygonatum verticillatum*, *Campanula trachelium* and the tall, beautiful *Ranunculus platanifolius* were much admired.

On Thursday, after a short drive along a boulder-studded track following the Rio Rutor, Professor Gams led a number of members eastwards by way of Pralongia some 5 km to the rocky lower slopes of Settsass, a mountain of seven peaks rising to 2561 m. As at Sella, the landscape was of *Pinus cembra* trees, growing here at one of their highest altitudes in the central Alps (2400m), scattered over the white dolomite boulders which were surprisingly cool to the touch considering the heat of the sun. Between Pralongia and Settsass, bushes of the grey *Salix glaucocercisia* (closely related to the northern *glauca*), flowering heads of the orange *Crepis aurea* in the acid flushes, numerous plants of the yellow crucifer *Biscutella laevigata* among the rocks, the by now familiar *Homogyne alpina* and *Aster alpinus*, and a wonderful display of the poisonous lichen *Letharia vulpina* on a larch trunk, were some of the plants admired, as was also the wonderful view of the snow-covered ski-slopes of the Marmolada to the south. *Adenostyles alliariae* covered some extensive damp areas not far from where the cars were left. Of the hot trek in error down almost to S. Cassiano, up again to Pralongia and down the Rio Rutor to find the cars, nothing shall be said! Four members spent the day driving to the south-west through Canazei, Campitello and Vigo di Fassa to Karersee where several species, not seen elsewhere, were noted: *Paris quadrifolia*, *Cystopteris montana* and *Lycopodium annotinum*.

Six members accompanied Professor Gams on the Friday in an ascent from Colfosco, north of Corvara to the Forc di Ciampi (2388 m), passing immediately below the fantastic pinnacles of Sass Songher which dominated Corvara. The physical effort was botanically well rewarded. There were scree slopes covered with dwarf *Valeriana supina*, *Dryas octopetala*, *Achillea oxyloba*, *Veronica aphylla*, *Papaver rhaticum*, *Saxifraga aphylla*, *S. aizoides* and *S. androsacea*. Rocks at the Forc showed magnificent *Potentilla nitida*, and also *Daphne striata*, *Gentiana clusii* and *Ranunculus alpestris*. The descent was made to Pescosta through the larch woods from which views to Corvara and southwards were obtained. Two members spent this day seeking and admiring *Eritrichium nanum* above Pordoi.

Thus the first part of the meeting ended and on Saturday 8th August the members of the party journeyed from the Dolomites into the head of the Ötztal in the Austrian northern Tirol where the headquarters was to be at Sölden. Towards the end of the day the weather deteriorated and the leader, having been delayed earlier *en route*, was storm-

bound overnight on the Italian side of the Timmelsjoch. The weather remained bad and serious botanizing became rather too homelike until Tuesday. However, members made visits in small groups on Sunday and Monday to the University of Innsbruck's field station at Obergurgl, the Stuibenfälle at Umhausen and the woods and riversides of the Ötztaler Ache a few miles north of Sölden, where *Myricaria germanica*, *Epilobium fleischeri*, *E. collinum*, *Linnaea borealis*, *Euphorbia cyparissias*, *Artemisia absinthium*, *Juniperus sabina*, *Calamagrostis pseudophragmites*, *Athyrium alpestre*, *Asplenium septentrionale*, *Carex contigua* and *C. pallescens* were among the species noted.

Tuesday 11th August was spent ascending the Ventertal, first by car along the time-regulated road to Vent and afterwards on foot up to the Hochjoch Hospiz at 2412 m from which the first glimpse of a glacier, the Hintereisferner, was obtained. At first the valley was green and even a little wooded but later the aspect became wilder with bare gravel, grey rocks and rushing torrents of muddy glacial water. Although not really rare in the Tirol (more than a thousand sheep come from the southern Tirol over passes into the Ötztal every year), the only sheep seen in the whole of the Tirol were in this valley and at the Hospiz a herd of goats roamed. Many familiar species were noticed and a long list was compiled. The yellow *Euphrasia minima* was common, *Androsace septentrionale* was strikingly in fruit and the conspicuous pale yellow dandelion-like *Hieracium intybaceum* was abundant on one gravelly slope beside the path. The handsome orange-flowered *Senecio abrotanifolius* (one plant of which was seen in the Dolomites, at Gardena) was quite common among the rocks in the higher part of the valley above the narrow gorge. On the way back Professor Gams noticed *Botrychium lanceolatum* which he had not seen before in the area.

Tuesday's quite good weather became really good on Wednesday and Thursday. On the first of these two days the upper chair lift was taken from Unt-Bruggboden to the Hohe Mutt at 2659 m from which a breathtaking view of the two valleys, Rotmoostal and Gaisbergtal, each containing a glacier, was apparent. Nearby, the blue *Primula glutinosa* was prominent in the turf and among other species examined were *Potentilla frigida*, *P. aurea*, *Cerastium uniflorum*, *C. cerastoides*, *Soldanella pusilla*, *Lloydia serotina*, *Kobresia myosuroides* and *Artemisia mutellina*. The party followed Professor Gams down into the Rotmoostal, up to the glacier and across its edge; returning along the south-west side of the valley and continuing down to Obergurgl. A long species list was made and included in it were *Artemisia genipi*, *Gentiana tenella*, *G. nivalis*, *Carex bicolor*, *Homogyne alpina*, *Trisetum spicatum*, *Pedicularis kernerii*, *Ranunculus glacialis*, *Epilobium fleischeri*, *Androsace alpina*, *Geum montanum*, *Doronicum clusii* and *Bellidiastrum michelii*.

On the final day Professor Gams permitted both ascent and descent by chairlift, first a ride of two kilometres to Hochsölden and then a shorter lift followed by a walk (during which fine specimens of *Senecio incanus* subsp. *carniolicus* and *Primula glutinosa* were passed) up to the Schwarz-see at 2796 m, apparently the highest fish-inhabited lake in the Alps. This lake was swathed in ice and snow and its blue, not black, water glittering between the floating icebergs presented a sight of such beauty that botany was temporarily forgotten. A few members trudged on up over the snow to the summit of Schwarzkogel at 3060 m, where they saw *Ranunculus glacialis*, *Primula glutinosa* and *Androsace alpina* in flower being visited by insects, and also *Sesleria disticha*. It was satisfying, at least for members of the C.S.S.F., to conclude the meeting and to take leave of Professor Gams amidst such splendour which, looked at closely, contained such reminders of home as *Silene acaulis*, *Cherleria sedoides*, *Salix repens*, *S. reticulata*, *Luzula spicata* and *Polygonum viviparum*.

B. W. RIBBONS



The code of conduct: a list of rare plants

A. J. RICHARDS

HON. SECRETARY, CONSERVATION COMMITTEE

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INTRODUCTION

During 1970, members of the Botanical Society of the British Isles (B.S.B.I.) were circulated with a document entitled 'A Code of Conduct for the Conservation of Flowering Plants and Ferns'. This 'Code', which was subsequently in great demand from other bodies and individuals, attempted to present a series of rules which, it was felt, should govern the behaviour of members of the Society with respect to Plant Conservation and, in particular, rarities. Under the first heading in the Code, 'Collecting', the following was stated:

'Members will not pick or collect any material of nationally rare species as defined in a list published by the Society.'

and in a footnote:

'This will be published in an early number of the journal *Watsonia* and may be subject to amendment from time to time.'

The purpose of this paper is to publish the list of rare plants.

STRUCTURE AND FUNCTION OF THE LIST

To facilitate the composition of a list of rare plants, always a difficult and controversial task, and in order that the structure and function of such a list be carefully considered, a special sub-committee of the Conservation Committee met.

This comprised:

E. Milne-Redhead	(President)
A. J. Richards	(Hon. Secretary, Conservation Committee)
F. H. Perring	(Hon. Secretary, Records Committee)
S. G. Harrison	(Welsh Region)
B. W. Ribbons	(Scottish Region)
D. A. Webb	(Irish Region)

Proposals and draft lists produced by the subcommittee were discussed and ratified by the Conservation Committee.

There was considerable discussion as to whether one list of rare and endangered species should be published, to cover the British Isles as a whole, or whether a number of regional lists should be produced, in which species rare in a given region (although perhaps less rare elsewhere in the British Isles) would be included. Eventually, it was decided that Ireland and Scotland formed areas of sufficiently distinct cultural and floral composition, and of a suitable size to warrant the production of separate lists. The Isle of Man, and the Channel Islands, although bearing important and distinct floral entities, seemed too small to justify the publication of separate lists at this juncture. However, in the case of the Channel Islands, the flora is so dissimilar from that of mainland Britain and Ireland that rarities confined to the Channel Islands have been distinguished by *; and those species on the England and Wales list, but not under threat in the Channel Islands by †. It is appropriate to thank Mrs F. Le Sueur and D. McClintock for help with the plants from the Channel Islands.

In any scheme in which rare and threatened species are enumerated, the problem of regional variation in the frequency of a species is of major importance. It is this factor that weighed so heavily when we considered whether the production of separate lists was justified, yet the resolution achieved by the production of just three lists is still clearly inadequate. For instance, *Calluna vulgaris* does not appear on the England and Wales list, not surprisingly, for it is a very common plant throughout most parts of these countries. Yet, it is a very rare plant in parts of eastern England, and would certainly appear on a list for Cambridgeshire. For this reason, it is hoped that regional or county lists of plants rare in the area will be forthcoming. County Naturalists' Trusts, Local Flora Writers and Regional Committees of the B.S.B.I. might co-operate in the production of such lists. The Biological Records Centre of the Nature Conservancy, at Monks Wood, near Huntingdon, maintains an up-to-date record system on the status of rare plants. Not only is this available to aid the construction of such lists, but it welcomes new information on the status of rarities. Details of the site are kept strictly confidential, but without access to recent reports on the status of rarities it is unable to act as 'watchdog' to advise and to guard against threats to nationally rare species.

The purpose of the construction of lists of rare species, whether local, regional or national, seems to us twofold. They should warn informed botanists that a species is very rare in a district and in danger of extinction as a result of either particular disturbance (picking, uprooting or even just visiting in some cases) or environmental disturbance (pollution, drainage, building, agriculture, etc.). In addition, published lists of rare plants should provide invaluable assistance to the conservationist: accurate information on the scarcity of a plant species is more likely to carry weight with land-owners, planning authorities, courts of enquiry etc., than a spoken opinion.

Lists of this kind can never be wholly satisfactory. Some excluded species may well be more threatened than some which are included, and doubtless some of those that are included might be omitted. Suggestions for improvements to the list will always be welcome and, if they are accepted by the Conservation Committee, can be included in subsequent editions.

Whilst the above considerations are applied to vascular plants, there is no reason why they should not apply equally to other groups of organisms: animals and lower plants. The 'Code' has been so well received that a revised edition, applicable to the public in general, has been produced in quantity through the generous assistance of the World Wildlife Fund (British National Appeal). Following the success of the 'Code of Conduct', a number of other Societies are following our example by producing their own 'Codes'. Eventually, it is hoped that all such Codes will be published together in a booklet and that those Societies will produce their own lists of rare species, both national and local.

CRITERIA FOR INCLUSION

After discussion, the following criteria were adopted.

1. The species should occur in very few localities in the region (usually 5 or fewer, but less in the case of large populations and more in the case of small populations).
2. The species should not be common or abundant anywhere in the region.
3. The species should not be obviously protected in most or all of its localities in the region by occurring in established Reserves, being inaccessible, etc.
4. Species known to be especially vulnerable reproductively (e.g. some annuals with poor regeneration) or those occurring in a vulnerable habitat (limestone pavement, shingle beaches, wetlands and other habitats liable to excessive influence by man) have been given special consideration.
5. The species should be native or very well-established introductions.
6. 'Agamospecies', 'microspecies', subspecies and other critical species-segregates should be excluded. It is hoped that these would be included in more locally based lists.

LISTS OF RARE SPECIES NOT TO BE COLLECTED OR PICKED BY MEMBERS

Nomenclature and systematic order follow Perring, F. H. & Walters, S. M. (1962), *Atlas of the British Flora*.

A. ENGLAND, WALES, CHANNEL ISLANDS AND MAN

<i>Lycopodium annotinum</i>	<i>T. bocconeii</i>
<i>Isoetes hystrix</i> †	<i>T. stellatum</i>
<i>Equisetum pratense</i>	<i>Ornithopus pinnatus</i>
<i>Trichomanes speciosum</i>	<i>Lathyrus palustris</i>
<i>Anogramma leptophylla</i> *	<i>Potentilla rupestris</i>
<i>Woodsia ilvensis</i>	<i>Sibbaldia procumbens</i>
<i>W. alpina</i>	<i>Cotoneaster integerrimus</i>
<i>Dryopteris cristata</i>	<i>Saxifraga nivalis</i>
<i>Ophioglossum lusitanicum</i>	<i>S. hirculus</i>
<i>Ranunculus paludosus</i> *	<i>S. cespitosa</i>
<i>R. reptans</i>	<i>Lythrum hyssopifolia</i>
<i>R. ophioglossifolius</i>	<i>Daphne mezereum</i>
<i>Rhynchosinapis wrightii</i>	<i>Ludwigia palustris</i>
<i>Isatis tinctoria</i>	<i>Eryngium campestre</i>
<i>Draba aizoides</i>	<i>Bupleurum falcatum</i>
<i>Cardaminopsis petraea</i>	<i>B. baldense</i>
<i>Arabis stricta</i>	<i>Meum athamanticum</i>
<i>Matthiola incana</i>	<i>Peucedanum officinale</i>
<i>M. sinuata</i>	<i>Euphorbia peplis</i>
<i>Viola rupestris</i>	<i>E. hyberna</i>
<i>V. stagnina</i>	<i>Polygonum maritimum</i>
<i>V. kitaibeliana</i> *	<i>Betula nana</i>
<i>Polygala amara</i> s.l.	<i>Pyrola media</i>
<i>Hypericum linarifolium</i>	<i>Orthilia secunda</i>
<i>Tuberaria guttata</i> †	<i>Limonium auriculae-ursifolium</i> *
<i>Helianthemum appeninum</i>	<i>Armeria arenaria</i> *
<i>Silene italica</i>	<i>Cyclamen hederifolium</i>
<i>Paeonia mascula</i>	<i>Exaculum pusillum</i> *
<i>Lychnis alpina</i>	<i>Centaureum tenuiflorum</i>
<i>L. viscaria</i>	<i>C. scilloides</i>
<i>Dianthus gratianopolitanus</i>	<i>Gentiana verna</i>
<i>D. gallicus</i> *	<i>Cynoglossum germanicum</i>
<i>Kohlruschia prolifera</i>	<i>Myosotis alpestris</i>
<i>Cerastium alpinum</i>	<i>M. sicula</i> *
<i>C. arcticum</i>	<i>Mertensia maritima</i>
<i>Minuartia stricta</i>	<i>Verbascum pulverulentum</i>
<i>Arenaria norvegica</i>	<i>Linaria pelisseriana</i> *
<i>Spergularia bocconii</i>	<i>Limosella subulata</i>
<i>Corrigiola littoralis</i>	<i>Veronica spicata</i>
<i>Herniaria glabra</i>	<i>V. praecox</i>
<i>H. ciliolata</i> †	<i>V. verna</i>
<i>Scleranthus perennis</i>	<i>V. triphyllos</i>
<i>Lavatera cretica</i>	<i>Rhinanthus serotinus</i>
<i>Althaea hirsuta</i>	<i>Melampyrum arvense</i>
<i>Genista pilosa</i>	<i>M. sylvaticum</i>
<i>Ononis reclinata</i>	<i>Bartsia alpina</i>
<i>Trifolium molinerii</i>	<i>Orobancha purpurea</i>

*Species occurring only in the Channel Islands.

†Species rare outside the Channel Islands.

<i>O. rapum-genistae</i> †	<i>Romulea columnae</i> †
<i>O. alba</i>	<i>Gladiolus illyricus</i>
<i>O. reticulata</i>	<i>Cypripedium calceolus</i>
<i>Thymus serpyllum</i>	<i>Cephalanthera rubra</i>
<i>Calamintha sylvatica</i>	<i>Epipactis dunensis</i>
<i>Salvia verbenaca</i> *	<i>Epipogium aphyllum</i>
<i>Stachys germanica</i>	<i>Spiranthes romanzoffiana</i>
<i>S. alpina</i>	<i>Goodyera repens</i>
<i>Galeopsis segetum</i>	<i>Hammarbya paludosa</i>
<i>Teucrium chamaedrys</i>	<i>Liparis loeselii</i>
<i>T. scordium</i>	<i>Corallorhiza trifida</i>
<i>T. botrys</i>	<i>Neotinea intacta</i>
<i>Ajuga pyramidalis</i>	<i>Ophrys fuciflora</i>
<i>Phyteuma spicatum</i>	<i>O. sphegodes</i>
<i>Lobelia urens</i>	<i>Himantoglossum hircinum</i>
<i>Linnaea borealis</i>	<i>Orchis militaris</i>
<i>Filago gallica</i>	<i>O. simia</i>
<i>Gnaphalium luteo-album</i>	<i>O. laxiflora</i> *
<i>Artemisia campestris</i>	<i>Eriophorum gracile</i>
<i>Cirsium tuberosum</i>	<i>Scirpus americanus</i>
<i>Centaurea paniculata</i> *	<i>S. holoschoenus</i>
<i>Hypochoeris maculata</i>	<i>Eleocharis parvula</i>
<i>Scorzonera humilis</i>	<i>Cyperus fuscus</i>
<i>Crepis foetida</i>	<i>Kobresia simpliciuscula</i>
<i>Damasonium alisma</i>	<i>Carex flava</i>
<i>Tofieldia pusilla</i>	<i>C. depauperata</i>
<i>Polygonatum verticillatum</i>	<i>C. filiformis</i>
<i>Maianthemum bifolium</i>	<i>C. montana</i>
<i>Lloydia serotina</i>	<i>C. ornithopoda</i>
<i>Muscari atlanticum</i>	<i>C. atrata</i>
<i>Juncus balticus</i>	<i>C. elongata</i>
<i>J. capitatus</i> †	<i>Poa alpina</i>
<i>J. alpinoarticulatus</i>	<i>P. glauca</i>
<i>J. mutabilis</i>	<i>Bromus interruptus</i>
<i>Allium ampeloprasum</i>	<i>Deschampsia alpina</i>
<i>A. sphaerocephalon</i>	<i>Lagurus ovatus</i> †
<i>A. schoenoprasum</i>	<i>Phleum alpinum</i>
<i>Leucojum aestivum</i>	<i>Alopecurus alpinus</i>
<i>L. vernum</i>	<i>Milium scabrum</i> *
<i>Narcissus obvallaris</i>	

B. SCOTLAND

<i>Trichomanes speciosum</i>	<i>Lychnis alpina</i>
<i>Asplenium obovatum</i>	<i>Minuartia rubella</i>
<i>A. septentrionale</i>	<i>Cerastium nigrescens</i>
<i>Cystopteris dickieana</i>	<i>Arenaria norvegica</i>
<i>Woodsia ilvensis</i>	<i>Linum anglicum</i>
<i>W. alpina</i>	<i>Ononis spinosa</i>
<i>Dryopteris cristata</i>	<i>O. reclinata</i>
<i>Thelypteris palustris</i>	<i>Trifolium fragiferum</i>
<i>T. robertiana</i>	<i>Astragalus alpinus</i>
<i>Ranunculus reptans</i>	<i>Oxytropis campestris</i>
<i>Thlaspi alpestre</i>	<i>Vicia tetrasperma</i>
<i>Cardamine impatiens</i>	<i>Lathyrus sylvestris</i>
<i>Silene conica</i>	<i>L. japonicus</i>

<i>Potentilla rupestris</i>	<i>Artemisia norvegica</i>
<i>Saxifraga hirculus</i>	<i>Cicerbita alpina</i>
<i>S. cernua</i>	<i>Scheuchzeria palustris</i>
<i>S. rivularis</i>	<i>Polygonatum verticillatum</i>
<i>S. cespitosa</i>	<i>Juncus compressus</i>
<i>Phyllodoce caerulea</i>	<i>J. filiformis</i>
<i>Monotropa hypopitys</i>	<i>J. nodulosus</i>
<i>Diapensia lapponica</i>	<i>Kobresia simpliciuscula</i>
<i>Gentiana nivalis</i>	<i>Carex punctata</i>
<i>Myosotis brevifolia</i>	<i>C. stenolepis</i>
<i>M. alpestris</i>	<i>C. buxbaumii</i>
<i>Rhinanthus serotinus</i>	<i>C. norvegica</i>
<i>Parentucellia viscosa</i>	<i>C. atrofusca</i>
<i>Bartsia alpina</i>	<i>C. recta</i>
<i>Orobancha rapum-genistae</i>	<i>C. chordorrhiza</i>
<i>Thymus pulegioides</i>	<i>C. elongata</i>
<i>Acinos arvensis</i>	<i>C. microglochin</i>
<i>Wahlenbergia hederacea</i>	<i>Vulpia membranacea</i>
<i>Homogyne alpina</i>	<i>Poa flexuosa</i>
<i>Inula crithmoides</i>	<i>Agropyron donianum</i>
<i>Erigeron acer</i>	<i>Calamagrostis canescens</i>
<i>E. borealis</i>	

C. IRELAND

<i>Trichomanes speciosum</i>	<i>Rubus chamaemorus</i>
<i>Cryptogramma crispa</i>	<i>Alchemilla alpina</i>
<i>Asplenium obovatum</i>	<i>Saxifraga nivalis</i>
<i>A. septentrionale</i>	<i>S. hirculus</i>
<i>Thelypteris dryopteris</i>	<i>S. hartii</i>
<i>Trollius europaeus</i>	<i>Epilobium alsinifolium</i>
<i>Ranunculus tripartitus</i>	<i>Oenanthe pimpinelloides</i>
<i>R. fluitans</i>	<i>Polygonum viviparum</i>
<i>Crambe maritima</i>	<i>Erica ciliaris</i>
<i>Teesdalia nudicaulis</i>	<i>Pyrola rotundifolia</i>
<i>Cardaminopsis petraea</i>	<i>Monotropa hypopitys</i>
<i>Matthiola sinuata</i>	<i>Centaurium littorale</i>
<i>Hypericum canadense</i>	<i>Mertensia maritima</i>
<i>Tuberaria guttata</i>	<i>Orobancha rapum-genistae</i>
<i>Helianthemum chamaecistus</i>	<i>Mentha pulegium</i>
<i>Minuartia recurva</i>	<i>Salvia horminoides</i>
<i>Arenaria ciliata</i>	<i>Ajuga pyramidalis</i>
<i>A. norvegica</i>	<i>Adoxa moschatellina</i>
<i>Atriplex littoralis</i>	<i>Inula salicina</i>
<i>Salicornia perennis</i>	<i>Otanthus maritimus</i>
<i>Geranium rotundifolium</i>	<i>Saussurea alpina</i>
<i>Trifolium glomeratum</i>	<i>Serratula tinctoria</i>
<i>T. subterraneum</i>	<i>Scheuchzeria palustris</i>
<i>Lotus hispidus</i>	<i>Simethis planifolia</i>
<i>Astragalus danicus</i>	<i>Asparagus officinalis</i>
<i>Vicia orobus</i>	<i>Colchicum autumnale</i>
<i>V. lathyroides</i>	<i>Juncus compressus</i>
<i>Lathyrus palustris</i>	<i>Leucojum aestivum</i>
<i>L. japonicus</i>	<i>Epipactis phyllanthos</i>

Carex flava
C. paupercula
C. appropinquata
C. divisa
C. elongata
C. pauciflora

Puccinellia fasciculata
Poa alpina
Hordelymus europaeus
Deschampsia alpina
Calamagrostis epigejos
Hierochloe odorata

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Watsonia

January 1972 Volume nine Part one

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Presidential Address 1972

THE COMMON GROUND OF WILD AND CULTIVATED PLANTS

D. McCLINTOCK

My interest in wild flowers has been increasingly concerned with and enriched by an interest in cultivated plants. That our Society's next conference in September 1972 is the first, and I hope not the last, joint one with the Royal Horticultural Society and that this should coincide with my Presidency of our Society is coincidental: the conference was planned before I was approached to take this office. Nevertheless I am glad of the coincidence, because I feel strongly that both gardeners and field botanists have much more in common than some realise and that each can gain from a closer acquaintance with the other's main area of interest. There are those who think that field botanists and gardeners are 'different animals'. Mr H. G. Hillier writes (in his new *Manual of Trees and Shrubs*, p. 364 (1971)) of W. J. Bean and E. H. Wilson that they were "tremendous companions" in the garden, but of A. Rehder that "like so many botanists he was not 'good company' in the garden". Of course all of us have, happily, different tastes and skills, each able to add something the man next door cannot, and *vice versa*. But any botanist worth his salt ought to be able to be "good company in a garden", explaining aspects the gardener may be unaware of.

The supreme reason for close collaboration between plantsmen of all interests is that the plant kingdom is one—indeed, all nature is. All garden plants derive ultimately from wild plants; and both are controlled by the same mechanisms and considerations. Only by taking the full range in cultivation and the wild can a proper appreciation be obtained of any group, such as a genus or a species. Other reasons for collaboration are that botanists and gardeners see them from different angles, and often knows different details; that a knowledge of ecology must help with cultivation; and that there is much to co-ordinate, and understand, in the naming of plants—and each can often give, and correct, names.

A main advantage of looking at a genus or species, both in the wild and in gardens, is to realise just what forms of it do, and can, exist. Those which do are rarely all those which can. In the wild, competition and natural selection are constantly eliminating extremes of variation. Plantsmen on the other hand cherish the extremes and the unusual; and the keener the plantsman, often the wider his taste. In specialist societies, such as the Heather Society, every form of variation is pounced on, propagated and cossetted. Snowdrop specialists and many others are just the same! Which of the results are really garden-worthy is a matter of opinion, and which are different enough from existing cultivars is another moot point. But knowing and recording and preserving every form of variation shows uniquely what a taxon is capable of. An indication of this for ordinary Ling, *Calluna vulgaris*, is to be seen in Plate

178 (alas, not reproduced in colour) in the Royal Horticultural Society's Journal for September 1971.

Some cultivars come from seedlings, or sports, observed in gardens. But many others will have been noticed, collected, and collected alive, in the wild. There are too many dried, dead herbarium specimens of interesting or potentially interesting variants which should have been propagated: recently at Kew I came across "*Erica cinerea floris pulchris carneis* from near Blair, the seat of the Duke of Athol in Scotland" in Lightfoot's Herbarium, some 200 years old. Once propagated, ample samples can be taken for the record, and gardens enriched as well. When Mr J. W. Dyce found a double-flowered *Calluna* in Norfolk in 1971, he rightly collected the odd voucher for a herbarium, but also shoots for cuttings, of which over 200 were taken, and he left the bulk of the plant intact. Undoubtedly it is easier just to pick and press specimens; taking cuttings calls for extra trouble, and skill as well, a skill too few field botanists possess. They would do well to get instruction in some of the arts of propagating and cultivation. Until they do, they lose, and so do our gardens.

I would suggest too that seed be especially taken, when convenient, partly for sowing and partly to store with the specimen, dried naturally, so it can be sown later if required, and for any seed bank. For the ability to grow and watch widens our knowledge. One can learn to recognise a plant at the seedling stage and right through to seed time, get familiar with its jizz throughout life, and so understand it better, and spot it the more readily and accurately in the wild. One can also safely collect rootstocks and the like from garden material. Unusual, and even usual, wild plants can be studied to see how stable they are and, perhaps, discover why they mutate or revert. Such cultivars of heathers as *Calluna* 'Ruth Sparkes,' which have sported in such a variety of forms, could well reward such study.

I must here anticipate the strictures of my friends of the never-pick-wild-flowers brigade. Maybe their extremism is now dead; indeed, an arch-protagonist provided the original inspiration for the booklet *Flowers You May Pick*, now long-overdue to appear. But I consider it not only right, but wrong not, to try to propagate a good form of a wild plant growing in a normal population—a heather cutting for example is a tiddley enough object for a plant to spare. Left to itself, a marked variant is likely to be lost, levelled down by gene flow. All the more important therefore to give it a helping hand to survive; and vegetative reproduction alone is reliable. Seed cannot be guaranteed to preserve the characters—but may do so. A broom I noticed in flower in September in Brittany some years ago transmits this character to its seedlings. So now I have brooms in my garden which flower not only in May but continue through July and August and go on right to the late autumn. But sow seed from a fine heather, and the chances are you will get ordinary ones. I do however rate the chances higher of good plants from seed from a collection of good varieties, where genes for desirable characters must be more prevalent. Equally, either because such extreme forms are less stable genetically or because observation in gardens is closer, or both, sports have been noticed much more in gardens than elsewhere.

Two groups of heathers, however, tend to transmit their characters to their seedlings. One is those with yellow or golden foliage, so easily picked out at the early seedling stage. The other is the prostrate forms from sea cliffs where there seems now to be inbred a genetic factor as well to survival in the

windy environment. Such ecotypes of course are to be found in other genera as well. But knowledge of their nature can come only by transplant and propagation experiments, growing plants and observing them in gardens. F. W. Burbridge wrote (*Jl R. hort. Soc.*, 11:83 (1889)): "The garden is a laboratory in which experiments are constantly being carried out, often unconsciously".

Sowing seeds can also be very instructive, particularly with controlled pollination. Only thus can we tell which of the dwarf brooms are genetically so. Only thus was it learnt that the vari-coloured flowers of *Daboecia cantabrica* 'Bicolor', once assumed to be a chimaera, could be transmitted to its offspring—there is an interim note on this in the Proceedings of the R.H.S. Scientific Committee for Sept. 22 and Oct. 13, 1970 (p. 50).

Not only do we learn more by propagating good plants we see in the wild, but we preserve them: conservation in action. Many gardens are doing valuable work by growing plants rare, or liable to extinction, in the wild. But I would also commend the bold action of the man who refound *Homogyne alpina* in Scotland when he took a root. This was grown on, shared with numerous other gardeners; and as a result specimens of the genuine Scottish plant could be, still can be, freely seen fresh, and are also readily available for herbarium specimens, all this without any further pressure on the wild patch. Such cultivation of rarities also enables localities to be restocked if the need arises, as I hope will soon be done with *Cypripedium calceolus*, or, in a much lesser way, was done with *Ornithopus compressus* at Swanley in Kent (details in the Bulletin of the Kent Field Club for 1969, p. 51).

Experiments, too, record the tolerance of a plant in different soils and conditions, i.e. give clues to its ecology. Thus gardens, or gardening botanists, can teach field botanists. Equally, field botanists can teach many gardeners what is likely to prosper in which conditions, knowledge which is patently lacking in certain gardens. Not that this is as clear as it might seem. Read any Flora, and it will tell you that *Erica ciliaris* grows in boggy places. Come to my very dry sandy garden and you will find it self-sown and exuberant on the steep south-east-facing, well drained, slopes. The secret here no doubt is lessened competition, as well as the probable fact that most plants are much more tolerant in such circumstances than is generally realised. Take another example. *Helianthemum polifolium* is a plant of limestone. Yet it seeds itself in my acid rockery, no doubt also from the same reason. But take also *Dianthus gratianopolitanus*, a plant of chalk and limestone, which barely survives there, and has not flowered for years. I interpret this that it needs lime as well as absence of competition, i.e. it is an obligate calcicole. So plants may do well in gardens in places where they would not do well in the wild. Even so, a knowledge of habitats must help garden planning, and is essential in the wild garden and for obtaining successful ground cover.

The last two are important sources of some of the border-line plants people hold differing views on—are they wild or are they not? To my mind a wild plant is one which competes successfully in natural, or semi-natural, associations, spreading by seed or vegetatively. That a plant is sterile is no bar to its fitting into the British scene—recent examples are *Veronica filiformis* and *Cicerbita uralensis* (*macrophylla*); and indeed *Lysimachia nummularia* may well also have been brought to this country for decorative or other reasons, and escaped. Forms of this last plant are currently being investigated. Bamboos flower rarely or even not at all, but some spread widely by rhizomes into great thickets.

Yet no wild flower book so far really includes them. Here, gardeners should come to our aid in naming them, although they are thankful for the help of the botanist, above all our own member Dr Hubbard.

There are admittedly difficulties in deciding when to treat a plant as wild and when not, and the decision must be a matter of personal opinion. But such an opinion should be the same throughout a book or a paper, the author having seen each doubtful plant *in situ* and judged by the same criteria. But to know what is grown in gardens is a great help in naming what survives, in gaining better precision by being aware what garden variants exist or may appear outside. Professional botanists have always tended—less so nowadays—to scorn non-native plants or escapes. Our wild flower literature is the thinner and poorer from such a narrow view. Our flora is always changing and one of the changes that is going on ever-increasingly is the incorporation into it of foreign plants, many of which derive from gardens. Specialised knowledge may be able to tell that a given variation in the wild must be garden-derived.

One way in which wild flower people can assist, and interest, gardeners, is with weeds, for a weed in a garden may be a natural rarity elsewhere, and weeds after all only exist where man has been. Not only may botanists name them, but they may deduce from them the nature of the soil and the history of the garden, for some weeds remain remarkably local, and the origin and history of many are fascinating. They may even give evidence that the birds had been fed the previous winter. Several distinctive weeds have been spread from nurseries, for example *Draba muralis*, *Rorippa sylvestris*, *Oxalis corymbosa*, *Crassula helmsii* and *Mibora verna*. Some of the distinctive, introduced, weeds in my own garden I have pleasure in recognising, or I am told suddenly appear, in the gardens of friends to whom I have given plants. Few gardeners can name many of the weeds they have. The names they do give them frequently differ from those in our books and some of our standard names might well be modified accordingly; and so might some of the names gardeners use for them, such as Mare's-tail. I hope that an increased awareness of what some 'weeds' are may mean less use of blanket herbicides in gardens. The gardener will gain agreeable surprises from the seedlings he will then discover from some of his own special plants, which otherwise would have succumbed to the general massacre.

For horticulturists, nomenclature is a major anathema, and a cause of dislike of 'botanists'. This is partly because of 'tongue-twisting' Latin names—and taxonomists would do well to bear the ordinary man in mind when coining names—and partly because of name changes. Citations mean nothing to practically any gardener, let alone those such as "(Benth. & Hook.) Asch. & Schweinf.", and it is even worse if these gentlemen's names are spelt out in full. Here I might quote from one of the admirable weekly essays in the Financial Times for Nov. 17, 1971, by Robin Lane Fox: "Plants have a science of their own and gardeners should be aware of it: botany, however, does not have many friends among gardeners (nor, often, does gardening among botanists), not least because botanists keep changing the names of flowers from one ugly polysyllable to another in the interests of what scientific congresses call nomenclature. This opposition between scientists and lovers of flowers is most regrettable. With the help of a little botany, gardeners can enjoy their flowers knowingly, and though it is hard to love cells and chromosomes, instead of the roses which are their finished product, what is lost in love is gained in understanding;

the botanically-minded gardener can size up the problems and charms of his plants much as the psychiatrist sizes up his patients. The simplest entry to botany is through books, but most of these are so unbearably prosy that few gardeners could bear them for long."

Field botanists dislike name changes just as much, and have done for many a long year, and also yearn for stability. Indeed, I wish there were a rule that no name change could be implemented until ten years after it was proposed, and even then it should be specially agreed by both horticulturists and botanists. This might eliminate some over-hasty proposals. But nurserymen in particular have a commercial grievance as well over name changes—it means altering all their catalogues and plant labels, and re-instructing their staff and their customers, who go on asking for plants by the same old name. This is where the proposal for horticultural equivalents may come in, horticulturists retaining the old name, but adding the new one in brackets, for a period anyway. It seems a sensible compromise. Here I should like to say a word or two in praise of the invaluable catalogues an ever-increasing number of nurseries are publishing. They are of value not only nowadays, but for years to come. Indeed, in any event old catalogues should not be thrown away, but presented to some suitable library such as the Lindley, Kew, Edinburgh or the British Museum.

But we must be clear that horticulturists are as much bound by the rules as anyone else: it is not just "botanists" who make and alter them. The *International Code of Nomenclature of Cultivated Plants* (latest edition 1969) is purely an extension of the *International Code of Botanical Nomenclature* (1966), agreed by gardening plenipotentiaries from all over the world: they are one, and truly international. Everyone ought to recognise that following the rules is the only hope for stability, although inevitably nomenclature must be to a certain extent unstable, because the plants themselves are, and because our knowledge of them develops.

The changes come from three main causes. If a plant has been bearing a name that clearly belongs to another, obviously it must give way, for two plants cannot bear the same name. One regrets the original inaccurate identification, but the sooner it is corrected, the better. Even here, there may be doubts as to how distinct two plants are, at specific, subspecific or varietal level. For the revision of a plant's status or genus the ground may be more debatable. Most such changes evidence improved awareness of relationships, but they should be proposed only with the greatest circumspection. Plants in different species, or even genera, which look distinct enough in the wild in this country, may prove elsewhere to be connected by intermediate forms with no clear distinctions possible. The final cause, and the least satisfactory of all, is the discovery that a hitherto familiar name is not in fact the earliest valid one under the Rules. The worst example of this was when *Erica* "*mediterranea*", which has been universally and unambiguously used for one plant and one plant only for nearly 200 years, had to be replaced by a specially coined and totally unwanted name, *E. erigena*. The history is set out in the Heather Society's *Guide to the Naming of Plants*, pp. 20–21 (1969).

One precision of horticultural nomenclature can surely be used profitably by field botanists—I refer to the treatment of clones and cultivars. Briefly, the essential difference between a clone and a variety is that a clone is a group of plants propagated vegetatively one from the other without full sexual processes, and all therefore identical in genetic make-up. "Variety" is often used for a

clone, but strictly it is a botanical category for a free-breeding population in the wild, which will inherently include variation as the genes combine differently every time pollen fertilizes ovule and seeds develop. A single variant from such a wild variety may be, often is, selected and propagated and thereby becomes a clone. But the difference between the genetically-identical, vegetatively-propagated clone, and the genetically-various sexually-produced variety is basic, and should be brought out by precision of nomenclature. Thus *Betula pendula* 'Dalecarlica' can be used only for the vegetative descendants of the original tree. But *f. dalecarlica* (L.f.) Schneider will cover any similar very deeply, narrowly and distinctively, lobed form. Thus too *Erica arborea* 'Alpina' and var. *alpina* Dieck.

Many of our wild plants, more than most people realise, are in fact clones, reproducing themselves unchanged by vegetative means. There are two main groups. One is plants such as mints, where seedlings are rare and stolons are almost the rule for natural spread, in this instance much aided by gardeners. Other examples are plants never, or hardly ever, known to fruit in this country, such as *Acorus calamus*. The other group is the agamospermous apomicts, where there is no sexual mingling, no gene exchange, but asexually-formed seed reproduces identically individual plants and individual aberrations, as in *Alchemilla* or most species of *Hieracium* or *Taraxacum*. To my mind, if we are sure they are clones, none of these taxa should have Latin names of specific or varietal status. A species, or a variety, once more, is a true-breeding population with all its inherent variation. The non-breeders have no variability and are as much clones as garden cultivars of heathers or Hebes or hundreds of other shrubs propagated by cuttings—and they should be named accordingly. The tall, stout garden Apple Mint should be *Mentha* 'Alopecuroides', or this same cultivar name with a hybrid binomial, if one is sure of the origin and the correct name for this particular cross. Garden nomenclature allows a cultivar name with only the genus, and such is frequently most convenient, and avoids any spurious accuracy.

Another genus in which such nomenclature should often be adopted is with the naturalised *Narcissi*. As was pointed out in the Royal Horticultural Society's *Daffodil and Tulip Year Book* for 1971, pp. 181–3, in a great many instances these are recognised, named, garden plants which, for reasons not yet fully understood, seem to persist unaltered over the ages, reproducing almost exclusively by offset bulbs. They should be named in Floras as *Narcissus* 'King Alfred', 'Princeps' and so on. I have earlier argued, e.g. in *Companion to Flowers*, p. 51 (1966), that *Sagina* 'Boydii' and *Erica* 'Stuartii' are nothing but clones and their names should show the fact. Cultivar names given since 1959 cannot be in Latin form. Nevertheless it might be advantageous if clones of purely wild plants did have basically Latin names although still in cultivar style, i.e. in single quotes, starting with a capital letter and not in italics, while the 'fancy names' were kept for clones arising in gardens, names such as *Rubus* 'Black Maria' for a garden blackberry—for those who like puns.

Accurate nomenclature is very much assisted by, perhaps impossible without, adequate dried specimens, hence the importance of herbaria. These *horti sicci* seem the antithesis of a garden, dead, brown plants, and this no doubt is one reason why so very few—any?—gardeners ever press a garden plant. Indeed until lately there was not even such a record for plants the Royal Horticultural Society had given an Award of Merit to—and as a result it is now impossible to

know what some of these were like. Herbaria are the essential complement to the living plant, each having advantages the other cannot have. So few are the cultivated plants in any of our herbaria, that it may be safely said that anyone who presses and dries specimens of the plants in his own garden will be doing a useful service, and at no risk to our rarities. Once dried, plants all lose, sooner or later, colour. This should be noted on the sheet, in the terms of one of the horticultural colour charts; and to have the same information for wild plants would be a rarely-seen benefit.

I have not said enough of the advantages to be gained by field botanists visiting gardens, public and private, or nurseries, especially to see what other plants in a genus or family look like, or even what cultivars there are of British wild plants, or to help name escapes they see. Equally gardeners could do well to take a look at the Order beds of our Botanic Gardens, or realise that all is not dry in a herbarium (and most have admirable collection of pictures as well), or in a Flora, to enlarge their ideas similarly. Only last year I showed *Potentilla erecta* on a moor to a keen and able young plantswoman, who was quite thrilled to realise there were wild Potentillas too. It just shows what rewarding pleasures there are unsuspected in the others' domain.

Variation in sea mayweed (*Tripleurospermum maritimum* (L.) Koch) in the British Isles

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ABSTRACT

Population samples of sea mayweed (*Tripleurospermum maritimum* (L.) Koch) collected from 32 maritime sites in the British Isles showed a wide range of morphological variation in simultaneous cultivation at Oxford, and remained distinct from scentless mayweed (*T. inodorum* (L.) Schultz Bip.). All were diploid ($2n = 18, 18 + B$, or $18 + 2B$). Plants from beach sites generally had fairly long, branching stems, brush-like or rather fleshy leaves, and strongly inflated achenes; the stems were prostrate in plants from exposed beaches but ascending or erect in plants from more sheltered sites. Plants from cliff sites were generally short-stemmed, with fleshy leaves and less inflated achenes. Most characters were substantially retained in cultivation. Plants from the Atlantic coast of Europe from north Portugal to southern England characterised by strong purple pigmentation and narrower leaf segments are referred to *T. maritimum* subsp. *maritimum* var. *salinum* (Wallr.) Kay, **comb. nov.** Natural selection appears to maintain the distinctive characters of some local populations despite gene-flow from other populations and from *T. inodorum*. Local populations are often very small, and genetic drift may be an important factor affecting variation.

INTRODUCTION

The sea mayweed, *Tripleurospermum maritimum* (L.) Koch (Asteraceae-Anthemideae), is a biennial or short-lived perennial herb, with much-divided, tripinnate leaves and large, white-rayed capitula, which is native on the coasts of western and northern Europe from northern Portugal to the Arctic. It is a halophytic plant, and is most frequently found near the highest drift-line on beaches and in the spray-zone on sea-cliffs, typically on rather unstable or moderately disturbed substrata. It also grows in some seabird nesting colonies, where it may be very abundant, and occasionally grows in artificially disturbed ruderal sites near the sea.

T. maritimum is a variable species which has attracted the attention of many taxonomists. A number of nomenclatural solutions, usually based on studies of herbarium material, have been proposed for the twin problems of variation within *T. maritimum* and the relationship between *T. maritimum* and scentless mayweed, *T. inodorum* (L.) Schultz Bip. (an annual weed of arable land and waste places). Many names have been coined for the taxa involved, at the levels of species, subspecies, variety and form, and nomenclatural confusion has been increased by periodic re-allocation of the taxa to a new genus; the genera *Matricaria*, *Chrysanthemum*, *Pyrethrum*, *Chamaemelum* and *Tripleurospermum* have been favoured at different periods. Studies of achene morphology (Briquet 1916, Kynčlová 1970) and of the chemistry of secondary products, especially polyacetylenes (Sørensen 1963), strongly support the inclusion of the taxa in the genus *Tripleurospermum*, which is now generally accepted. Opinion is still divided on the question of the status of *T. maritimum* and the related

species *T. inodorum*. A number of investigators who have used comparative cultivation and other experimental techniques have concluded that *T. maritimum* and *T. inodorum*, although interfertile to some extent, are best regarded as separate species (Nehou 1953, Lövkvist 1963, Kay 1969), but other workers have regarded the taxa as subspecies (Vaarama 1953, Pedersen 1961). The marked ecological and morphological differences between *T. maritimum* and *T. inodorum*, the infrequency of hybrid and intermediate populations, and the partial or complete sterility of a proportion of the hybrids do, however, support the view that it is best to treat the taxa as species.

The pattern of variation within *T. maritimum sensu stricto* is not well understood. Several forms of the species were described by Neuman (1882) from Swedish material, and Lester-Garland (1921) attempted to apply Neuman's classification to British plants, though with limited success; Lester-Garland's translation of Neuman's key to the forms is erroneous at one point, partly reversing Neuman's meaning, and annotations on herbarium specimens show that Neuman's and Lester-Garland's classifications were interpreted very differently by different taxonomists. Transplant experiments carried out during the nineteenth and early twentieth centuries (Lloyd 1844, Drabble & Drabble 1910, Massart 1921) were interpreted as showing that *T. maritimum* was merely an environmental modification of *T. inodorum*, with no genetic basis, and, if this view is taken, named varieties of *T. maritimum* have little significance. However, several more recent studies of *T. maritimum* in which transplant experiments or comparative cultivation have been used have demonstrated that *T. maritimum* and *T. inodorum* remain distinct in cultivation, and have also shown that different populations of *T. maritimum* retain their differences in cultivation (Turesson 1922, Hüser 1930, Nehou 1953, Rottgardt 1956). These investigators each restricted their studies to a relatively small area and a small number of populations. Most recent taxonomic treatments of *T. maritimum sensu stricto* divide it into three taxa: southern populations with distinctive purplish-red stems and brush-like leaves are separated as the taxon *salinum*; northern and Arctic populations with distinctive broad, brown-black borders to the involucre bracts are separated as the taxon *phaeocephalum* ('*ambiguum*'), which is sometimes regarded as a species, and the remaining geographically intermediate populations are regarded as typical *maritimum*. Clapham (1962) observed that the British forms of *T. maritimum* (and *T. inodorum*) required further study; he regarded *T. maritimum* and *T. inodorum* as subspecies of *T. maritimum* (subsp. *maritimum*, and subsp. *inodorum* (L.) Hyland. ex Vaarama) but, rather surprisingly, tentatively allocated the maritime forms of southern British coasts (var. *salinum*) to subsp. *inodorum*. In his view, subsp. *maritimum* was found only on the coasts of western and northern Britain, usually as var. *maritimum* but with some var. *phaeocephalum* in the extreme north.

Although the taxonomic status of British *Tripleurospermum* populations clearly merited investigation, the work described in the present paper was not undertaken primarily in the hope that it would provide a neat solution to a taxonomic problem. During an investigation of the biology of the British species of *Anthemis*, *Matricaria* and *Tripleurospermum* (Kay 1965), I realised that the maritime *Tripleurospermum* populations were unusually interesting, both in their varied and often extreme maritime habitats, and in their population structure: small, fluctuating populations of short-lived perennials with a high reproductive capacity, growing in localities which are often widely separated

from one another and subject to considerable environmental changes from year to year. It soon became apparent from field observations that virtually all these maritime populations, including those of southern Britain, belonged to *T. maritimum* rather than to *T. inodorum* both morphologically (notably in the characters of their achenes) and, with some exceptions, ecologically, in their close limitation to the drift-line and spray-zone habitat. It was felt that an investigation of the amount of morphological and genetic variation that existed in these populations would be extremely interesting and would help to elucidate the relationships between the populations and the extent to which each population was adapted to its local environment, and would also help to clarify the relationship between *T. maritimum* and *T. inodorum*; preliminary morphological investigations had suggested that some populations of *T. maritimum* had been affected by introgression from *T. inodorum*.

T. maritimum is a phenotypically plastic species, especially in size, habit and leaf characters, and comparisons between specimens collected in the field are of limited value because the phenotypic differences between plants growing in different environments may lack a genetic basis. Sample groups of plants from the populations that were to be compared were, therefore, grown simultaneously under identical conditions in order to eliminate environmentally induced, purely phenotypic differences. Most of the morphological comparisons described below were made using these simultaneously cultivated plants. The characters of the achenes, which appeared to be relatively non-plastic, were, however, studied using material collected in the field; comparison of achenes collected in the field with achenes collected from cultivated plants showed that the morphology of the achenes remained fairly constant in plants from the same population, whether they grew in their natural environment or in cultivation.

MATERIALS AND METHODS

Thirty-two populations of *T. maritimum* (some apparently affected by introgression from *T. inodorum*) and 4 populations of *T. inodorum*, collected from various sites in the British Isles, were included in the comparison. The localities of these populations are listed in Table 1 and shown in Fig. 1. A brief description of the habitat of each population, the dates when achenes were collected, and rough estimates of the number of established plants in each population and the approximate distance separating each population from the nearest population of the same species (unusually easy to estimate in *T. maritimum*, which is very conspicuous when in flower) are also given in Table 1. Ripe achenes were collected from some populations in 1962 and from the rest in 1963. Where possible, single ripe capitula (each containing *c.* 50–180 achenes) were collected from each of 25–30 well-separated plants and the samples bulked. In many cases fewer plants were sampled (most frequently because the population was so small that fewer than 25 plants bore ripe achenes) and in those cases a single capitulum was still taken from each plant, but instead of bulking the achenes equal numbers of achenes were taken from each capitulum so that each original plant had an equal representation in morphological comparisons.

All 36 populations were included in a single comparative-cultivation experiment carried out at Oxford in 1963–1965. Achene samples from all the populations were germinated simultaneously in Petri dishes in October 1963, and

TABLE 1. SITE, HABITAT, POPULATION AND SAMPLE SIZES, AND CHROMOSOME NUMBERS OF SAMPLED POPULATIONS OF *T. MARITIMUM* AND *T. INODORUM*

Ref. No.	Site	Grid reference	Habitat	Altitude above EHWS	A	B	C	D	Date of collection
<i>T. maritimum</i>									
1	Scolt Head, Norfolk	53/80.46	DiSaSh	0-1m	15	2	>5	18 (2)	16.9.63
2	Orfordness, Suffolk	62/46.55	Di/Rs	0-1m	80	25-30	>5	18 (1)	4.10.63
3	Swalecliff, Kent	61/13.67	DiSh	0-1m	100	25-30	>10	18 (1)	3.10.63
4	Pegwell Bay, Kent	61/35.64	DiSaSh	0-1m	200	25-30	>10	18 (2)	3.10.63
5	St Margaret's Bay, Kent	61/37.44	Di/Rs	1-2m	40	20-25	>5	18 (2)	2.10.63
6	Selsey, Sussex	40/85.92	Di/CF	0-2m	30	12	>2	18, 18+2B (4, 1)	29.9.62
7	Portchester, Hampshire	41/62.05	Di/Rs	0-1m	200	25-30	<0.5	18 (5)	29.9.62
8	Keyhaven, Hampshire	40/30.90	DiGr	0-1m	150	35-40	>1	18 (2)	18.9.63
9	Lulworth Cove, Dorset	30/82.97	CFGGr	1-4m	300	35-40	2	18 (1)	19.9.63
10	Burton Bradstock, Dorset	30/48.88	CFGGr	1-5m	100	25-30	>5	18 (2)	22.9.63
11	Perranuthnoe, Cornwall	10/548.285	Di/CF	0-3m	50	20-25	0.5	18 (1)	30.7.63
12	Perranuthnoe, Cornwall	10/544.289	EC	10-16m	50	20-25	0.5	18 (1)	30.7.63
13	Tintagel, Cornwall	20/05.89	CGr	35m	2	2	>1	18 (2)	5.10.63
14	Dinham, Cornwall	10/97.74	Di	0m	12	3	1	18 (1)	5.10.63
15	Constantine Bay, Cornwall	10/85.74	DiSa	0-1m	50	12	<1	18 (1)	3.10.62
16	Port William, Cornwall	20/04.86	CGr	35m	15	6-8	<1	18 (2)	1.10.62
17	St Bride's, Pembroke	12/80.11	DiSh	0-1m	40	12	0.8-2	18 (1)	5.9.63
18	Cemaes Bay, Anglesey	23/37.93	CF	2-8m	30	12	0.2 (3)	18 (1)	27.3.63
19	Llanbadrig, Anglesey	23/37.94	Di/CF	0-5m	50	10	0.6 (3)	18 (1)	27.3.63

20	Traeth Bychan, Anglesey	23/51.85	CFGr	2-10m	20	5	0.2 (2)	18 (2)	26.3.63
21	Ferry Point, Co. Waterford	—	DlSh	0-1m	—	3	—	18 (1)	26.8.63
22	Cromane, Co. Kerry	—	DlSh	0-1m	50	3	—	18 (1)	15.8.63
23	Aughinish Bay, Co. Galway	—	DlSh	0-1m	50	3	2	18 (1)	21.8.63
24	Loch Etive, Argyll	17/89.33	DlSh	0m	40	8	0.2	18 (1)	12.9.63
25	Luing Island, Argyll	17/73.08	DlSh	0-1m	100	8	0.5	18 (1)	9.9.63
26	Seil Island, Argyll	17/76.19	DlSh	0m	30	6	>0.5	18 (1)	8.9.63
27	Garvellachs Is., Argyll	17/640.096	C	10-50m	30	4	0.3 (2)	18 (2)	27.7.62
28	Garvellachs Is., Argyll	17/636.093	DlSa	0-1m	12	3	0.3 (2)	18+2B (1)	27.7.62
29	Greg Ness, Aberdeen	38/97.04	C	5-20m	150	20-25	0.1	18 (3)	6.9.63
30	Doonies, Kincardine	38/96.03	EC	20-25m	400	20-25	0.1	18 (2)	6.9.63
31	Tentsmuir, Fife	37/50.24	DlSa	0m	20	3	>2	18 (1)	19.7.62
32	Easter Quarff, Shetland	N 41/43.25	DI	0-1m	—	5	—	18 (2)	7.10.62
<i>T. inodorum</i>									
33	Manston, Kent	61/34.65	Ar	45m	500	25-30	0.2	18 (2)	3.10.63
34	Aldeburgh, Suffolk	62/46.56	Rs	3m	40	12	<0.5	18, 18+1B (1, 1)	4.10.63
35	Besselsleigh, Berkshire	42/45.02	Ar	105m	2000	50	0.3	18 (5)	10.10.62
36	Tannadice, Angus	37/50.57	Ar	70m	2000	25-30	0.2	18 (1)	23.7.62

KEY

Habitats: DI, drift-line (on); Sa, sandy beach; Sh, shingle beach; EC, unstable cliff with soft substratum; C, more stable cliff with rock substratum; Gr, grassy sward; CF, cliff-foot; Rs, roadside; Ar, arable land.

A: estimated number of established plants in the population

B: number of plants from which achenes were collected

C: estimated distance to next population in km (distance to next group of populations in parentheses)

D: chromosome number (2n) from germinated achenes (number of seedlings counted in parentheses)



FIGURE 1. Locations of the populations of *T. maritimum* and *T. inodorum* included in the comparison.

ten seedlings were taken from each sample and grown under uniform conditions in a cool greenhouse, evenly spaced and uniformly illuminated in identical boxes, 45cm $\times$ 30cm $\times$ 8cm deep, containing a single batch of sieved John Innes No. 2 potting compost, with 20 plants in each box. In some cases one or more of the seedlings failed to establish themselves, but in most cases growth was satisfactory and uniform within population samples, although marked differences between different populations in the rate of growth of the seedlings were observed. In early May 1964 five plants (but six from populations 3, 12, 22, and 31, and all ten from populations 25 and 27) were taken from each of these groups of ten plants, and transplanted singly into 9cm plastic pots, again containing a uniform batch of John Innes No. 2 potting compost; the pots were

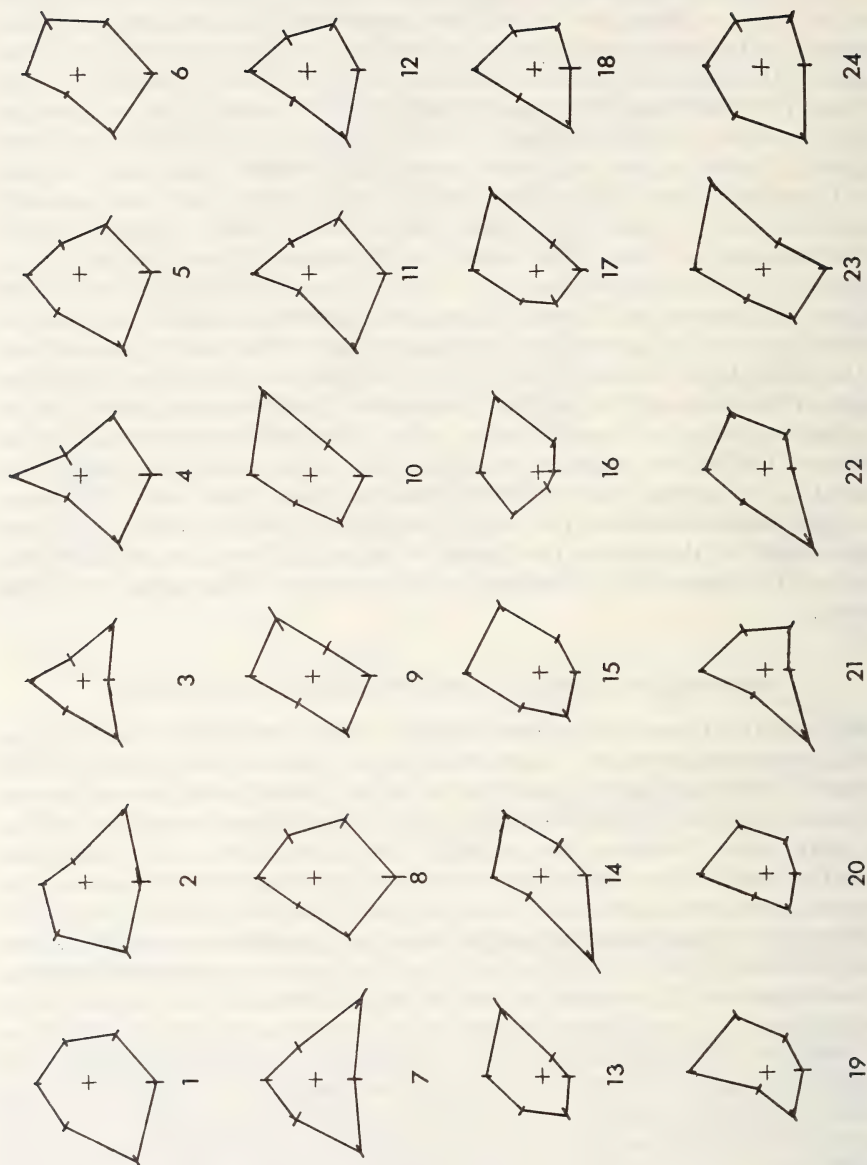
evenly spaced at 15cm centres in rows 20cm apart (and thus moderately crowded) in a water-retaining bed of horticultural peat on a flat, uniform, concrete surface outdoors. Care was taken at all stages to ensure uniform watering and to avoid damage to the plants. The populations were arranged randomly, not in a geographical sequence, but plants from the same population were grown side by side in a single row to facilitate comparison. In most cases the plants appeared to be healthy and grew to a size within the range observed in normal plants of the species in the field. However, in three cases—Tintagel (13), Port William (16), and Luing (25)—most or all of the cultivated plants were moderately to severely chlorotic during the entire period of cultivation, and consequently lacked vigour and were considerably smaller than their parents. The Garvellachs beach (28) plants, although not chlorotic, were also unusually small and weak. In some other cases the cultivated plants, although healthy and of average size, were either larger (e.g. Orfordness, 2, and Swalecliff, 3) or smaller (e.g. Perranuthnoe beach, 11, and Tentsmuir, 31) than those of the original wild population. The main characters that were studied in simultaneous cultivation were, in the seedlings, the morphology of the fourth true leaf and, in the adult plants, the morphology of the rosette leaves, the colour, habit and length of the stems and the degree of perennation. Leaf characters were recorded by shadow-printing on bromide paper, using a focussed light-source so that the outline of the leaf was recorded accurately. The characters of the achenes were studied using samples from the field collection made from each population; the main achene characters that were investigated were the length, width and mean weight of the achene, the degree of inflation of the ribs on the ventral face, and the shape of the 'oil-glands' at the upper end of the dorsal face of the achene.

MORPHOLOGICAL AND PHYSIOLOGICAL VARIATION

There was (with some exceptions discussed below) relatively little variation within most populations of *T. maritimum*, both in the characters of the achenes collected in the field and in the characters of the plants grown in simultaneous cultivation, but the differences between different populations were very striking in many cases. Variation was generally irregularly clinal, and populations from the same region usually had several regional characters in common, but in some cases populations from closely adjacent localities showed conspicuous differences in several characters, and in other cases populations resembled others from the same region in most characters but had one or more unusual features. *T. maritimum* and *T. inodorum* maintained their differences in cultivation. Some populations of *T. maritimum* showed fairly clear signs of introgression from *T. inodorum*. The polygraphs in Fig. 2 summarise, for each population, six characters (degree of inflation of the ribs and shape of the oil-glands of the achene, length and angle to the horizontal of the main stem, and the shape and number of the leaf-divisions) which were among those characters which differed significantly from population to population and showed apparent correlations with regional and local environmental variation.

ACHENE CHARACTERS

Differences in achene morphology are regarded as being among the most reliable and constant characters separating *T. inodorum* from *T. maritimum*



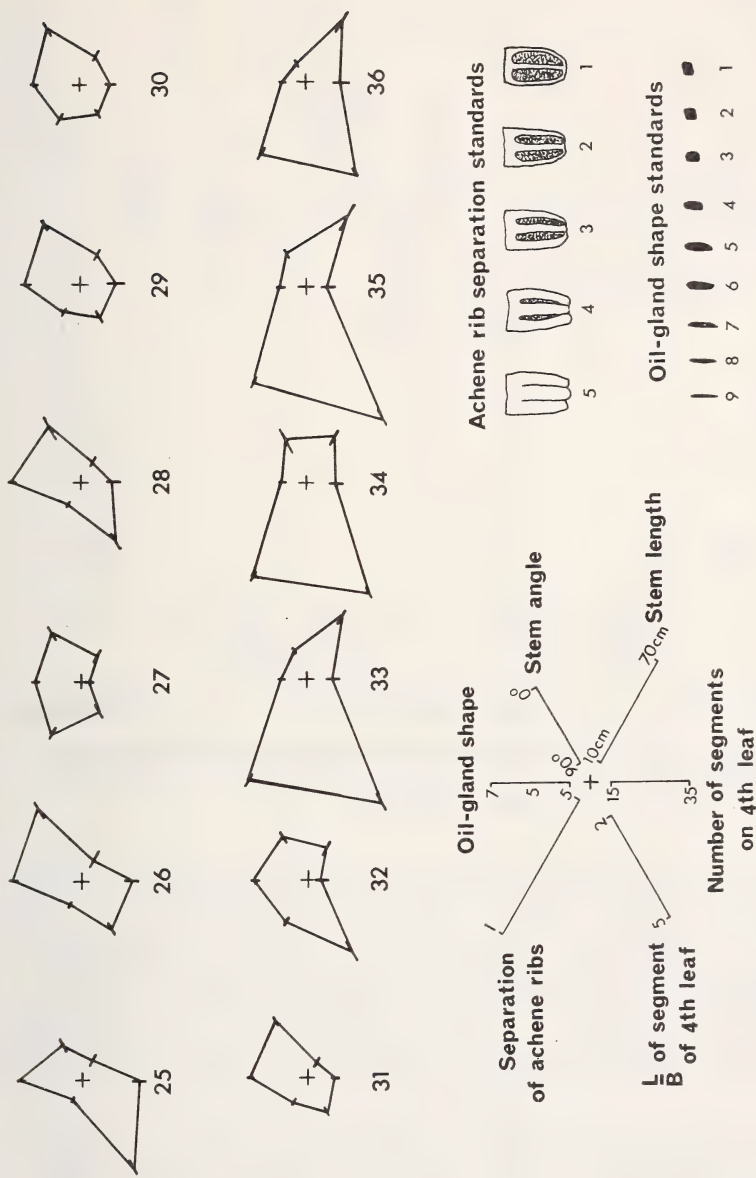


FIGURE 2. Polygraphs showing the population means for two achene characters ($n = 30$), two leaf characters ($n = 10$) and two stem characters ($n = 5$ or more). The short radial lines are drawn to a length equal to twice the standard error of the mean in each case. The sites of the numbered populations are shown in Fig. 1 and listed in Table 1.

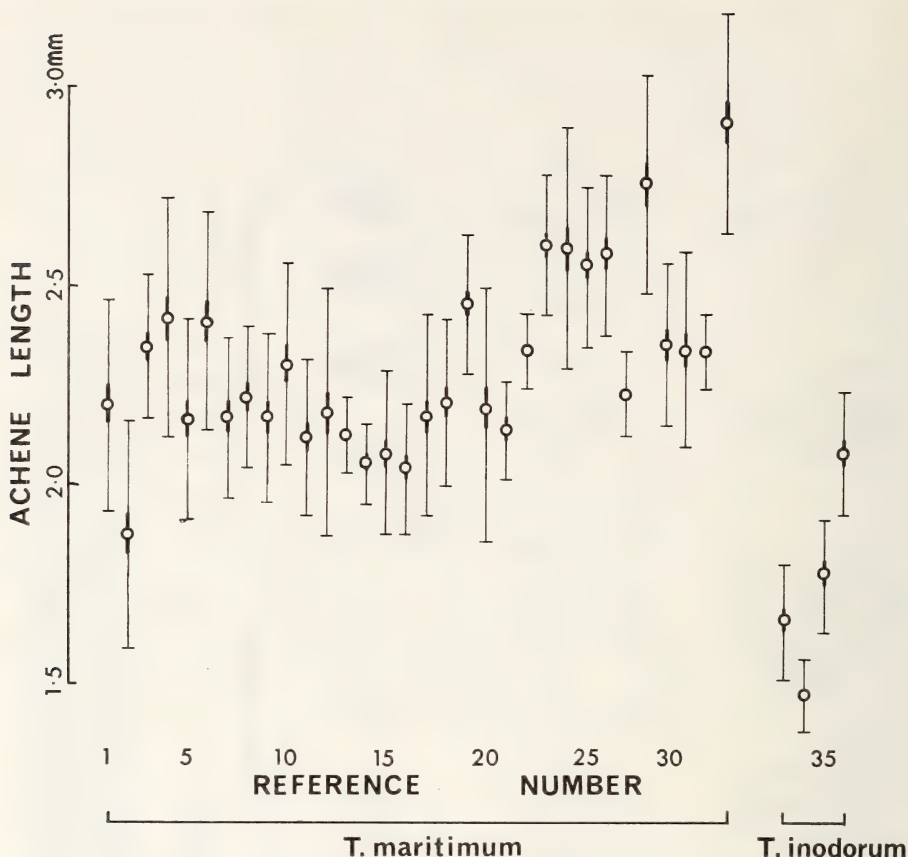
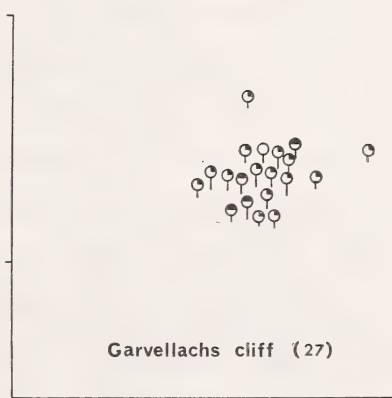
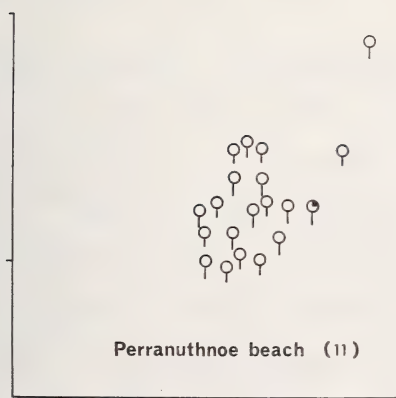
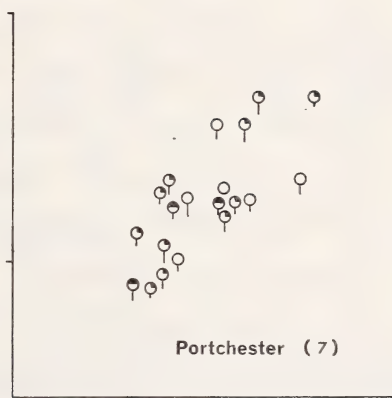
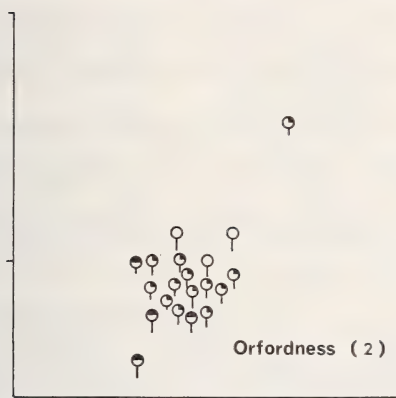
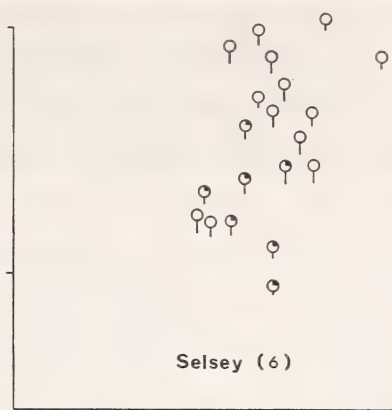
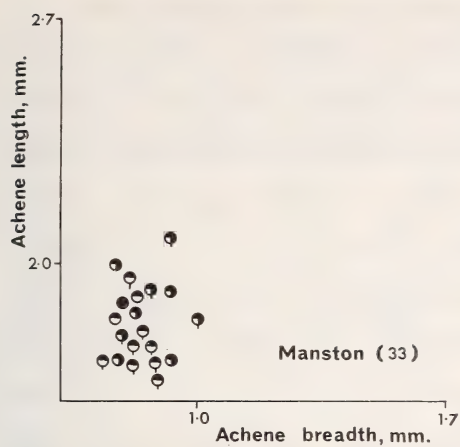


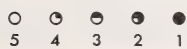
FIGURE 3. Achene-length. The circles show the population means; the thick bars are drawn to a length equal to twice the standard error of the mean, and the thin lines to a length equal to twice the standard deviation.

(Nehou 1953); *T. inodorum* typically has relatively small achenes with the ventral ribs dense in texture and well separated, and the oil-glands at the apex of the dorsal face roughly isodiametric, while *T. maritimum* typically has larger achenes with the ventral ribs spongy in texture, inflated, and contiguous or scarcely separated, and the oil-glands longitudinally elongated. The size of the achenes (Fig. 3) was found to show considerable variation among the populations of *T. maritimum* that were sampled. Scatter-diagrams of achene characters (Fig. 4) suggest that the relatively small mean size of the achenes of

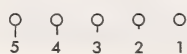
FIGURE 4. Scatter diagrams showing the characters of samples of twenty achenes from five populations of *T. maritimum* and one population (33) of *T. inodorum*. The Orfordness (2) and Portchester (7) populations of *T. maritimum* appear to be strongly introgressed by *T. inodorum* and the Selsey (6) population also shows some signs of introgression. The Perranuthnoe beach (11) population exemplifies 'pure' beach *T. maritimum*, with buoyant, strongly inflated achenes. The achenes of the Garvellachs cliff population probably show the effects of relaxation of selection for coat buoyancy in its cliff habitat, rather than introgression from *T. inodorum*; the latter was absent from the uninhabited Garvellachs.



Rib separation



Oil-gland shape



some populations from the southern and eastern coasts of England (2, 5, 7) was a consequence of introgression from *T. inodorum*. If these introgressed populations are disregarded, the remaining, relatively pure populations of *T. maritimum* show a fairly clear regional pattern of variation in achene-size in Britain—an irregular cline, with the size of the achenes decreasing from east to west along the southern coast of England, reaching a minimum in Cornwall, and then increasing northwards to reach a maximum in western Scotland. More samples would of course be desirable; the three Irish samples suggest that a parallel cline may possibly exist in Ireland, and the very large achenes of the Shetland population (32) may represent a northward extension of the cline. *T. inodorum* also showed a range of mean achene-size among the four populations that were included in the comparison, from 1.48mm $\times$ 0.69mm (Aldeburgh, 34) to 2.10mm $\times$ 1.16mm (Tannadice, 36). The mean size of the achenes also varies clinally in *T. inodorum* in Britain, increasing from a minimum of c 1.5mm $\times$ 0.7mm in southern and eastern England to a maximum of c 2.2mm $\times$ 1.2mm in northern Scotland (Kay 1965); and while it is usually possible to distinguish *T. maritimum* from *T. inodorum* by achene-size alone in southern England, where the achenes of *T. inodorum* are much smaller than those of *T. maritimum*, it is not possible to do so in north-eastern Scotland, where the achenes of the two species are similar in size.

The degree of inflation and separation of the ventral ribs of the achenes were scored by comparison with a set of standards (Fig. 2). The achenes collected from beach populations of *T. maritimum* had uniformly strongly inflated and contiguous or almost contiguous ribs, with the exception of those collected from a number of populations that had probably or possibly been affected by introgression from *T. inodorum* (2, 5, 7, and possibly 21, 22 and 24). The achenes collected from some cliff populations of *T. maritimum* (e.g. 16 and 27) had ribs which were less strongly inflated and showed some degree of separation, and the oil-glands also were relatively weakly elongated (see below); the achenes resembled therefore those of 'introgressed' populations. In comparative cultivation, plants from these cliff populations retained their achene characters, but also retained extremely fleshy leaves, short, little-branched stems, and other extreme *maritimum* characters.

The degree of longitudinal elongation of the dorsal oil-glands of the achene was also scored by comparison with a set of standards (Fig. 2). The pattern of variation shown by this character was similar to that shown by the rib characters; some achenes with isodiametric oil-glands, resembling those of *T. inodorum*, were found among the achenes collected from 'introgressed' beach populations, and some cliff populations, which were morphologically very different from *T. inodorum* in all except achene characters, also had achenes with relatively broad or even isodiametric oil-glands. Oil-gland shape and rib inflation were weakly linked in 'introgressed' populations (Fig. 4). Much variation in oil-gland shape was, however, found in *T. maritimum*, both within populations and between populations from the same area, in contrast to the relative uniformity of the rib characters. Although the oil-glands of *T. inodorum* are uniformly isodiametric or broader than long, never longitudinally elongated, it was clear that oil-gland shape alone is an unreliable character for distinguishing *T. maritimum* from *T. inodorum*.

A number of achene characters that were difficult to measure or score precisely also showed some variation from population to population, for example

colour, surface texture, shape, the length of the groove separating the ribs, and the form of the short membranous pappus at the crown of the achene (Fig. 5). Narrow, supernumerary dorsal ribs were frequent in some populations. Achenes with four ventral ribs were a minor component of the achene collections from several populations, and a few achenes with only two ventral ribs were observed among the achenes collected from the unusual Shetland (32) population.

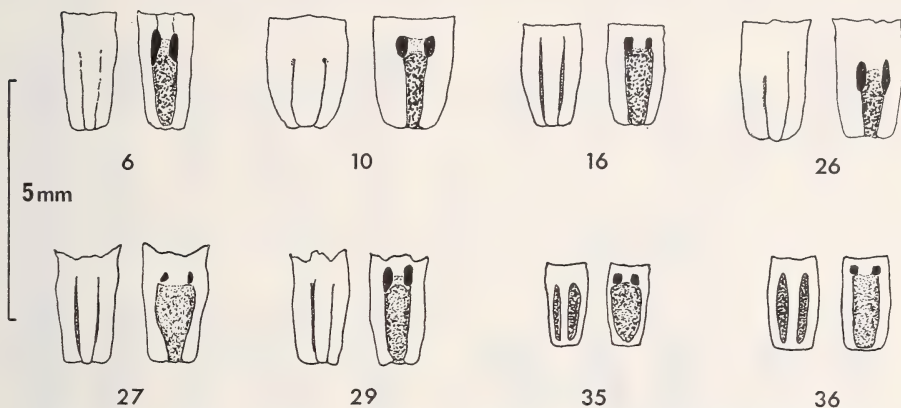


FIGURE 5. Dorsal and ventral views of typical achenes from six populations of *T. maritimum* and two populations (35, 36) of *T. inodorum*.

GERMINATION BEHAVIOUR

The germination behaviour of the achenes collected in 1962 was studied in January and March 1963. Preliminary tests had shown that the achenes of both species required both light and alternating temperatures for optimum germination, and the comparative tests were carried out in the regime which had given the most rapid and complete germination (16 hours in darkness at 3°C alternating with 8 hours in light at 20°C). Samples of 50 achenes from each population were tested in January, and the experiment was repeated, with samples of 100 achenes from each population, in March. The results are shown in Table 2. The populations of *T. maritimum* that were tested showed some differences from one another, but all except the introgressed Portchester (7) population germinated much more rapidly and completely than any of the twelve populations of diploid *T. inodorum* that were included in this comparison, without leaving the residue of dormant but viable achenes which is characteristic of *T. inodorum*. Only two of these populations of *T. inodorum* were included in the later morphological comparison in simultaneous cultivation (Besselsleigh, 35, and Tannadice, 36), but the results of germination tests on three other populations of *T. inodorum* are given in Table 2, to show the typical germination behaviour of diploid *T. inodorum*.

LEAF CHARACTERS

The adult rosette leaves of *T. inodorum* and *T. maritimum* are irregularly tri-pinnately divided into a large number of segments. These leaf-segments are

TABLE 2. GERMINATION OF ACHENES OF *T. MARITIMUM* AND *T. INODORUM*

3°C night/20°C day temperature alternations were used, with diffused natural lighting. After 21 days in this régime, the pericarps of the remaining ungerminated achenes were removed, and achenes which lacked embryos, or contained embryos which failed to germinate within 7 days after removal of the pericarp, were regarded as inviable. Germination is expressed as a percentage of the total number of viable achenes.

Reference number	Site of collection	% germination					
		January 1963			March 1963		
		Days			Days		
		7	14	21	7	14	21
<i>T. maritimum</i>							
6	Selsey	59	98	100	75	100	100
7	Portchester	16	68	96	46	88	93
15	Constantine Bay	80	100	100	91	99	100
16	Port William	79	100	100	77	97	100
27	Garvellachs cliff	4	98	100	20	99	100
29	Greg Ness	54	98	100	66	100	100
<i>T. inodorum</i>							
—	Fareham, Hampshire	12	69	81	40	79	86
35	Besselsleigh	16	70	85	23	78	90
—	Stillington, Yorkshire	4	72	82	21	88	95
—	Dalmeny, West Lothian	nil	33	66	6	60	82
36	Tannadice	2	35	48	9	69	81

long, narrow and acute in *T. inodorum*, but relatively short, broad, obtuse and fleshy in *T. maritimum*. It was found that there was a close correlation between the characters of the fourth leaf of the seedling and those of the adult rosette leaves on the same plant, and most quantitative measurements and comparisons between populations were made using the fourth leaves of simultaneously cultivated seedlings. In most cases ten plants were sampled from each population. The results are summarised in Fig. 2. Differences in the characters of the leaves of different populations of *T. maritimum* had of course been observed in the field, but the extent to which these differences had a genotypic basis had been uncertain. In simultaneous cultivation many populations retained very marked differences from one another, and these differences were even more striking when they were observed in plants growing side by side (Figs. 6 & 7). Most of the cliff populations had, both in simultaneous cultivation and in the field, leaves with very short, broad, fleshy segments which were relatively few in number, e.g. Port William (16), Garvellachs cliff (27) and Greg Ness (29). The beach populations showed more variation. Most beach populations from southern England had short but relatively narrow leaf segments, which were very numerous and closely packed in the adult leaves, giving the latter a rather brush-like appearance, but the Swalecliff (3) and Portchester (7) populations had relatively few leaf segments, and the Portchester population also had unusually narrow leaf segments, probably as a consequence of introgression from *T. inodorum*. The leaves of beach and cliff-foot populations

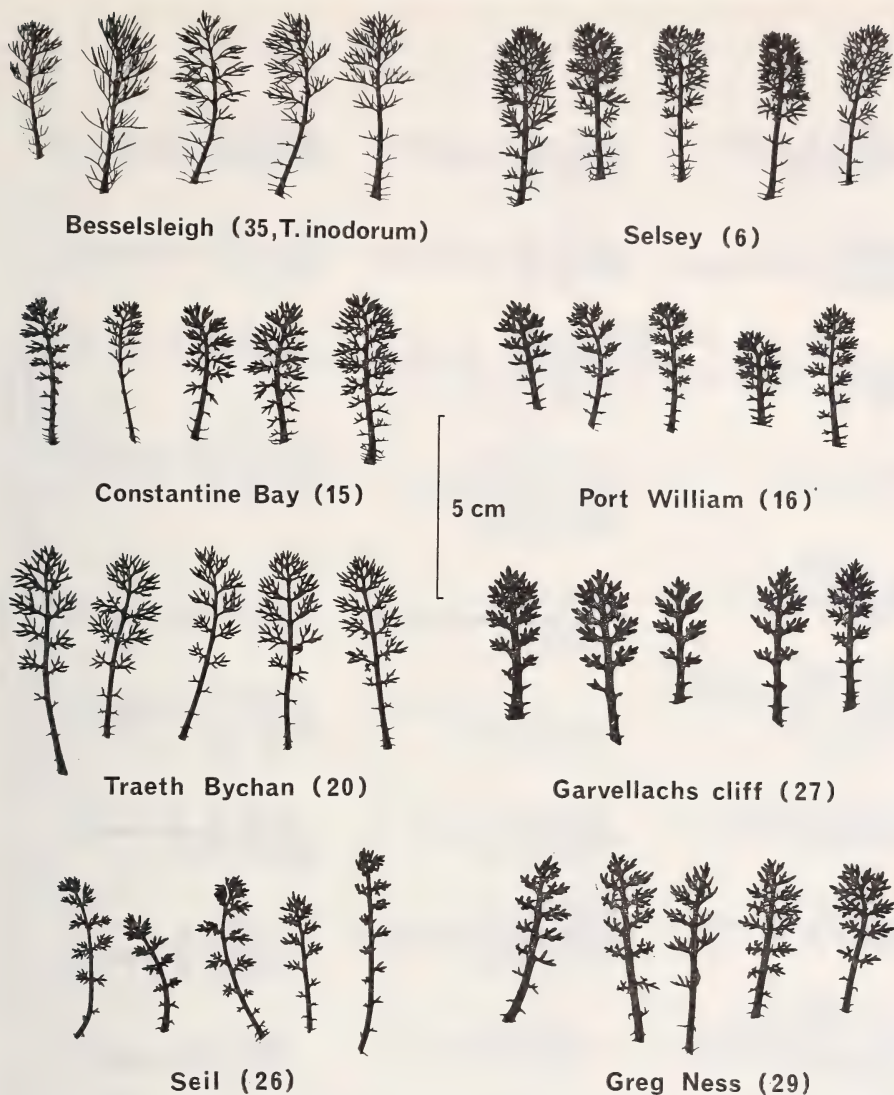


FIGURE 6. Leaf-prints of typical rosette leaves from plants grown in simultaneous cultivation, May 27th 1964. Each leaf was taken from a separate plant.

from western England and Wales had relatively short and broad segments, which were generally fewer in number than those of southern English populations; the Dinham (14) population was exceptional in having unusually narrow leaf segments. The beach populations from Ireland and north-western Scotland showed most variety in their leaf characters. The two southern Irish populations (Waterford, 21, and Cromane, 22) had relatively elongated leaf segments, which were few in number; the leaf segments of the Loch Etive (24) and Luing (25) populations were also elongated, but numerous; the Aughinish Bay (23, western Ireland) and Seil (26, north-western Scotland) populations resembled

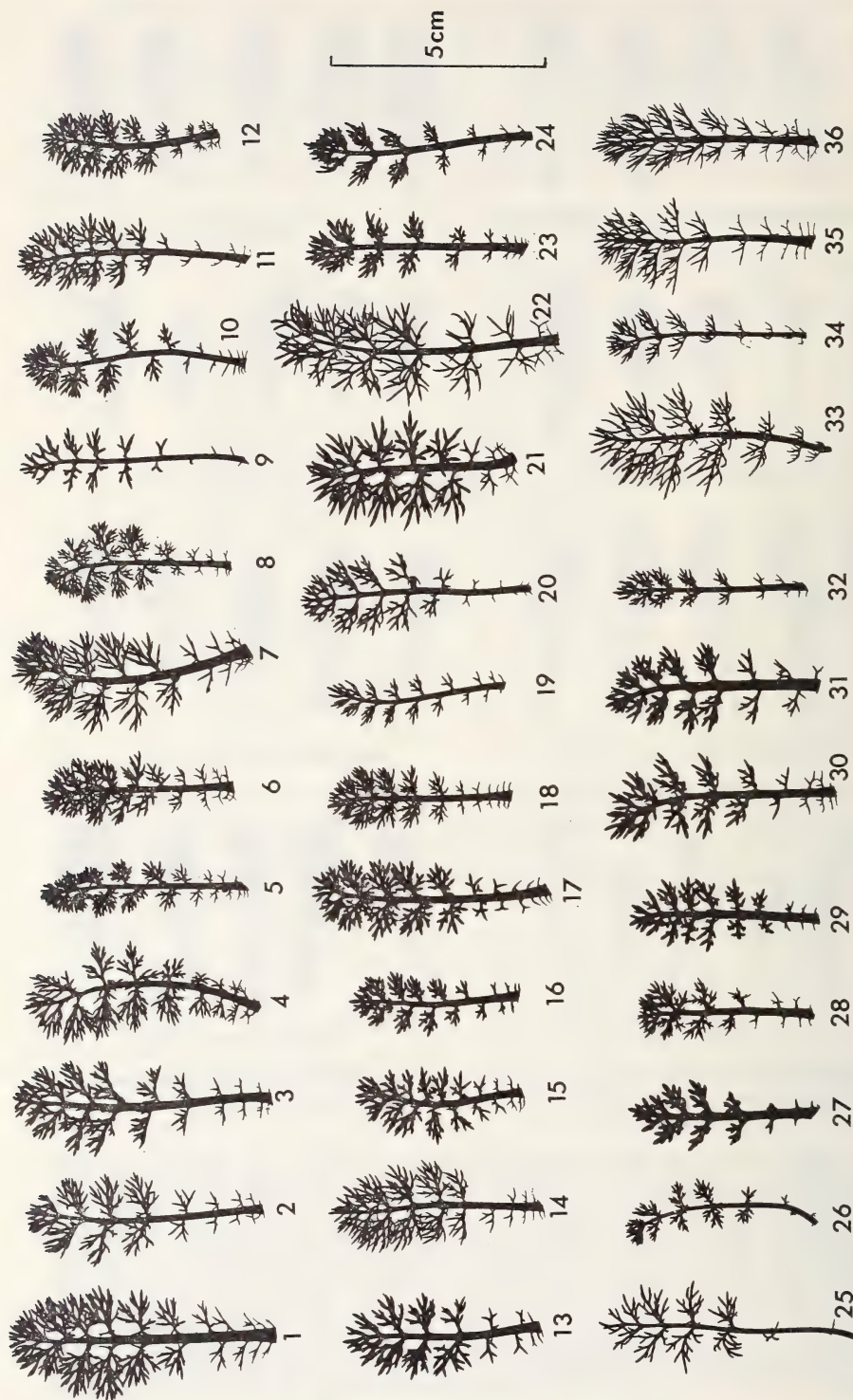


FIGURE 7. Leaf-prints of typical rosette leaves from plants grown in simultaneous cultivation, 27th-28th May 1964. The sites of the numbered populations are shown in Fig. 1 and listed in Table 1.

one another in having short, narrow and numerous leaf segments which were bunched in separate groups on long, narrow leaves of distinctive appearance. The Tentsmuir (31, eastern Scotland) population, which grew on a sandy beach, had extremely fleshy leaves with short, broad segments resembling those of the eastern Scottish cliff populations (Greg Ness, 29, and Doonies, 30).

The four populations of *T. inodorum* that were included in the comparison all had long, narrow and acute leaf segments which were relatively few in number, giving the adult leaves an open structure which contrasted with the compact fleshy or brush-like structure of the adult leaves of most populations of *T. maritimum*.

HABIT AND STEM CHARACTERS

Many of the populations of *T. maritimum* that were included in the comparison had shown marked differences from one another in size, habit, and stem characters in the field, but, as with the leaf characters, the extent to which these differences had a genetic basis had been in considerable doubt. However, in simultaneous cultivation there was still much variation from population to population in the size of the plants and in the lengths, pattern of branching, angle to the horizontal and colour of the main and subsidiary flowering stems, and the differences between plants from different populations growing side by side were very striking. At one extreme, all the plants from Aughinish Bay (23) had completely prostrate stems, with the primary stem only half the length of the basal axillary stems; at the other extreme, most plants from south-eastern English populations had erect primary stems which equalled or exceeded the ascending basal axillary stems. The mean values for the length and angle of the flowering stems in simultaneous cultivation are shown diagrammatically in Fig. 8. Most population samples were fairly homogeneous in habit and stem characters, but there were some exceptions. The most notable was the occurrence of a few plants (one in the Portchester sample, 7, one in the Constantine Bay sample, 15, and three in the Seil sample, 26) which lacked normal elongated flowering stems, but had a large number of very short flowering stems which were concealed by the leaves, giving the plants a distinctive caespitose appearance when in flower. The other plants in these three population samples had elongated flowering stems of normal length. All the plants which originated from populations growing on exposed beaches in the western British Isles, from Dorset to Argyll (9, 10, 15, 17, 23, 26), were prostrate, nearly prostrate, or caespitose in cultivation; the prostrate stems grew to a considerable length in some cases. Plants originating from beach populations in southern and eastern England (2, 3, 4, 5, 7, 8) were generally ascending or erect in cultivation, although some came from exposed habitats in which the parental plants had been dwarf or prostrate (e.g. Swalecliff, 3); the Scolt Head (1) and Selsey (6) plants, which came from the most exposed sites in this group, were only weakly ascending in cultivation. Plants originating from populations growing in relatively sheltered beach and cliff-foot sites in the western British Isles were weakly or distinctly ascending in habit (e.g. 11, 18, 22). Plants from cliff populations varied: those from the sheltered Perranuthnoe cliff (12) resembled those from the nearby sheltered beach population (11) in their ascending habit and fairly long stems, but the plants originating from the exposed cliff sites at Tintagel (13) and Port William (16) were prostrate in cultivation; only about half of the plants from the exposed Scottish cliff sites (27, 29, 30) flowered in cultivation,

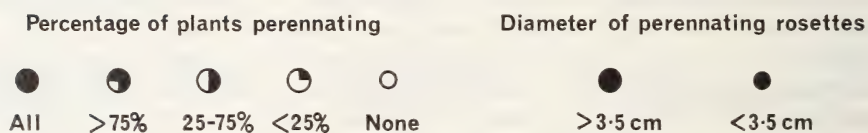
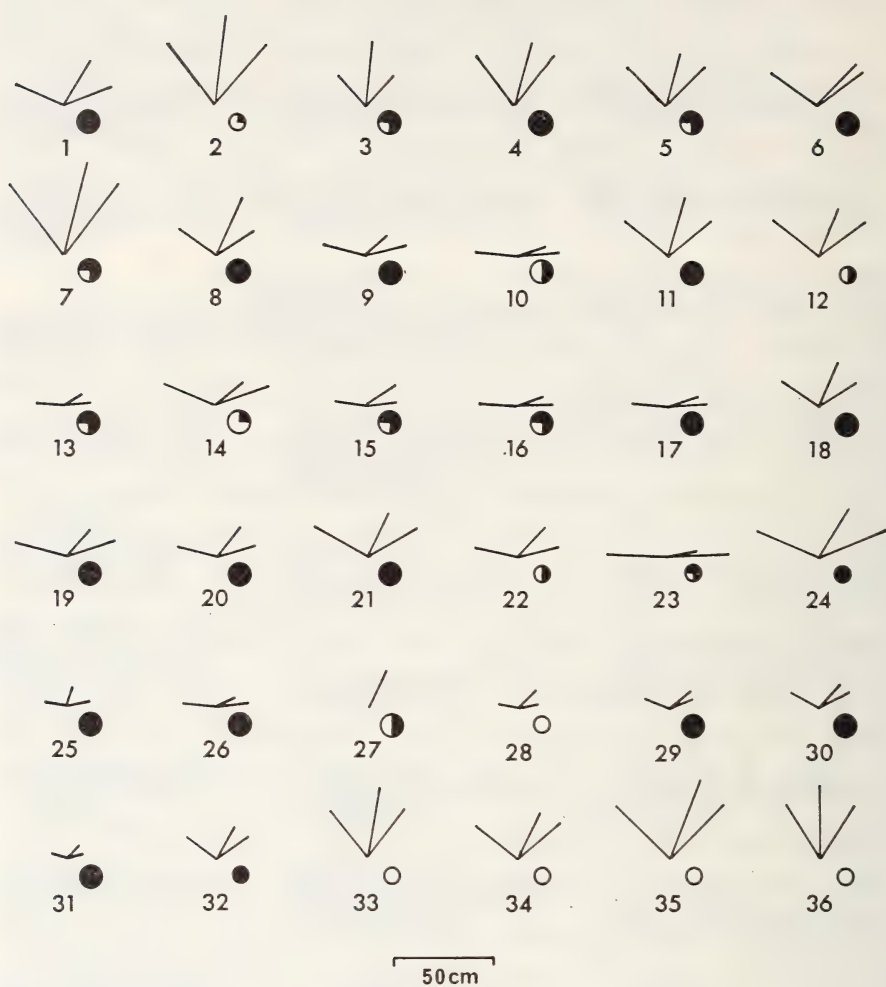


FIGURE 8. Perennation and habit of the flowering stems of the population samples of *T. maritimum* and *T. inodorum* in simultaneous cultivation. The lines show the population means for the lengths and angles of the primary stem (in centre) and the longest basal axillary stems. The metroglyphs show the proportion of plants that had formed perennating rosettes, and the mean diameter of the perennating rosettes, on 18th January 1965.

and those that did had short, ascending flowering stems, as did the anomalous Tentsmuir (31) beach population.

The populations of *T. inodorum* that were included in the comparison showed some variation in habit in cultivation, but all had erect or ascending main and axillary stems, with the primary stem exceeding the axillary stems. However some populations of *T. inodorum* from southern England, for example cereal weed populations from the Berkshire Downs and northern Norfolk, can assume a prostrate habit in cultivation, although others, for example the Tannadice (36) cereal weed population, appear to have a fixed erect habit even in well-spaced cultivation (Kay 1965).

The colour of the flowering stems of *T. maritimum* shows a wide range of variation, from pale green to intense purplish-red; the purplish-red anthocyanin pigmentation may also extend into the bases of the leaves. The colour of the flowering stems of *T. inodorum* varies less, and is usually pale or medium purplish-red. In simultaneous cultivation, the most intense purplish-red pigmentation was found in plants of *T. maritimum* from populations on the southern coast of England (2, 4, 6, 7, 8, 9, 10, 11, 12) and no plants from this region lacked pigmentation. Some plants from several populations in western Britain and Ireland (15, 17, 18, 19, 21, 23, 25) showed medium purplish-red pigmentation, but most plants from the west and north had stems with pale purplish-red pigmentation, and some plants lacking pigmentation occurred in the samples from all the Anglesey and Argyll populations (18, 19, 20, 24, 25, 26, 27, 28). All the plants in the Tintagel (13) and Tentsmuir (31) populations lacked anthocyanin pigmentation.

Deep purplish-red stem coloration has been regarded as a character of the southern 'salinum' taxon of *T. maritimum*. Some such plants occurred in all the cultivated population samples with relatively brush-like 'salinum' leaves, but other plants in most of these samples had stems which did not differ in colour from those of some plants from northern and western populations with no 'salinum' characters. However, the intensity of the pigmentation appeared to increase in dry conditions, and it is possible that southern populations may have relatively darker stems in their rather drier natural environment than they have in cultivation.

PERENNATION

T. maritimum is intermediate between a hemicryptophyte and a rosette chamaephyte in its growth form, perennating rosettes of leaves being formed near to and around the bases of the flowering stems in the autumn. It is usually a rather short-lived perennial, and in the field plants often die after flowering profusely. The extent to which the plants perennated in simultaneous cultivation was estimated by recording the occurrence and average diameter of perennating rosettes in late January 1965 (Fig. 8). None of the plants from populations of *T. inodorum* perennated, and all were dead by late January. Most of the plants from populations of *T. maritimum* perennated well, and in the majority of cases all the plants from a population perennated strongly. One plant was lost from populations 5, 7, 13, 15, 16 and 23, two from 10 and 22, three (of ten) from 27, four from 2, 14 and 12, and none survived from 28. The perennating rosettes were exceptionally small (3 cm or less in diameter) on the surviving plants from 2, 12, 22, 23, 24 and 32. Many of the populations which lost plants or perennated weakly (especially Orfordness, 2, Portchester, 7, Dinham, 14, Loch Etive, 24,

and, to a lesser extent, St Margaret's Bay, 5, Perranuthnoe cliff, 12, Cromane, 22, and perhaps Shetland, 32) were those which deviated towards *T. inodorum* in their morphological and other characters, and thus may have been affected by introgression. The relatively poor perennation of the plants from the Burton Bradstock (10), Tintagel (13), Constantine Bay (15), Port William (16) and Garvellachs beach (28) populations, none of which showed any clear evidence of introgression from *T. inodorum* in their vegetative characters, appeared to result from their unusual habit of growth. All were exceptionally prostrate (Fig. 8) and formed perennating rosettes some distance along their prostrate stems; in the field, these rosettes would probably be able to form adventitious roots and establish themselves, but in pot cultivation they were formed beyond the rim of the pot and tended to die. The plants from the small Tintagel and Garvellachs beach populations, which consisted respectively of two and twelve established plants, were also rather weak in the field (Table 1), perhaps as a consequence of inbreeding depression.

CHROMOSOME NUMBERS

Both diploid ($2n = 18$) and tetraploid ($2n = 36$) cytotypes exist in *T. inodorum* (Rottgardt 1956, Kay 1969); all the populations of *T. inodorum* that were included in the comparison were diploid. Most well-authenticated chromosome counts of *T. maritimum* have given $2n = 18$, but counts of $2n = 36$ have occasionally been reported for the species, for example by Harling (1951). Chromosome counts were made on one or more plants from each of the 32 populations of *T. maritimum* that were included in the comparison: all were diploid ($2n = 18$). Plants with one or two supernumerary chromosomes occurred in some populations (Table 1).

FERTILITY OF INTERSPECIFIC AND INTERPOPULATION HYBRIDS

Two interspecific (6×35 , 15×35) and two interpopulation crosses (6×27 , 5×29) were made. The interspecific crosses gave a high yield of hybrid seed, with either species as the female parent; the F_1 hybrid plants were vigorous, morphologically intermediate, and of moderate to fairly high (50%–80%) pollen fertility; F_2 s and backcrosses showed a wider range of morphology and fertility, and included a few sterile plants. The plants from the interpopulation crosses were also vigorous and morphologically intermediate between their parents; no plants from the 6×27 (Selsey $\times$ Garvellachs cliff) cross flowered in cultivation, but five plants from the 5×29 (St Margaret's Bay $\times$ Greg Ness) cross flowered; all were of high pollen fertility (more than 90%).

DISCUSSION

The number of populations of *T. maritimum* that was sampled for this investigation was relatively small (32), but their sites covered a wide geographical and ecological range, and they probably included much of the range of genetic variation found in the British Isles. It would have been desirable to have grown a greater number of plants from each population in simultaneous cultivation, but the large size of the plants and the limited area available for experimental cultivation made this impossible. Nevertheless the samples were large enough to demonstrate satisfactorily the pattern of variation within the species; the relatively small amount of variation found within most population samples,

and the consistent and often large differences found between the samples in many characters, were striking, and in most cases experimental sampling error, although it undoubtedly occurred, probably did not affect the validity of the results.

The problem of the relative importance of the various factors—natural selection, gene-flow from other populations, the number of plants in the population, and introgression from *T. inodorum*—which may originate and maintain the genetic differences between different populations of *T. maritimum*, is of great interest. The overall pattern of variation has already been described. Marked differences were found between adjacent populations and among populations growing in the same area in a number of instances. In the case of the Garvellachs beach and cliff populations, considerable differences were found between populations growing in strongly contrasted habitats (shell-sand beach and exposed vertical cliffs) within 300m of one another, on a small uninhabited island 8km from the nearest cultivated island and 11km from the mainland. The Perranuthnoe beach and cliff populations, which were separated by about 500m, grew in less contrasted habitats (cliff-foot and sloping earthy cliffs, both with a southerly aspect) and showed few differences; the differences that were observed were mainly in achene characters and degree of perennation, and may well have been a consequence of introgression into the cliff population from *T. inodorum*, which grew as a weed of neighbouring farmland. Both the north Cornish (13–16) and the Argyll (24–28) populations showed considerable diversity, much of it apparently adaptive, among populations separated from one another by distances of a few kilometres; only the Dinham (14) and Loch Etive (24) populations showed clear signs of introgression from *T. inodorum*.

NATURAL SELECTION

Many of the morphological characters that were investigated in simultaneous cultivation appeared to be of some adaptive importance, and a number of the differences between different populations in these characters can be tentatively correlated with differences in the environments of the original populations. In comparative cultivation, plants from exposed cliff populations generally had relatively short and little-branched stems, fleshy leaves with relatively few divisions, showed greater variation from population to population in the date of first flowering (perhaps correlated with the differing aspects of their habitats) and had achenes with ribs less strongly inflated than did plants from beach populations; the latter usually had longer, branched stems, which were extremely prostrate in plants from some exposed localities but ascending in plants from more sheltered localities, and had less fleshy and often much-divided leaves; the strongly inflated ribs of the achenes of plants from beach sites appear to be an adaptation for dispersal by water (see below). These apparently adaptive morphological differences were retained in cultivation and presumably resulted from genotypic differences between the populations. However, *T. maritimum* is a phenotypically plastic species, and it was evident that genetic assimilation of apparently adaptive phenotypic characters which were observed in the field had been incomplete in some cases. For example, the Tentsmuir (31) beach population closely resembled the apparently well-adapted cliff populations from the same region (29 and 30) in cultivation (short little-branched stems, fleshy leaves, late-flowering), but differed from them

in the field, where the *Tentsmuir* plants were tall and much-branched, with less fleshy leaves. Conversely, and less unexpectedly, the Swalecliff (3) and Pegwell Bay (4) beach populations were prostrate or short-stemmed in their rather exposed natural habitats, but were tall and erect in cultivation. It could be argued that the relative loss of phenotypic plasticity shown by many of the other investigated populations of *T. maritimum*, which retained in garden cultivation characters more suited to a windswept beach or spray-washed cliff, was unadaptive because they would be unable to take advantage of locally or temporarily more favourable conditions in the field, but perhaps it is selectively advantageous in their natural habitats to be prepared for unfavourable conditions.

Gene-flow between genetically different populations of *T. maritimum*, and even between *T. maritimum* and *T. inodorum*, is probably fairly free in many cases (see below) and it seems that continuous natural selection must play a very large part in maintaining the genetic differences between different populations of *T. maritimum* growing in different habitats, especially when they are closely adjacent to one another.

GENE-FLOW AND ACHENE DISPERSAL

T. maritimum is self-incompatible (Kay 1965), and is visited and cross-pollinated mainly by flies; few bees visit its flowers, although those that do (e.g. *Andrena* spp.) may be of some local and seasonal importance. Pollinating flies are, however, abundant and active during most of the flowering season, and some strong-flying species (e.g. *Eristalis* spp.) are able to fly several hundred metres with ease; other, weaker-flying species may be blown for similar distances and then return to the capitula of *T. maritimum*, especially in the linear coastal habitat in which coastwise winds may be frequent for topographical reasons. Thus gene-flow by cross-pollination probably occurs freely, both within populations and between closely adjacent populations. Ecological barriers may reduce cross-pollination between neighbouring beach and cliff populations to some extent, but intermediate and transitional habitats are common.

Local populations are often spatially isolated from one another because areas of beach or cliff which are suitable for *T. maritimum* may be separated by long stretches of unsuitable coastline. Thus, as for example on the coast of south-eastern England where unfavourable chalk cliffs or sea-walls separate occasional suitable drift-line sites, a local population or group of neighbouring populations may be separated from the next population or group of populations by a distance of several kilometres. The same is true of some other coastal species, for example *Crambe maritima*, *Lavatera arborea* and *Raphanus maritimus*. Populations of *T. maritimum* growing on islands may also, of course, be separated from the next island or mainland population by a considerable distance. Such populations may therefore be separated from one another by too great a distance for inter-population pollen transfer to occur. However, there may still be some gene-flow between the populations. *T. maritimum* is probably dispersed over medium and long ranges quite effectively by its floating achenes. Achenes collected from the Selsey (6) population were found to remain afloat in sea-water for at least eight months, meanwhile retaining high viability (Table 3); and the highest drift-line, where floating achenes may be deposited by winter storms, is a common habitat of beach populations of *T. maritimum*. Thus beach populations may be in genetic contact with one another by floating achenes,

TABLE 3. FLOATING AND SURVIVAL OF ACHENES OF *T. MARITIMUM* AND *T. INODORUM* IN SEA WATER

Replicates of 50 achenes were used. The containers were stored at 20° C and periodically shaken. After the 40 day and 220 day periods, the achenes from one replicate of each sample were removed from the sea water and washed in distilled water; the pericarps were removed from the achenes and the embryos were placed on moist filter-paper in petri dishes. The embryos which failed to germinate within two weeks appeared to be dead, and were regarded as inviable.

	2 days		40 days		220 days	
	% floating	% viable	% floating	% viable	% floating	% viable
<i>T. maritimum</i> (Selsey, 6)	100	n.d.	98	84	96	88
<i>T. inodorum</i> (Besselsleigh, 35)	20	n.d.	16	84	4	74

even though they may be separated by distances of many kilometres. This mode of dispersal will be less effective as a means of genetically linking cliff populations with one another and with beach populations, because many cliff populations do not extend down to the level of the storm drift-line. However, cliff populations which lack suitable cliff-foot habitats may interpollinate with neighbouring beach populations, and may thus be in indirect genetic contact with other cliff populations through the floating achenes of intermediary beach populations. Direct genetic contact between spatially isolated cliff populations may occasionally take place as a consequence of achene-dispersal by seabirds or man.

INTROGRESSION FROM *TRIPLEUROSPERMUM INODORUM*

Intogression from *T. inodorum* into *T. maritimum* is probably common. Hybrids between the species are vigorous and moderately to fairly highly fertile, and can often be found, sometimes in considerable numbers, in places where the parental species meet and suitable intermediate habitats occur. Populations of hybrid origin are locally well-established as weeds of some ruderal habitats in western Britain (see below).

Many isolated populations of *T. maritimum* in southern England, and probably also elsewhere, grow in sites where *T. inodorum* is abundant in nearby farmland, but are separated from the nearest population of *T. maritimum* by distances of some kilometres. Such populations may cross-pollinate freely with *T. inodorum*, while they are in contact with other populations of *T. maritimum* only by drifted achenes. Field observations suggested that this was the case with the Keyhaven (8), St Margaret's Bay (5) and Pegwell Bay (4) populations; the Orfordness (2), Swalecliff (3) and Portchester (7) populations were close to fairly large roadside populations of *T. inodorum*, and the Perranuthnoe (11, 12) and possibly also the Selsey (6) and Lulworth (9) populations were fairly close to smaller populations of *T. inodorum*. However, the populations in this southern English group that clearly deviated towards *T. inodorum* in their morphological characters in cultivation (2, 5, 7, 12) all grew in habitats

that were to some extent intermediate between the arable land and roadside habitats of *T. inodorum* and the maritime habitat of *T. maritimum*. The Orfordness and Portchester sites were both disturbed roadsides which sloped down to the beach and were within reach of winter high tides, the St Margaret's Bay plants grew on a shingle-ridge which was enclosed by a low sea-wall and used as a car-park but was still within reach of spray and occasional waves during winter storms, and the Perranuthnoe cliff site was an unstable sloping earthy cliff below the edge of a ploughed field. Natural selection may have favoured the intermediate characters provided by introgression from *T. inodorum* in these intermediate habitats. Introgression from *T. inodorum* may also have affected the Swalecliff and Pegwell Bay populations to some extent; although these populations had extremely inflated achenes and other unmistakable characters of *T. maritimum*, they also had some unusual features, in leaf characters, habit, and perhaps increased plasticity, which may have resulted from some gene-flow from *T. inodorum*. The Lulworth, Keyhaven, and Selsey populations, which showed scarcely any morphological signs of introgression from *T. inodorum*, grew in typical maritime sites; the Keyhaven population, which grew on the seaward side of a grassy sea-wall enclosing a cultivated field in which a large population of typical *T. inodorum* grew as a field weed, must have been particularly subject to cross-pollination by *T. inodorum*.

This evidence strongly suggests that substantial introgression from *T. inodorum* into a population of *T. maritimum* can only take place when a fairly large population of *T. inodorum* is present and when the habitat of the *T. maritimum* population has been modified by artificial disturbance.

POPULATION SIZE

The population structure of *T. maritimum* is unusual in several ways: in the small number of plants in a typical population (populations of less than 50 established plants, separated by distances of 1km or more from the next population, are the rule rather than the exception in some areas), in the temporary and unstable nature of the cliff and drift-line habitat, in the fairly wide range of shore habitats in which the species can grow, and in its effective means of long-distance dispersal by floating achenes. It is difficult to see how the founder effect (incomplete representation of the range of genetic variation of the species in the small number of plants founding a new population) and genetic drift (random fluctuations leading to loss of alleles in small populations) can fail to affect the genetic nature of some populations of *T. maritimum*. The plants that were grown from the achenes collected from the two smallest populations that were sampled (Tintagel, 13, and Garvellachs beach, 28, the former consisting of two established plants and the latter population of about twelve) were relatively weak in cultivation and appeared to suffer from inbreeding depression, presumably as a consequence of the operation of these two virtually indistinguishable factors. However, the small number of adult plants in an apparently isolated population of *T. maritimum* may be to some extent misleading; many more plants may be seasonally present at the seedling stage, perhaps regularly including some growing from achenes drifted from other populations, and there may thus be opportunities both for competition among a variety of genotypes and for recruitment of new alleles into the gene-pool of the population. On the other hand, not all the established plants may flower in any one year, and those that do flower may have differing success, so that the

majority of the achenes will be produced by a much smaller number of plants than is present in the whole population.

One way to demonstrate the extent to which small populations of *T. maritimum* may have lost normally widespread alleles would be to determine the number of incompatibility alleles occurring in the population. *T. inodorum* has a sporophytic self-incompatibility system of the type found in other members of the Asteraceae (Kay 1965), and *T. maritimum* presumably has the same system. Large numbers of alleles must occur at the single self-incompatibility locus for this system to be fully effective. A population composed of, or solely descended from, a small number of plants will possess a limited number of alleles; if, for example, an isolated population has at some stage reached a minimum of three plants, a maximum of six self-incompatibility alleles will be present in the population.

THE CLASSIFICATION OF *TRIPLEUROSPERMUM* IN THE BRITISH ISLES

It is difficult to fit the patterns of variation of variable outbreeders like *Tripleurospermum maritimum* and *T. inodorum* into the classical taxonomic categories, and any attempt to do this, and particularly to divide differentiated local populations into varieties, is inevitably unsatisfactory and to some extent misleading in that it superimposes a discontinuous classification on a pattern of variation which is essentially continuous. The most appropriate formal classification of the taxa of *Tripleurospermum* found in the British Isles is given below together with a key.

T. INODORUM (L.) Schultz Bip. ($2n = 18, 36$; annual weeds of arable land and waste places; mainly diploid in western Europe, tetraploid in eastern and northern Europe, tetraploids very rare in the British Isles. Populations 33–36.)

T. MARITIMUM (L.) Koch ($2n = 18$; short-lived perennials of maritime habitats and some inland ruderal sites.)

Subsp. **MARITIMUM**

var. **MARITIMUM** (Coasts of British Isles, North Sea and the Baltic. Populations 1–3, 13–31.)

var. **SALINUM** (Wallr.) Kay, **comb. nov.**

Pyrethrum inodorum var. *salinum* Wallr., *Sched. Crit.*, 485 (1822) (Atlantic coast of western Europe from northern Portugal to northern France and southern England. Populations 4–12.)

Subsp. **PHAEOCEPHALUM** (Rupr.) Hämet-Ahti (Coasts of northern Scotland, Shetland Islands, Faroe Islands, Iceland, Greenland, Arctic coasts of N. America, Scandinavia and the U.S.S.R. Population 32.)

- 1 Annual; ribs on ventral face of mature achene clearly separated (by at least $\frac{1}{3}$ of their breadth), oil-glands at upper end of dorsal face less than 1.5 times as long as broad *T. inodorum*
- Perennial or biennial; ribs on ventral face of mature achene contiguous or separated by less than $\frac{1}{4}$ of their breadth, oil-glands at upper end of dorsal face usually at least twice as long as broad 2

- 2 Involucral bracts broadly triangular, with conspicuous blackish-brown scarious margins at least 0.4mm wide
T. maritimum subsp. *phaeocephalum*
 Involucral bracts broadly triangular to oblong, with pale brown or brown scarious margins less than 0.3mm wide 3
- 3 Flowering stems purplish-red to at least half-way; rosette leaves brush-like distally, with segments 0.5–0.6mm wide
T. maritimum subsp. *maritimum* var. *salinum*
 Flowering stems with red pigmentation confined to bases of main and axillary stems or absent; rosette leaves not brush-like, with segments 0.6–1.0mm wide . . . *T. maritimum* subsp. *maritimum* var. *maritimum*

Some local populations and groups of populations included in var. *maritimum* in this classification are very distinct morphologically and might well be distinguished as separate varieties (e.g. populations 23 and 26, 27 and 29–31). Each of these groups, like var. *salinum* and var. *maritimum sensu stricto*, has a genetic basis and is morphologically distinct and identifiable in its typical form. It must however be clearly realised that within subsp. *maritimum* all the state either certainly or probably intergrade with some or all of the others both morphologically and genetically; plants of more than one taxon may be found in the same population and many plants and populations are morphologically intermediate between taxa. The same considerations apply to subsp. *phaeocephalum* and subsp. *maritimum*; from herbarium specimens it appears that these subspecies probably hybridise and intergrade in northern Scotland as they do in Scandinavia (Hämet-Ahti 1969).

Extensive hybridisation between *T. maritimum* and *T. inodorum*, leading to the local establishment of variable but generally intermediate populations, appears to be a relatively recent phenomenon in the British Isles. Morphologically intermediate populations have been observed on areas of industrial waste land with unstable soils within a few miles of the sea in several parts of western Britain. Suitable habitats may be created and maintained by industrial activity (especially smelting and quarrying) and also occur near railways and main roads but are often impermanent (e.g. on construction sites). Habitats of this type have existed only since the mid-eighteenth century in the British Isles. These intermediate populations, which usually include a proportion of morphologically abnormal and sterile plants, require further study. Interspecific hybrids have also been seen by the author at a number of localities where farmland, with *T. inodorum* as a weed, adjoins drift-line or cliff sites with natural populations of *T. maritimum*, for example near the Keyhaven (8) and Peranuthnoe cliff (12) populations. These hybrids were, however, few in number and mainly restricted to narrow strips of intermediate habitat. Opportunities for hybridisation between the species must have been present for a much longer time in these seaside farmland habitats than in the industrial wasteland habitats described above.

Much work remains to be done on the problems of micro-evolution and variation in the sea mayweed. More work on the effective size of populations and on fluctuations in their size and genetic composition, and on the inter-relationships and degree of differentiation of neighbouring local populations would probably be most rewarding.

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REFERENCES

- BRIQUET, J. I. (1916). Compositae, in BURNAT, E., *Flore des Alpes Maritimes*, 6 (1). Geneva, Basle & Lyons.
- CLAPHAM, A. R. (1962). *Tripleurospermum*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 852–854. Cambridge.
- DRABBLE, E. & DRABBLE, H. (1910). Notes on the Flora of Cheshire. *J. Bot., Lond.*, 48: 152–156.
- HÄMET-AHTI, L. (1967). *Tripleurospermum* (Compositae) in the northern parts of Scandinavia, Finland and Russia. *Acta bot. fenn.*, 75: 3–19.
- HARLING, G. (1951). Embryological studies in the Compositae. II. Anthemideae-Chrysantheminae. *Acta Horti Bergiani*, 16: 1–56.
- HÜSER, W. (1930). Untersuchungen über die Anatomie und Wasserökologie einiger Ostsee-strandpflanzen. *Planta*, 11: 485–508.
- KAY, Q. O. N. (1965). *Experimental studies of selected weeds*. D. Phil. thesis. University of Oxford.
- KAY, Q. O. N. (1969). The origin and distribution of diploid and tetraploid *Tripleurospermum inodorum* (L.) Schultz Bip. *Watsonia*, 7: 130–141.
- KYNČLOVÁ, M. (1970). Comparative morphology of achenes of the tribe Anthemideae Cass. (Family Asteraceae) and its taxonomic significance. *Preslia*, 42: 33–53.
- LESTER-GARLAND, L. V. (1921). The maritime forms of *Matricaria inodora*. *J. Bot., Lond.*, 59: 170–174.
- LLOYD, J. (1844). *Flore de la Loire-inférieure*. Nantes.
- LÖVKVIST, B. (1963). Chromosome and differentiation studies in flowering plants of Skåne, South Sweden. *Bot. Notiser*, 115: 261–287.
- MASSART, J. (1921). *Eléments de Biologie générale et de Botanique*. Brussels.
- NEHOU, J. (1953). Étude comparative de *Matricaria inodora* L. et de *M. maritima* L. (Composées Radiées). *Bull. Soc. scient. Bretagne*, 28: 133–153.
- NEUMAN, L. M. (1882). Studier öfver Skånes och Hallands flora. *Bot. Notiser*, 1882: 167–175.
- PEDERSEN, A. (1961). Kurvblomsternes udbredelse i Danmark (ekskl. *Hieracium* og *Taraxacum*). *Bot. Tidsskr.*, 57: 83–289.
- ROTTGARDT, K. (1956). Morphologische, cytologische, und physiologische Untersuchungen von Ökotypen in Schleswig-Holstein. *Beitr. Biol. Pfl.*, 32: 225–278.
- SØRENSEN, N. A. (1963). Chemical Taxonomy of Acetylenic Compounds, in SWAIN, T., ed. *Chemical Plant Taxonomy*, pp. 219–252. London.
- TURESSON, G. W. (1922). The genotypical response of the plant species to the habitat. *Hereditas*, 3: 211–350.
- VAAARAMA, A. (1953). Cytotaxonomical studies on northern *Tripleurospermum* forms. *Proc. 7th Int. bot. Congr.*, 1950: 279–280.

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Population variation within *Centaurea nigra* L. in the Sheffield region

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ABSTRACT

Measurements have been made on population samples of *Centaurea nigra* L. collected from a range of sites in the Sheffield region. These show that the variation within each population encompasses the range of the characters usually used to distinguish the two subspecies, *nigra* and *nemoralis* (Jord.) Gugl., into which the species is often divided. It is therefore not possible to satisfactorily divide plants of *C. nigra* in this way in the Sheffield area. It is pointed out that, since the same situation has been previously recorded from Cambridgeshire, it may be widespread in Britain and the recognition of two subspecies in this country often may not be justified.

INTRODUCTION

Centaurea nigra L. is a common and wide-ranging British species, which, according to Clapham (1962), contains two subspecies, subsp. *nigra* and subsp. *nemoralis* (Jord.) Gugl. These have commonly been regarded as species in the past, e.g. by Marsden-Jones & Turrill (1954). More recently Ockendon *et alia* (1969) have described populations from Cambridgeshire which encompass the variational range of the characters usually used to distinguish these two taxa (see Table 3). Clapham (1962) also states that there are geographical and ecological differences between the two subspecies, subsp. *nigra* being the prevalent northern form and on heavier and moister soils in the south, while subsp. *nemoralis* is the prevalent southern form, usually on lighter soils and commonly on calcareous ones. It was therefore thought useful to investigate the variation to be found in the Sheffield region, an area on the boundary of the highland and lowland zones of England, with a considerable range of geological formations and associated soils (see Clapham 1969).

LOCALITIES

Four populations were selected for study to cover a range of geological formations, habitats and climate in the Sheffield region. The populations sampled are all in semi-natural or long-established vegetation. Locality details, together with soils data, are given in Table 1. The Miller's Dale site is on a steep, south-facing dale slope with a tall, ungrazed, species-rich grassland, developed on a rendzina soil profile. The population at Totley Bents grows in a cattle-grazed pasture near a stream on a heavy clay soil developed on Coal Measures strata. The site has scattered trees and bushes of *Ulex europaeus* indicating that the grassland is long-established. The two populations on the Magnesian limestone east of Sheffield are both in areas of ungrazed grassland,

which appear to be semi-natural. Lists of the species present in 1m² quadrats are given in Table 2.

CYTOLOGY

Previous chromosome counts of *Centaurea nigra* in Britain have all been $2n = 44$ (Roy 1937), although one unpublished count of $2n = 22$ has been obtained from a population at Ardtornish, Morven, Argyll, in Scotland (S. M. Walters, *pers. comm.*). Counts were therefore made on a plant from each population sampled. Plants were grown in water culture, and the root-tips pretreated with 0.002M 8-hydroxyquinoline for three hours and fixed in 1:3 glacial acetic acid: absolute alcohol. Roots were hydrolysed in N HCl for eight minutes at 60°C, stained by the Feulgen method, squashed in 45% acetic acid, made permanent by the liquid CO₂ method and mounted in Euparal.

All counts made were $2n = 44$.

TABLE 1. LOCALITY DETAILS AND SOILS DATA FOR POPULATIONS SAMPLED

Sample	1	2	3	4
Locality	Miller's Dale, Derbys.	Totley Bents, S.W. Yorks.	Stony Houghton, Derbys.	North Anston, S.W. Yorks.
Grid Reference	43/153.733	43/305.804	43/667.502	43/838.526
Altitude (m)	210	160	150	90
Geological Formation	Carboniferous Limestone	Coal Measures	Magnesian Limestone	Magnesian Limestone
Soil pH (0-10cm)	6.8	5.3	7.1	7.2
Organic Matter %	10.8	10.0	7.6	7.4
Carbonates %	6.2	2.0	4.5	3.4

pH determined electrometrically at field capacity.

Organic matter determined by wet oxidation with hydrogen peroxide.

Carbonates determined by treatment with HCl.

MORPHOLOGICAL VARIATION

CHARACTERS AND MEASUREMENTS

The characters by which subsp. *nigra* and subsp. *nemoralis* are distinguished are listed in Table 3 together with the measurements made on the population samples. A number of characters were not measured. All plants were pubescent and none noticeably hispid. Stem-width appears to be dependent on the size of plant and was not, therefore, considered a useful character. The degree of concealment of the basal parts of the bracts, as noted by Ockendon *et alia* (1969), varies with size and age of the head and has little taxonomic value. The shape of the bract discs in an individual head is very variable, the innermost bracts tending to have broadly ovate discs, while the outer, basal bracts usually have more or less lanceolate discs. Measurements were therefore made on several series of bract discs from two groups of herbarium specimens in CGE representative of the two subspecies. From these the disc length/breadth ratio

TABLE 2. LISTS OF ASSOCIATED SPECIES AT SITES SAMPLED

Cover-abundance scored on the Domin scale within 1m² areas.

Locality	1	2	3	4
<i>Agropyron repens</i>				3
<i>Agrostis tenuis</i>	7	7		
<i>Anthoxanthum odoratum</i>	4			
<i>Arrhenatherum elatius</i>				8
<i>Brachypodium sylvaticum</i>	4			
<i>Briza media</i>			1	
<i>Bromus erectus</i>			8	
<i>Carex nigra</i>				1
<i>Dactylis glomerata</i>			4	3
<i>Festuca ovina</i>			5	
<i>Helictotrichon pratense</i>	3			
<i>H. pubescens</i>			3	
<i>Holcus lanatus</i>		7		
<i>Achillea millefolium</i>		3	1	
<i>Angelica sylvestris</i>	1			
<i>Campanula rotundifolia</i>	2	1	1	
<i>Centaurea nigra</i>	4	2	2	5
<i>C. scabiosa</i>	2			
<i>Cirsium arvense</i>				4
<i>Conopodium majus</i>				6
<i>Galium verum</i>			4	
<i>Helianthemum chamaecistus</i>			3	
<i>Heracleum sphondylium</i>	1			2
<i>Hieracium</i> sp.				7
<i>Hypericum hirsutum</i>	2			
<i>H. perforatum</i>	2			
<i>Lotus corniculatus</i>			3	3
<i>Origanum vulgare</i>	4			
<i>Pimpinella saxifraga</i>	2		1	
<i>Plantago lanceolata</i>	3	3	2	
<i>Poterium sanguisorba</i>			3	
<i>Ranunculus acris</i>		2		
<i>Rumex acetosa</i>		2		
<i>Silene nutans</i>	3			
<i>Stachys sylvatica</i>				4
<i>Trifolium pratense</i>			5	3
<i>T. repens</i>		2		

and the ratio of maximum tooth-length to disc-length, as an index of relative tooth-length, were calculated. The series were of discs from the innermost bracts, discs from the outermost bracts (mentioned by Clapham 1962) and discs from the third spiral (apparent row) of bracts from the base of the head (used by Marsden-Jones & Turrill 1954). In all cases there were no differences between the ranges of the ratios for each of the two subspecies. There is a partial correlation and separation into two groups representing the two subspecies only when the two sets of ratios obtained by measurement of the

TABLE 3. MORPHOLOGICAL DIFFERENCES BETWEEN *CENTAUREA NIGRA* SUBSP. *NIGRA* AND SUBSP. *NEMORALIS* (mainly from Clapham 1962) AND MEASUREMENTS MADE ON POPULATION SAMPLES

Character	Subsp. <i>nigra</i>	Subsp. <i>nemoralis</i>	Measurements taken
Leaf-pubescence	hispid	pubescent	—
Leaf-shape	broadly lanceolate	narrowly lanceolate	lamina length/breadth ratio of fifth cauline leaf from base
Leaf-dissection	toothed or shallowly pinnatifid	entire or sinuate-toothed	ratio of maximum lamina-width to minimum lamina-width of a mid-stem leaf (dissection index)
Stem	stout	slender	—
Stem	conspicuously swollen beneath the heads	not much swollen beneath the heads	ratio of stem-width immediately below heads to normal stem-width
Head-shape	scarcely longer than broad	markedly longer than broad	length/breadth ratio of head including bracts, but excluding emergent florets
Bract appendages	± completely concealing pale basal parts	not completely concealing pale basal parts	—
Outer bract discs	very broadly triangular	discs ± equilaterally triangular	—
	teeth about equalling the undivided central portion	teeth longer than the undivided central portion	—

outermost bract discs are combined in a scatter diagram. This separation is not, however, complete and measurements of bract discs are not therefore included here.

The measurements listed in Table 3 were made on each of fifty plants collected at random within each population sampled. Only stems with flowering heads were collected for investigation. One leaf and one head were measured per plant, the ratios were calculated and the scatter diagrams prepared from these data.

RESULTS

LEAF MEASUREMENTS. Scatter diagrams of length/breadth ratio of lamina and dissection index have been plotted for the populations sampled. All scatter

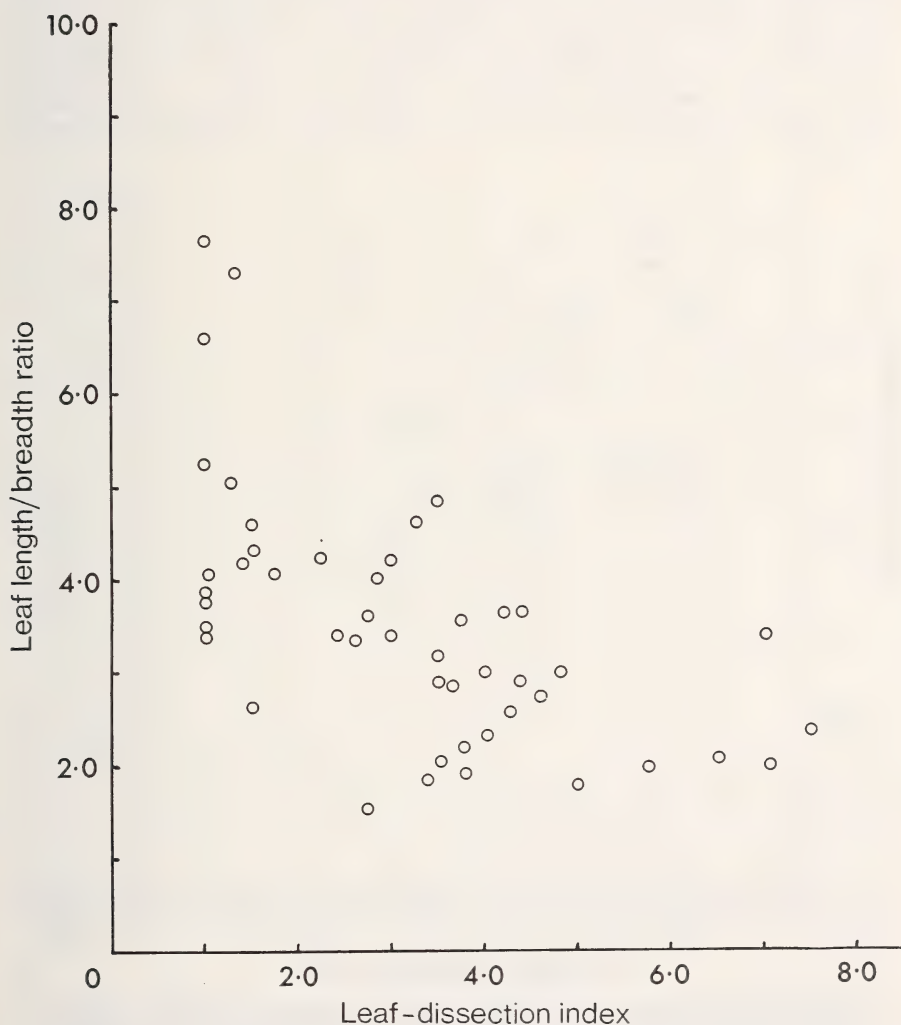


FIGURE 1. Scatter diagram of leaf length/breadth ratio and dissection index measurements for the population sample from locality 2, Totley Bents.

diagrams are similar and those of the population samples from locality 2, Totley Bents, and 3, Stony Houghton, are given as examples (Figs. 1 & 2), the latter also including the ratios obtained from the measurement of the representative herbarium specimens mentioned previously. There is clearly both a wide range in values for these ratios within a population and also correlation between them. Plants with relatively narrow leaves tend to have low dissection, these being distinguishing features of subsp. *nemoralis*, while plants with relatively wide leaves have high dissection, these being features which

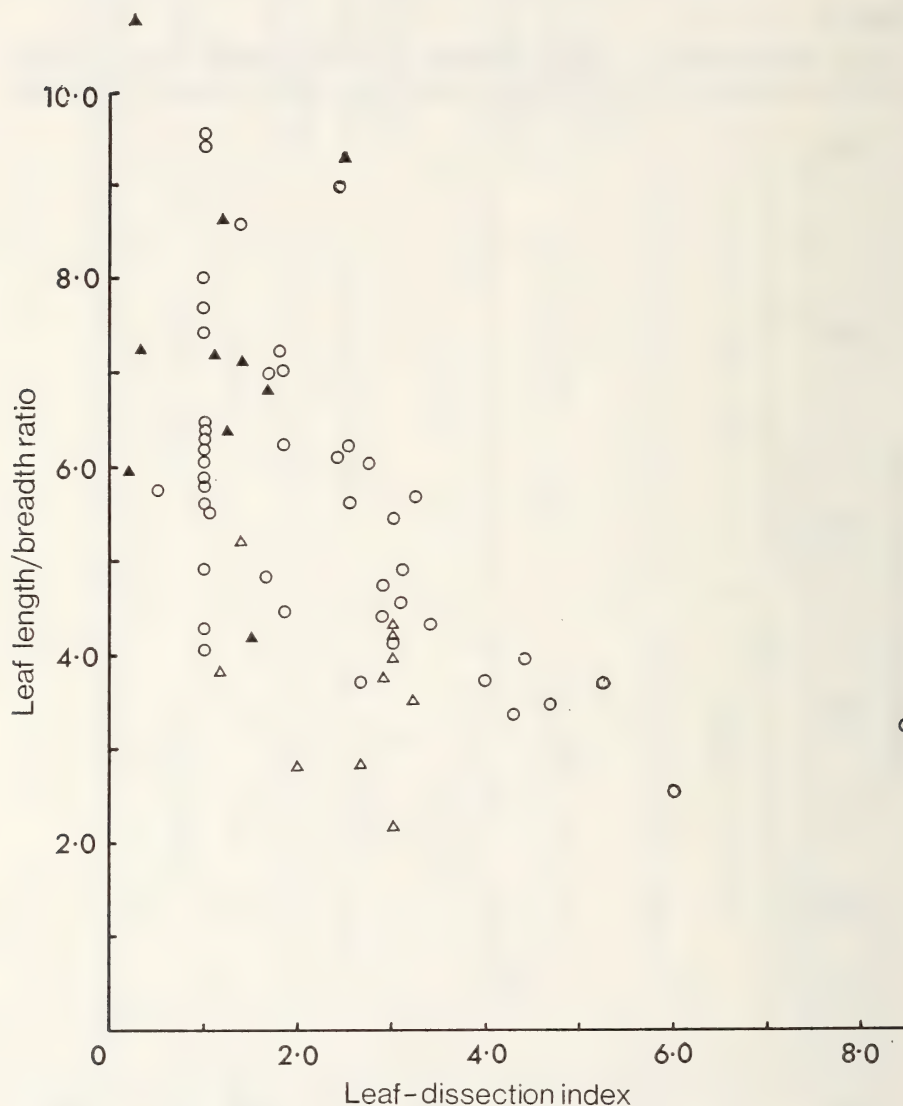


FIGURE 2. Scatter diagram of leaf length/breadth ratio and dissection index measurements for the population sample from locality 3, Stony Houghton (O), together with measurements of representative herbarium specimens of *C. nigra* subsp. *nigra* (Δ), and *C. nigra* subsp. *nemoralis* (▲).

characterise subsp. *nigra*. These extremes are, however, connected by a wide and continuous range of intermediates. The groups of herbarium specimens show the same features, but to a lesser degree.

There are minor differences between the populations, these being greatest in the populations for which scatter diagrams are given. Thus the Stony Houghton population has a predominance of individuals with relatively narrow, little-dissected leaves, while that from Totley Bents has a majority with relatively wider, more dissected leaves. It is worth noting that the Totley population is from a site on Coal Measure strata, the soils being heavier than those from the limestone localities.

HEAD MEASUREMENTS. Scatter diagrams of length/breadth ratio of heads and stem inflation index were prepared for the population samples. The diagram for the sample at locality 1, Miller's Dale, is shown in Fig. 3, together with the measurements of representative herbarium specimens. As in the case of the leaf measurements, the variation within a population spans the range of variation of specimens representative of both subspecies. There are also differences between the variational patterns of the populations. That from

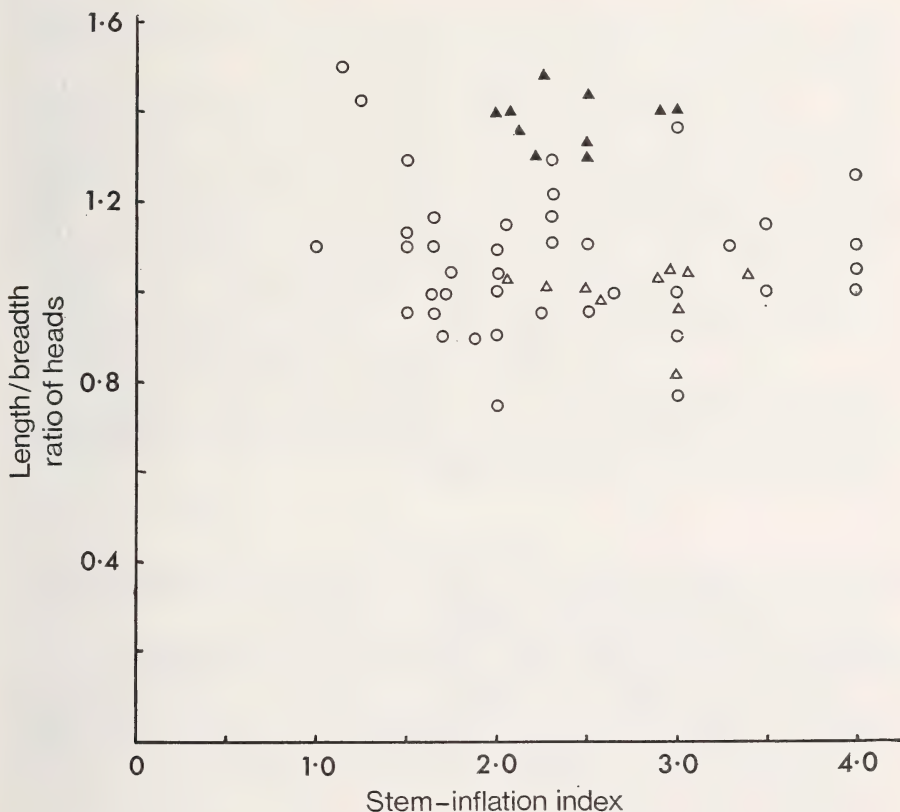


FIGURE 3. Scatter diagram of head length/breadth ratio and stem inflation index measurements for the population sample from locality 1, Miller's Dale (○), together with measurements of representative herbarium specimens of *C. nigra* subsp. *nigra* (Δ) and *C. nigra* subsp. *nemoralis* (▲).

Miller's Dale is most variable and has individuals like subsp. *nigra* for these characters; that from Stony Houghton lacks such plants, but has individuals with measurements corresponding to subsp. *nemoralis*. The population pattern for these characters is therefore different from that resulting from measurement of leaf characters, indicating that leaf and flowering-head characters are not correlated.

DISCUSSION

It is clear that the populations sampled in the Sheffield district have a wide range of variation, similar to that recorded from Cambridgeshire by Ockendon *et alia* (1969). Indeed it is difficult to find specimens which have all the characteristics of one or other of the subspecies. As in Cambridgeshire there are differences in flowering time between the populations, those from Totley Bents and Stony Houghton being in full flower about one month later than the other two. There is, however, no correlation between this and the morphological characters studied, and indeed the Totley Bents and Stony Houghton populations are the two which are most dissimilar in terms of leaf characters. Much of the variation within *Centaurea nigra* has been ascribed by Marsden-Jones & Turrill (1954) to hybridization with *C. jacea*, but there is no evidence for this in the Sheffield area, nor is *C. jacea* recorded for the region.

It seems possible that the variation recorded here is normal within populations of this species, both for the Sheffield area, which includes a wide range of climatic conditions and soil types, and for Cambridgeshire. In some other parts of Britain only part of the variational range of the species may be present; thus the maps given by Perring & Sell (1968) indicate that plants with subsp. *nemoralis* features are characteristic of the chalk and limestone of southern England, whereas plants with subsp. *nigra* characters are much more scattered in these areas. It is therefore not possible to satisfactorily divide plants of *Centaurea nigra* in the Sheffield region into two taxa and the populations in this area are thus similar in this respect to those in Cambridgeshire studied by Ockendon *et alia* (1969). If further investigations show that this situation is widespread in Britain recognition of two subspecies in this country would not be justified, although it would clearly be interesting to map the distribution of individual characters within this species.

REFERENCES

- CLAPHAM, A. R. (1962). *Compositae*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 800–931. Cambridge.
- CLAPHAM, A. R., ed. (1969). *Flora of Derbyshire*. Derby.
- MARSDEN-JONES, E. M. & TURRILL, W. B. (1954). *British Knapweeds*. London.
- OCKENDON, D. J., WALTERS, S. M. & WHIFFEN, T. P. (1969). Variation within *Centaurea nigra* L. *Proc. bot. Soc. Br. Isl.*, 7: 549–552.
- PERRING, F. H. & SELL, P. D., ed. (1968). *Critical supplement to the Atlas of the British Flora*. London.
- ROY, B. (1937). Chromosome numbers in some species and hybrids of *Centaurea*. *J. Genet.*, 35: 89–95.

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A Welsh Bramble Foray

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ABSTRACT

The distribution of *Rubus* species in part of mid- and north Wales is reviewed and habitat characteristics discussed. The position of species widespread in England within the Welsh bramble communities is contrasted with that of endemic species and a table of relative frequencies is provided. Three new taxa are described. A list of records analysed by 10km squares is given in an Appendix.

INTRODUCTION

The published material on the subject of north Welsh brambles is scanty; many visits in pursuit of them have however been made by the botanists of the past. In the early years of the century Augustin Ley collected large numbers from Radnor and the more southerly counties, but isolated visits to Bangor, Betws-y-Coed and Festiniog (where he collected *Rubus bellardii*) were the extent of his considerable brambling exploits in a northerly direction. Earlier, the Betws-y-Coed-Llanberis district had been visited by Edwin Lees, A. Bloxam and C. C. Babington; the former described *R. lentiginosus* from Capel Curig and the last *R. incurvatus* from Llanberis. In the heyday of J. E. Griffith, about 1895, one or two visits were made by W. Moyle Rogers, in one instance in the company of his German mentor, W. O. Focke. These resulted in the publication of *R. griffithianus*, *R. chrysoxylon*, *R. semiglaber* and *R. cambricus*, which was almost immediately equated with *R. lentiginosus* Lees.

J. Harbord Lewis from Liverpool and Charles Bailey from Manchester collected in the Bangor-Llanberis area and R. P. Murray at Festiniog, whence specimens of no. 91 of the British set, distributed as *R. podophyllus* P. J. Muell., were afterwards named *R. fuscicortex* by Sudre. In 1895 the district around Harlech was visited by W. R. Linton (Linton 1895, 1896) and many gatherings were made which could not be named satisfactorily; there are also exsiccata of W. H. Painter from the Aberystwyth area. Later visitors included S. H. Bickham along the northern seaboard and W. C. Barton and H. J. Riddelsdell (Riddelsdell 1923, 1924) to the Portmadoc, Dolgelley and Machynlleth districts in 1922 and 1923. Many of their gatherings were issued through the Botanical Society and Exchange Club of the British Isles and Barton's (MSS in BM) notes went some way towards recognising distinct taxa in the area. Finally, W. H. Mills paid visits to Beddgelert in the early fifties and in 1950 W. C. R. Watson published a list of his observations in the Dolgelley area (Watson 1950).

A large amount of north Welsh material collected by all these botanists survives. Much is of constant, clearly recognisable species, named and unnamed, but a proportion of the plants, while exhibiting features which at first sight resemble plants of other parts of the British Isles, cannot in fact be matched elsewhere. Some appear to have a fairly wide distribution, others are confined

to limited areas or even from the herbarium evidence existed as isolated individuals.

This material prompted the following questions which could only be answered by careful inspection in the field:

What are the main constituents of the north Welsh bramble flora?

Are the widespread species of England equally as widespread there?

Are there outliers of previously unrecorded English species?

What are the limits of the endemic species? Are they confined to particular areas? Do they form part of distinct communities? Do their distributions overlap?

It was decided to take a preliminary look at the situation in the field in 1971 and the following itinerary was chosen. A start was made from the Presteigne area where the bramble flora is reasonably well known. From there the eastern side of Radnor Forest was explored and then the upper reaches of the Wye from Builth Wells to Rhayader previously examined by Rogers (1899). The central Wales massif was crossed and the country bounded by Devil's Bridge, Aberystwyth and Strata Florida examined thoroughly. A route was then chosen from Aberystwyth to Portmadoc via Machynlleth, Harlech and Maentwrog, with visits to most of the west-facing valleys including the Dovey, Mawddach and the shorter streams in the Talsarnau and Tal-y-bont areas; finally, the journey was completed via Beddgelert and the west side of Snowdon to the foothills of the Padarn ridge east of Caernarvon.

GENERAL CONCLUSIONS ON THE HABITAT OF BRAMBLE COMMUNITIES

1. Discontinuous but pronounced communities were frequently visible at the 700–800 ft (213–244m) contour, which appears to correspond well with a marginal scrub zone between the upper limit of past deciduous forest and higher moorland.
2. A fairly constant fringe was observed at the lower limit of woodland between approximately 50 and 300 ft (15 and 92m). These communities are often very rich in species, particularly on gravel fans at the mouths of glacially-steepened side valleys. Between 300 and 700 ft (92 and 213m) in the areas occupied by the denser woodland and the steeper slopes, brambles occur sporadically and in small quantity.
3. River banks and terraces up to 800 ft (244m) exhibit communities similar to those of the surrounding scrub and woodland, but at least at lower levels provide ground for a limited infiltration of species more frequently to be found in the next group.
4. The littoral and sub-littoral fringe below 50 ft (15m) is occupied by a distinct assemblage of plants which are rarely found in the other groups. This contains several species common and widespread in lowland England.

East of the Radnor Forest area this stratification of habitat is replaced by a situation in which bramble communities are most luxuriant within the woodland zone, along valley sides at approximately 200–700 ft (61–213m) (A), with an attenuated upper 'marginal scrub' zone extending into the hills (B). A similar

situation obtains in the Upper Wye Valley where, however, the valley slopes are spattered with terrace and fluvio-glacial gravels which are exceptionally conducive to the profusion of bramble colonies. Below Aberedw as the valley begins to widen there is evidence of a rudimentary disturbed ground and hedgerow community (C) reminiscent of 4 above.

In Table 1 an attempt is made to estimate the relative frequency of species observed in eight distinct areas in the habitats defined above.

The species are classified as follows:

- Class 1 Species widespread and common in Britain as a whole.
- 2 Species widespread but not common in Britain as a whole.
- 3 Species widespread and common in the western half of Britain.
- 4 Species endemic to mid- and north Wales.
- 5 Species endemic to the Wye Valley and south Wales.
- 6 Species common in the north of England.
- 7 Species common in the south of England.

Frequency is assessed as follows:

- R Confined to a restricted area, or as isolated bushes here and there.
- F Widespread in a limited area, or as widely distributed isolated bushes.
- C In quantity throughout the area.

REMARKS ON DISTRIBUTION

1. Species of the Section Suberecti are normally confined to the moorland fringe zone.
2. Some of the 'widespread' groups are virtually confined in Wales to the lowest community, suggesting relatively recent infiltration, e.g. *R. ulmifolius*, *R. cardiophyllus* and *R. vestitus* in the more northerly portions of the area surveyed. Others, e.g. *R. selmeri*, *R. pyramidalis*, *R. polyanthemus* and *R. lindleianus*, are well distributed throughout, but do not achieve the dominance of the Welsh near-endemics. Only *R. dasyphyllus* of this group forms a major constant member of all the Welsh communities and achieves co-dominance.
3. Many species widespread in England or with a predominantly westerly distribution are represented only by small colonies, e.g. *R. sprengelii*, *R. bellardii*, *R. flexuosus* and *R. rubritinctus*.
4. The Welsh endemics form numerically a significant proportion of the bramble communities, e.g. *R. incurvatus*, *R. silurum*. It is noteworthy however that in this case their distributions are almost mutually exclusive. Many of this group are extremely vigorous within fairly limited areas, e.g. *R. riparius*, *R. ordovicum* and a few of the as yet undescribed species.
5. It is noteworthy that some of the Wye Valley brambles do not cross the central massif, e.g. *R. acclivitatum*, *R. ludensis*, while others, e.g. *R. bartonii*, *R. silurum*, are found on both sides of the central moorland.
6. The absence of some of the 'Bangor brambles' is noteworthy.

NEW SPECIES

Further investigation is necessary before some of the unpublished species can be effectively described; research is, however, sufficient for the publication of the following three species:

[illegible]

Undescribed species

'*lentiginosus* prickly form'

'villicaulis' 1'

'villicaulis 2'

'portmadocensis Barton MS'

'tremadocensis Barton MS'

'discolor'

1. *Rubus bartonii* A. Newton, sp. nov.

Turio arcuato-procumbens, robustus, in apricis fusco-purpureus, superficiebus planis vel leviter excavatis, capillis simplicibus stellatisque vestitus, aculeis numerosis haud ad angulos omnino dispersis, inaequalibus, brevibus, e basi lata declinatis; aciculis aculeolis et glandulis stipitatis nonnullis obsitus. Stipulae latae.

Folia saepe magna, 4-quinata-digitata vel subpedata, quorum petioli pubescentes aculeis reclinatis inermibus brevibus numerosis et glandulis stipitatis paucis muniti. Foliola superne strigosa, subtus vix pilosa, durescentia, irregulariter dentata plerumque haud profunde incisa, saepe $\pm$ lobata. Petioluli sat longi. Foliolum terminale late obovatum vel pentagonum, breviter cuspidatum vel acuminatum, basi lata emarginata, eiusdem petiolulo duplo longius.

Inflorescentia saepe longa florifera, late vel anguste pyramidata ad apicem truncata; ramuli superiores fasciculati, inferiores inter se distantes ascendentes c 45°; medii multiflori, corymbosi vel subumbellati. Rachis vix flexuosa, inferne sparsim, superne dense pilosa, ad apicem et in pedicellis villosa; aculei sat inermes, inaequales, breves, patentes vel declinati; aculeolis aciculis nonnullis, glandulis stipitatis minoribus quam pilis armata.

Flores sat magni c 2.5cm diameter; sepala sub anthesi et post anthesin leviter reflexa, late ovata, attenuata; aciculis glandulisque sparsis et capillis densis vestita. Petala longa, obovata, angusta, dilute rosea. Stamina alba stylos virides longe superantia; carpella $\pm$ pilosa.

Stem arcuate-prostrate, robust, long, dull purplish in exposure, bluntly angled with flat or concave faces, moderately hairy (hairs single and clustered); prickles numerous, not entirely confined to angles, unequal but short, declining from stoutish base, usually with some pricklets, acicles and stalked glands on the faces. Stipules broad.

Leaves often large, 4-5-nate, digitate, sometimes $\pm$ pedate, petioles and petiolules rather long so that the leaflets are well spaced. Petioles armed with many weak, short, curved prickles, hairy and sometimes with a few stalked glands. Leaflets strigose above, sparingly hairy and harsh to the touch beneath; toothing usually compound-dentate, not deeply incised, often $\pm$ lobate. Terminal leaflet broadly obovate or pentagonal with a short cuspidate or acuminate point and a broad, emarginate base, the petiolule long, usually about half the length of the terminal leaflet.

Panicle often large, floriferous, broadly pyramidal with truncate top when fully developed but narrowly pyramidal or cylindrical when lower branches are less developed; branches, except the uppermost, ascending at about 45°; upper branches rather close, the lower increasingly spaced downwards, most divided well above the middle, many-flowered and corymbose or subumbellate; leaves large, ternate below, simple above. Rachis somewhat flexuous, densely villous and hairy towards the top and on the pedicels; prickles weak, unequal, but all short, patent or declining, with some pricklets, acicles and stalked glands shorter than the hairs.

Flowers rather large, c 2.5 cm diameter, star-like. Sepals loosely reflexed in flower and fruit, broadly ovate with long tip, shaggy and with some acicles and glands. Petals long, narrow, obovate, pale pink, with pilose margins. White

stamens far exceeding the green styles. Carpels $\pm$ pilose. Floral organs occasionally turn pink.

HOLOTYPE: Llynant Valley, v.c. 47, 8/1923, *W. C. Barton* no. 4821 in **herb. Barton & Riddelsdell (BM)** (*R. arthogensis* MS)

The weak, varied armature, dull purple-brown stem, long-stalked terminal leaflet of constant outline, large, truncate, pyramidal panicle, star-like flowers and loosely reflexed sepals are characteristic features.

Widespread in mid- and north Wales and the Welsh Marches and forming a major element in the bramble flora, this species was first recognised as a distinct taxon by Ley (1894, p. 67, under *R. macrophyllus*) but was left undescribed. Thirty or so years later it was again distinguished independently by Barton who left notes and a draft description in MSS (**BM**) as *Rubus arthogensis*. It is appropriate that Barton's original and valuable researches into the *Rubus* flora of Britain and Europe should be recognised by his association with this species. It should stand in section Appendiculati (Genev.) Sudre subseries Virescentes Sudre.

I have seen the following exsiccata:

BM (herb. Barton & Riddelsdell)

Eardisland (v.c. 36), 1926, *H. J. Riddelsdell* no. 1583/96, '*R. hirtifolius* ×'

Titley (v.c. 36), 1891, *A. Ley* no. 4819

Cwm Einion (v.c. 46), 8/1923, *W. C. Barton* no. 689/91/2, '*R. arthogensis* (*R. mollissimus*, *R. prius*)'

Llynant Valley (v.c. 47), 8/1923, *W. C. Barton* no. 501-4/8, 4820/2/3, '*R. arthogensis* (*R. mollissimus*, *R. prius*)'

Fridd Gate, Corris Valley (v.c. 47), 8/1923, *W. C. Barton* no. 505-6, 4824, '*R. arthogensis* (*R. mollissimus*, *R. prius*)'

Dolgelley (v.c. 48), 8/1923, *W. C. Barton* no. 500/7, 686-8/90, 5392, 7235/6, '*R. arthogensis* (*R. mollissimus*, *R. prius*)'

Corris Valley (v.c. 48), 8/1923, *W. C. Barton* no. 4826, 11999, '*R. arthogensis* (*R. mollissimus*, *R. prius*)'

Llangower (v.c. 48), 8/1923, *W. C. Barton* no. 565, 684, '*R. arthogensis* (*R. mollissimus*, *R. prius*)'

CGE

Shirl heath, Eardisland (v.c. 36), 18/7/1898, *A.L.*, '*R. macrophyllus* var. *macrophylloides*'

*Frequent about Shobdon, in woods (v.c. 36), 13/9/1887, *A.L.* no. C.C.B 2316, '*R. muenteri*, C. C. Babington'

Valley of R. Lugg, Aymestrey (v.c. 36), 12/9/1905, *S.H.B.* and *A.L.*, 'near *R. macrophyllus*, W. M. Rogers'

Nextend, Lyonshall (v.c. 36), 4/8/1963, *B. A. Miles* no. 63/258

Shobdon churchyard (v.c. 36), 4/8/1963, *B. A. Miles* no. 63/257

Aberystwyth (v.c. 46), 30/8/1848, *C.C.B.* no. C.C.B. 198, '*R. macrophyllus* probably but not typical, W. M. Rogers'

Cwm Einion (v.c. 46), 15/7/1908, *W. H. Painter*, '*R. hirtifolius* f., W. M. Rogers'

†Cwm Einion (v.c. 46), 2/7/1906, *W. H. Painter*, '*R. curvidens*'

†Cwm Einion (v.c. 46), 18/7/1907, *W. H. Painter*, '*R. lettii*'

Caersws (v.c. 47), 1965, *T. A. W. Davis* no. 65/963

Rough ground by railway station, Festiniog (v.c. 48), 1/8/1963, *B.A.M.* no. 63/230

Saracen's Head, Beddgelert (v.c. 49), 3/8/1947, *W. H. Mills*, '*R. curvidens*'

Roadside south of Ganllwyd (v.c. 49), 31/7/1962, *E. S. Edees* no. 18151

Rhydd-Ddu (v.c. 49), 29/7/1963, *B.A.M.* no. 63/202

Coed-y-Celyn, Capel Garmon (v.c. 50), 18/9/1863, *C.C.B.* no. C.C.B 511, '*R. tereticaulis*'

Caergwrle (v.c. 51), 17/8/1965, *E.S.E.* no. 19237

Fairy Cottage ravine (v.c. 71), 5/8/1963, *D. E. Allen*, '*R. radula*'?

* A note attached to this sheet reads: 'I think this is the plant common about Dolgelley and down to Cardigan, seen by me also in Hereford, which Barton and I call "N. Wales *mollissimus*", H. J. Riddelsdell, 12/2/36.'

† Some stem pieces on sheets of these mixed gatherings, which caused some unfortunate confusion at the time (see Painter (1908) under *R. lettii*).

In my own herbarium I have gatherings from Eardisland, Shobdon and near Presteigne (v.c. 36), the junction of A479/A4081 (v.c. 43), Devil's Bridge (v.c. 46), Llyfnant Valley (v.c. 47), Arthog, Talsarnau (v.c. 48), Waenfawr, Bangor (v.c. 49) and Nant y Ffrith (v.c. 50 & 51). It occurs in small quantity in Staffordshire (v.c. 39) (*vide* E. S. Edees) and probably in Carmarthen (v.c. 44) (*vide* A. Ley). A sheet of the same species, coll. W. C. R. Watson, **SLBI**, is labelled '*adscitus*' and it is evidently the plant referred to by that name by Watson (1950).

2. *Rubus ordovicum* A. Newton, sp. nov.

syn. *R. leucostachys* var. *macrothyrsus* N. E. Brown in Sowerby & Smith, English Botany, 3rd ed., Supp., 101 (1892), non *R. macrothyrsus* Lange, Flora Danica, 16: 6-7, t. 2832 (1871).

R. leucostachys var. *gymnostachys* sensu Griffith, Flora of Anglesey and Caernarvon, 48 (1895) et Rogers, Handbook of British Rubi, 51 (1900), p.p. quoad spp. ex North Wales.

Turio altiarcuratus, rufo-purpurascens, obtuse angulatus, superficiebus ± planis, striatis; aculeis plerumque ad angulos dispositis, e basi lata declinatis, rectis vel paullo deflexis, inaequalibus, capillis simplicibus stellatisque et glandulis purpureis nonnullis obsitus.

Folia 4-quinata subpedata parva, quorum petioli aculeis deflexis, capillis stellatis et glandulis sparsis praedita. Foliola vix imbricata, supra viridia, infra griseo-viride vel cinereo-tomentosa, quorum venae prominentes capillis laxis vestitae, aequaliter serrata sed ad apicem dentibus nonnullis patentibus. Foliolum terminale oblongum vel elliptico-obovatum, abrupte cuspidatum, basi truncata vel emarginata eiusdem petiolulo triplo longius.

Inflorescentia elongata angusta vel subpyramidata, ad apicem truncata, superne aphylla, ramuli inferiores subracemosi c 60° ascendentes, medii 30°-70°, subcymosi 3-5 flori. Rachis valida, haud flexuosa, superne pilosa, tomentosa, aculeis aculeolisque numerosis rectis declinatis et glandulis numerosis purpureis tenuibusque armata. Pedicelli sicut rachis vestiti.

Flores magni *c* 3 cm diameter. Sepala reflexa utrinque cinereo-tomentosa glandulis parvis purpureis et aculeolis praedita. Petala elliptica vel obovata, atro-roseata, pilosa. Stamina roseata stylos ad basin roseos superantia. Anthera glabra; carpella dense pilosa.

Stem high-arching, deep dull crimson, blunt-angled, sides $\pm$ flat, striate. Prickles mostly on the angles, straight or slightly curved, declining from a strong base, of various sizes, the longest greater than the stem-width, the shorter about half the stem-width, clothed with simple and stellate hairs and sparse, short-stalked purple glands.

Leaves 4-quinate, subpedate, smallish, the petioles with curved prickles, stellate down and sparse, short-stalked glands. Leaflets barely imbricate, green above, greyish-green to greyish-white felted beneath, the veins prominent but clothed with spreading hairs below, the margins evenly serrate but sub-compound-serrate in the upper half with prominent main teeth. Terminal leaflet oblong-elliptic-obovate, abruptly cuspidate, with truncate or emarginate base, approximately three times the length of its petiolule.

Panicle long, cylindrical but subpyramidal when well developed, with truncate top, the upper half leafless; lower branches ascending *c* 60°, subracemose; median branches spreading or ascending 30°–70°, subcymose, 3–5-flowered. Rachis straight, strong, clothed with close, grey, appressed down and brownish hairs above, armed with numerous straight, slightly declining prickles, pricklets and numerous slender, purple, stalked glands equalling or exceeding the hair, and rare gland-tipped pricklets. Pedicels armed as the rachis.

Flowers *c* 3 cm diameter. Sepals reflexed, grey-white felted on both sides, clothed with short pricklets and numerous short, dotted purple glands. Petals almost contiguous, oval or obovate, deep rose, pilose. Stamens longer than the buff, pink-based styles. Filaments deep rose, anthers deep yellow, glabrous. Carpels densely pilose.

HOLOTYPE: Bangor, v.c. 49, 9/1892, *J. E. Griffith & W. R. Linton* no. 87 in Set of British Rubi (CGE) (*R. leucostachys* var. *macrothyrsus* N. E. Brown)

This handsome, well-marked species has long been known from North Wales whence specimens were distributed by Bailey, Griffith, Bickham and others. For some time it was equated with *R. macrothyrsus* Lange *fide* W. O. Focke which was later thought synonymous with *R. gymnostachys* Genev. It differs from autographed specimens of *R. macrothyrsus* collected by Lange at Viehburg, Kiel, particularly in leaf-shape and prickliness and glandulosity of the panicle. The same characters distinguish it from *R. gymnostachys* Genev., syntype specimens of which reveal a distinct plant unknown in Britain (see Barton & Riddelsdell 1935). It has sometimes been regarded as a form or hybrid of *R. vestitus* Weihe, but is constant in character and produces well-formed fruit throughout its range. The two species rarely overlap and where they do *R. vestitus* is noticeably less frequent.

The observed range of the plant is from Harlech, in Merioneth, through Festiniog and Beddgelert to the Bangor area in Caernarvon, thence through Denbigh to the Mold district. It appears to favour the lower foothills. I have seen the following exsiccata (*inter alia*):

CGE

*Llanberis (v.c. 49), 9/1891, *R. P. Murray* no. 87 of British set, '*R. leucostachys* var. *macrothyrsus* N. E. Brown'

*Bangor (v.c. 49), 8/1893, *J. E. Griffith & W. R. Linton* no. 87 of British set, '*R. leucostachys* var. *macrothyrsus* N. E. Brown'

Coed Menai (v.c. 49), 9/1903, *J. E. Griffith & S. H. Bickham*

Upper Bangor (v.c. 49), 9/1915, *S. H. Bickham*

Portmadoc (v.c. 48/49), 9/1922, *W. C. Barton*

MANCH

Bangor Rd, Menai Bridge (v.c. 49), 16/8/1872, *F. M. Webb*, '*R. vestitus* J. B. L. Warren'

Brynnlwyd, nr Bangor (v.c. 49), 9/1886, *J. E. Griffith*, '*R. conspicuus* C. C. Babington, *R. vestitus* approaching *R. ulmifolius* W. O. Focke'

Gorphwysfa, Menai (v.c. 49), 8/9/1888, *C. Bailey*, '*R. macrothyrsus* Focke'

Dolbadarn Castle, Llanberis (v.c. 49), 14/9/1888, *C. Bailey*, '*R. macrothyrsus*'

Near Bangor (v.c. 49), 7/1890, *J. E. Griffith*, *R. macrothyrsus*, *R. vestitus* C.C.B.

Upper Bangor (v.c. 49), 10/9/1915, *S. H. Bickham*, '*R. leucostachys* var. *gymnostachys*'

Some pieces on gatherings by W. Wilson in the Bangor district 8/1826 as '*R. glandulosus*'

*The labels on the sheets of set 87 state 'much more glandular than Lange's plant and not identical with it.'

The position of this species in the British List is in section Appendiculati (Genev.) Sudre subseries Hypoleuci Sudre.

3. *Rubus riparius* W. C. Barton ex A. Newton, sp. nov.

Eglandulosus. Turio altiarcuratus, fusco-rufescens, lucens, $\pm$ glaber, acute angulatus, superficiebus $\pm$ planis, striatis; aculeis ad angulos dispositis, compressis, e basi media rectis declinatis, nonnullis obfalcatis obsitus.

Folia quinata-digitata, plana, supra atro-viridia, infra vix pubescentia, quorum petioli paullo canaliculati vix pubescentes aculeis deflexis armati. Folium terminale suborbiculare vel late obovatum vel ellipticum basi truncata vel subcordata, breviter cuspidatum, aequaliter serratum, eiusdem petiolulo duplo longius. Foliola infima breviter petiolulata, nonnunquam sat angusta.

Inflorescentia brevis late pyramidata, racemosa, inferne foliis ternatis quorum terminale suborbiculare superne foliis simplicibus ellipticis paene ad apicem ascendentibus; ramuli medii infime partiti quam folia breviores, 2-3 flori, superiores saepe elongati et arcuati ascendentes. Rachis inferne flexuosa, pilosa, aculeis plerumque tenuibus leviter deflexis praedita. Pedicelli superiores aculeolis tenuibus, patentibus vel leviter deflexis armati.

Flores 2-2.5 cm diameter. Sepala sub anthesi reflexa vel patentia fructum laxè amplexantia, attenuata, albo-marginata, aciculis nonnullis obsita. Petala suborbicularia vix emarginata pallide albo-rosea. Stamina stylos pallide luteos vix superantia. Filamenta alba, anthera capillis nonnullis ornata; carpella glabra.

Eglandular. Stem high-arching, brownish-maroon, shining, $\pm$ glabrous,

sharp-angled with sides flat or shallowly grooved, striate; prickles confined to angles, mostly as long as the stem width, compressed, straight, declining from a moderate base, a few slightly obfalcate.

Leaves quinate-digitate, flat, dark, shining green above, thinly hairy beneath. Petioles slightly grooved, thinly pubescent, with a few curved prickles. Terminal leaflet suborbicular–broadly obovate–elliptical with a truncate or subcordate base, shortly cuspidate, evenly serrate, twice the length of its petiolule; basal leaflets short-stalked (*c* 3 mm), elliptical and sometimes quite narrow.

Panicle short, broadly pyramidal, racemose, with ternate leaves below (the lowest terminal leaflets suborbicular, the upper obovate to elliptical) and two or three simple leaves above reaching almost to the top; middle branches divided below half-way, shorter than the subtending leaves, 2–3-flowered. Upper branches often long, curved, ascending. Rachis flexuous below, pilose with a few, mostly slender, slightly curved, declining prickles and an occasional pricklet. The upper pedicels armed with a few, slender, straight or slightly curved, acicular prickles.

Flowers *c* 2–2.5 cm diameter. Sepals loosely reflexed to patent during flowering, loosely clasping the ripe fruit, the tips attenuate, grey-felted with a white border, armed with a few acicles. Petals not contiguous, roundish, slightly erose at the tips, pinkish, sometimes with a pale lilac tinge, margins glabrous. Stamens short, only barely exceeding the pale yellow styles. Filaments white, anthers slightly pilose; carpels glabrous.

HOLOTYPE: Craig bwlch-y-moch, near Portmadoc, v.c. 49, 8/1922, *W. C. Barton* no. 6702A in **herb Barton & Riddelsdell (BM)**

This species has been observed often in large quantity between Tal-y-bont, in Cardigan, and Montgomery, through Dolgelley and Harlech in Merioneth to Criccieth and Beddgelert in Caernarvon. It also occurs about Llanberis and in Anglesey, and forms a major component of the *Rubus* community at the edge of moorland, within the wooded valleys and on the low-lying gravel fans and rocky heath of the Portmadoc–Talsarnau district.

Specimens (no. 1003) were issued by Barton in 1923 through the Botanical Society and Exchange Club of the British Isles (Barton 1924) as *R. caeresiensis* var. *integribasis* but his MSS reveal that even then he was conscious of significant differences between the Welsh plant and its nearest allies, *R. subintegribasis* Druce of Hampshire and Dorset, and *R. briggsianus* (Rogers) W. C. R. Watson of the south-west, with which he and Riddelsdell were at first inclined to associate it. Later he referred to the plant in MSS by the name *riparius* and listed the main distinctive features. Watson (1930) originally named these gatherings '*R. maasii* var. *glabratus* Bab.' and evidently thought at that time that they were the same species as the plant from Herefordshire which he later named *R. cambrensis*. He subsequently appears to have abandoned this view (Watson 1956). There are points of similarity between *R. riparius* and these species, but the dark green cast, the characteristic finely serrate, suborbicular terminal leaflet, the inflorescence-shape and floral characters (*inter alia*) all serve to distinguish it. In the British list it should be placed in the section *Sylvatici* P. J. Muell. subsection *Virescentes* Genev.

I have seen the following exsiccata:

BM (herb. Barton & Riddelsdell)

Nr Portmadoc (v.c. 49), 8 & 9/1922, *W. C. Barton* no. 6700/1/4, '*R. riparius* MS'
 Maentwrog (v.c. 48), 9/1922, *W. C. Barton* no. 6705, '*R. riparius* MS'
 Talsarnau (v.c. 48), 8/1922 & 8/1923, *W. C. Barton* no. 6706/16, '*R. riparius* MS'
 Festiniog Valley (v.c. 48), *W. C. Barton* no. 6707/8, '*R. riparius* MS'
 Llyfnant Valley (v.c. 46/7), *W. C. Barton* no. 6709/10/5, '*R. riparius* MS'
 Dolgelley (v.c. 48), 8/1923, *W. C. Barton* no. 6711/2, '*R. riparius* MS'
 Ffridd Gate (v.c. 47/8), *W. C. Barton* no. 6713/4, '*R. riparius* MS'

CGE

Llanberis (v.c. 49), 28/8/1847, *A. Bloxam*?, '*R. affinis*'
 Llanberis (v.c. 49), 8/9/1847, *C. C. Babington* no. 143, '*R. affinis*; *R. scheuzii*,
 less prickly than usual *W. M. Rogers*'
 Dolgelley, wood near the Torrents (v.c. 48), 8/1844, *E. Lees*, '*R. vulgaris*'
 Bank above Festiniog railway station (v.c. 48), 1/8/1963, *B. A. Miles* no. 63/232
 Side of B4418, Rhyd-ddu, Caernarvon (v.c. 49), 29/7/1963, *B. A. Miles* no.
 63/201
 Bank of Llyn Dinas, Beddgelert (v.c. 49), 28/7/1963, *B. A. Miles* no. 63/186
 Nr Cwm Cloch Farm, Beddgelert (v.c. 49), 29/7/1963, *B. A. Miles* no. 63/197
 Cytir Llandegfan, Anglesey (v.c. 52), 30/8/1965, *B. A. Miles* no. 65/322
 Llandegfan, Anglesey (v.c. 52), 16/9/1949, *W. C. R. Watson*, '*R. briggsianus*'

MANCH

Nr Portmadoc (v.c. 48/49), 8 & 9/1922, *W. C. Barton* no. 1003, '*R. integri-*
basis'

ACKNOWLEDGMENTS

I wish to record my appreciation of the herbarium facilities afforded by the Botany School, Cambridge University, the Manchester Museum and British Museum (Natural History).

REFERENCES

- BARTON, W. C. (1924). In MARQUAND, C. V., ed., Report of the distributor for 1923. *Rep. botl Soc. Exch. Club Br. Isl.*, 7: 382-385.
 BARTON, W. C. & RIDDELSDELL, H. J. (1935). *Rubus gymnostachys* Genev. *J. Bot., Lond.*, 75: 108.
 LEY, A. (1894). *Additions to the flora of Herefordshire*. Hereford.
 LINTON, W. R. (1895). Merionethshire plants. *J. Bot., Lond.*, 33: 359-363.
 LINTON, W. R. (1896). In BEEBY, W. H., ed., Report of the editor for 1895. *Rep. botl Soc. Exch. Club Br. Isl.*, 1: 477.
 PAINTER, W. H. (1908). In RIDDELSDELL, H. J., ed., Report of the distributor for 1907. *Rep. botl Soc. Exch. Club Br. Isl.*, 2: 285.
 RIDDELSDELL, H. J. (1923). In LESTER-GARLAND, L. V., ed., Report of the distributor for 1922. *Rep. botl Soc. Exch. Club Br. Isl.*, 6: 833-837.
 RIDDELSDELL, H. J. (1924). Review of 'Quidam Rubi cultorum'. *J. Bot., Lond.*, 62: 85.
 ROGERS, W. M. (1899). Radnorshire and Breconshire *Rubi*. *J. Bot., Lond.*, 37: 193.
 WATSON, W. C. R. (1931). In DRUCE, G. C., ed., New county and other records. *Rep. botl Soc. Exch. Club Br. Isl.*, 9: 346.
 WATSON, W. C. R. (1950). In CAMPBELL, M. S. & PRICE, W. R., eds., Excursions 1948. *Yb. bot. Soc. Br. Isl.*, 1950: 47.
 WATSON, W. C. R. (1956). New species and combinations in the genus *Rubus* L. *Watsonia*, 3: 286.

APPENDIX

Analysis of *Rubus* records by 10 km grid squares and vice-counties (named species only)

10 km square	v.c.	
32/3.6.	36	<i>selmeri</i> , <i>lindebergii</i> , <i>silurum</i> , <i>bartonii</i> , <i>vestitus</i> , <i>leyanus</i> , <i>longithyrsiger</i> , <i>dasyphyllus</i> .
32/3.5.	36	<i>prolongatus</i> , <i>polyanthemus</i> , <i>moylei</i> , <i>longithyrsiger</i> , <i>rufescens</i> , <i>hylocharis</i> , <i>dasyphyllus</i> .
32/2.5.	36	<i>polyanthemus</i> , <i>mucronatoides</i> , <i>bartonii</i> , <i>vestitus</i> , <i>raduloides</i> , <i>moylei</i> , <i>dasyphyllus</i> .
32/2.6.	43	<i>lindleianus</i> , <i>polyanthemus</i> , <i>acclivitatum</i> , <i>pascuorum</i> , <i>dasyphyllus</i> .
32/0.4.	43	<i>dumetorum</i> agg., <i>lindleianus</i> , <i>acclivitatum</i> , <i>ulmifolius</i> , <i>angustifolius</i> Rogers, <i>dasyphyllus</i> .
32/0.5.	42 & 43	<i>dumetorum</i> agg., <i>scissus</i> (42 only), <i>opacus</i> (42 only), <i>lindleianus</i> , <i>ludensis</i> , <i>polyanthemus</i> (42 only), <i>acclivitatum</i> (43 only), <i>incurvatus</i> var. <i>subcarpinifolius</i> Rogers & Riddelsd. (42 only), <i>silurum</i> , <i>ulmifolius</i> (43 only), <i>vestitus</i> , <i>raduloides</i> , <i>moylei</i> , <i>dasyphyllus</i> .
32/0.6.	43	<i>selmeri</i> , <i>ludensis</i> , <i>pyramidalis</i> , <i>polyanthemus</i> , <i>silurum</i> , <i>bartonii</i> , <i>pallidus</i> , <i>euryanthemus</i> , <i>moylei</i> , <i>dasyphyllus</i> .
22/9.6.	43	<i>scissus</i> , <i>dumetorum</i> agg., <i>ludensis</i> , <i>lindleianus</i> , <i>dumnoniensis</i> , <i>silurum</i> , <i>raduloides</i> , <i>moylei</i> , <i>dasyphyllus</i> .
22/8.6.	43	none observed.
22/8.7.	46	<i>silurum</i> , <i>dasyphyllus</i> .
22/7.7.	46	<i>scissus</i> , <i>silurum</i> , <i>bartonii</i> , <i>vestitus</i> , <i>hylocharis</i> , <i>dasyphyllus</i> .
22/7.6.	46	<i>scissus</i> , <i>dumetorum</i> agg., <i>selmeri</i> , <i>lindleianus</i> , <i>pyramidalis</i> , <i>silurum</i> , <i>bartonii</i> , <i>vestitus</i> , <i>dasyphyllus</i> .
22/6.7.	46	<i>selmeri</i> , <i>lindleianus</i> , <i>silurum</i> , <i>ulmifolius</i> , <i>bartonii</i> , <i>vestitus</i> , <i>dasyphyllus</i> .
22/6.8.	46	<i>dumetorum</i> agg., <i>lindleianus</i> , <i>favonii</i> , <i>incurvatus</i> , <i>prolongatus</i> , <i>dumnoniensis</i> , <i>silurum</i> , <i>ulmifolius</i> , <i>bartonii</i> , <i>dasyphyllus</i> .
22/6.9.	46	<i>selmeri</i> , <i>pyramidalis</i> , <i>albionis</i> , <i>incurvatus</i> , <i>rubritinctus</i> , <i>silurum</i> , <i>bartonii</i> .
	48	<i>selmeri</i> , <i>lindleianus</i> , <i>pyramidalis</i> , <i>incurvatus</i> , <i>polyanthemus</i> , <i>silurum</i> , <i>ulmifolius</i> , 'propinquus', <i>bartonii</i> .
22/7.9.	46 & 47	<i>selmeri</i> (46 only), <i>lindleianus</i> , <i>albionis</i> , <i>incurvatus</i> , <i>prolongatus</i> (47 only), <i>cardiophyllus</i> (47 only), <i>silurum</i> , <i>ulmifolius</i> (47 only), 'propinquus' (47 only), <i>bartonii</i> , <i>vestitus</i> , <i>hebecaulis</i> , <i>dasyphyllus</i> , <i>riparius</i> .
23/7.0.	48	<i>lindleianus</i> , <i>incurvatus</i> , <i>rubritinctus</i> , <i>silurum</i> , 'propinquus', <i>bartonii</i> , <i>vestitus</i> , <i>hebecaulis</i> , <i>flexuosus</i> , <i>dasyphyllus</i> .
23/7.1.	48	<i>monensis</i> , <i>selmeri</i> , <i>lindleianus</i> , <i>pyramidalis</i> , <i>incurvatus</i> , <i>polyanthemus</i> , <i>ulmifolius</i> , <i>bartonii</i> , <i>dasyphyllus</i> , <i>riparius</i> .
23/6.1.	48	<i>dumetorum</i> agg., <i>incurvatus</i> , <i>ulmifolius</i> , 'propinquus', <i>bartonii</i> , <i>vestitus</i> .
23/5.0.	48	<i>dumetorum</i> agg., <i>incurvatus</i> , <i>ulmifolius</i> , 'propinquus', <i>bartonii</i> .
23/6.0.	48	<i>cardiophyllus</i> , <i>ulmifolius</i> , 'propinquus', <i>bartonii</i> , <i>dasyphyllus</i> .
23/8.0.	47	<i>dumetorum</i> agg., <i>lindleianus</i> , <i>pyramidalis</i> , <i>incurvatus</i> , <i>silurum</i> , 'propinquus', <i>bartonii</i> , <i>vestitus</i> , <i>dasyphyllus</i> .
23/5.2.	48	<i>incurvatus</i> , <i>ulmifolius</i> , 'propinquus', <i>bartonii</i> , <i>hebecaulis</i> , <i>ordovicum</i> , <i>taeniarum</i> , <i>dasyphyllus</i> , <i>semiglaber</i> ?
23/6.2.	48	<i>incurvatus</i> , <i>hebecaulis</i> , <i>bartonii</i> , <i>semiglaber</i> ?
23/5.3.	48	<i>prolongatus</i> , <i>bartonii</i> , <i>ordovicum</i> , <i>dasyphyllus</i> .
	49	<i>caesius</i> , <i>dumetorum</i> agg., <i>riparius</i> , <i>selmeri</i> , <i>lindleianus</i> , <i>incurvatus</i> , <i>ulmifolius</i> , <i>bartonii</i> , <i>vestitus</i> , <i>ordovicum</i> .

- 23/6.3. 48 *riparius, lindleianus, pyramidalis, incurvatus, prolongatus, ulmifolius, fuscicortex, bartonii, hebecaulis, dasyphyllus.*
- 23/6.4. 48 *scissus, riparius, monensis, lindleianus, incurvatus, polyanthemus, cardiophyllus, sprengelii, fuscicortex, ordovicum, hebecaulis, dasyphyllus, semiglaber, bellardii.*
- 49 *riparius, incurvatus, hebecaulis, dasyphyllus.*
- 23/5.4. 49 *scissus, affinis, riparius, monensis, selmeri, incurvatus, polyanthemus, cardiophyllus, fuscicortex, bartonii, hebecaulis, ordovicum, dasyphyllus.*
- 23/5.5. 49 *riparius, lindleianus, incurvatus, polyanthemus, bartonii, hebecaulis, dasyphyllus.*
- 23/5.6. 49 *scissus, dumetorum agg., lindleianus, incurvatus, polyanthemus, cardiophyllus, ulmifolius, lentiginosus, bartonii, hebecaulis, ordovicum, longithyriger, dasyphyllus, semiglaber.*

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The chromosome constitution of *Diplotaxis muralis* (L.) DC.

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ABSTRACT

Morphological and cytological examination of *Diplotaxis muralis* (L.) DC. ($2n = 42$), *D. tenuifolia* (L.) DC. ($2n = 22$) and *D. viminea* (L.) DC. ($2n = 20$) and of the hybrids *D. muralis* $\times$ *D. tenuifolia* and *D. muralis* $\times$ *D. viminea* indicate that *D. muralis* is an allotetraploid species derived from the other two.

The two species of *Diplotaxis* occurring in Britain, both introduced or doubtfully native, are fairly easily distinguished from each other, but on a wider geographical scale the genus poses considerable taxonomic difficulty. Furthermore, in common with the rest of the subtribe Brassicinae, the genus is not easily investigated cytologically. In consequence, it is not surprising to find some discrepancy among the published chromosome counts for the species—thus several numbers have been reported as characteristic of *Diplotaxis muralis* (L.) DC. Three of the earlier papers agree in reporting the chromosome number as $2n = 42$ (Maude 1939, Löve & Löve 1944, Ibarra & La Porte 1947) and this is the number observed in all six collections of the species examined at Leeds (Harberd 1972). The counts of Baez Mayor (1934) ($2n = 18 + 2b$), Jaretsky (1932) ($2n = 22$) and Lübbert (1951) ($2n = 44$) are therefore presumed to be errors.

The number $2n = 42$ is somewhat high for a diploid species of the Brassicinae (Harberd 1972) and this fact alone suggests that the species might be an allotetraploid derived from two other species of the subtribe. Apparently the only natural species hybrid involving *D. muralis* is that with *D. tenuifolia* (L.) DC. (= *D. x wirtgenii* Rouy & Fouc.) and Schulz (1919) records that this has been observed several times. At Leeds we have found that this hybrid is fairly easily made and several plants of it have been raised.

Again, the published chromosome counts for *D. tenuifolia* are not in complete agreement. Our material, four separate collections of the species, all has $2n = 22$ (Harberd 1972) and this is the number reported for the species by most other workers (Manton 1932, Ibarra & La Porte 1947, Lübbert 1951, Mulligan 1959, Gadella & Kliphuis 1968). Accordingly, two other counts, of $2n = 14$ (Jaretsky 1932) and $2n = 20 + 2b$ (Baez Mayor 1934), are again presumed to be in error.

The Leeds hybrids of *D. muralis* $\times$ *D. tenuifolia* were found to have the expected chromosome number of $2n = 32$. At meiosis (Table 1, Plates 1a & 1b) the chromosomes almost always pair to give 11 bivalents and 10 univalents. Furthermore, the bivalents are clearly composed of closely homologous chromosomes since in most cases they have formed chiasmata on both sides of the centromeres. The constancy of the 11 bivalents, the high chiasma frequency per bivalent, and the correspondence of 11 with the haploid number of *D.*

tenuifolia, all strongly imply that *D. tenuifolia* is one of two diploid species involved in the ancestry of *D. muralis*.

An alternative possible interpretation of the high chromosome pairing of the hybrid would be that *D. muralis* is a near autotetraploid species and that the meiotic configurations are essentially autosyndetic. There is, however, other evidence that this interpretation is most unlikely. This relates to the meiotic pairing between *D. muralis* and some other species of the sub-tribe, *Brassica campestris* ($2n = 20$), *B. oleracea* ($2n = 18$) and *Sinapodendron frutescens* ($2n = 20$). In all of these cases the degree of pairing is low, averaging about 3 bivalents per cell; variable, ranging from 0 to 6 bivalents per cell; and weak, with rarely more than 1 chiasma per bivalent, indicating not only little relation-

TABLE 1. MEIOTIC METAPHASE PAIRING IN THE HYBRID *DIPLOTAXIS MURALIS* $\times$ *D. TENUIFOLIA*

Bivalents	Univalents	No. of pollen mother cells
10	12	2
11	10	99
12	8	1

ship between the species, but also very little autosynopsis within any of them. The suggestion that the bivalents in *D. muralis* $\times$ *D. tenuifolia* are each composed of one chromosome from *D. tenuifolia* and one homologue from *D. muralis*, and that all eleven chromosomes of *D. tenuifolia* are so paired in the hybrid, is thus strengthened. Finally, before leaving the hybrid, one further observation should be recorded in preparation for later discussion—in this hybrid the bivalents are relatively large and tend to be more than twice the size of the unpaired chromosomes.

Acceptance as a working hypothesis that *D. tenuifolia* is one of the diploid ancestors of *D. muralis* leads to speculation as to the nature of the other species involved. This species must have the chromosome number $2n = 20$, and we can suggest its likely characters by comparing those of *D. muralis* with those of *D. tenuifolia*. In Table 2 we have first listed seven characters which are stressed by certain Floras (Schulz 1919, Clapham 1952) as being particularly good for separating *D. tenuifolia* and *D. muralis* (columns 2 and 3), and by comparing these we have listed in the fourth column the probable characters of the other diploid species involved. *D. viminea* (L.) DC., alone among the species of the Brassicaceae, agrees with this description, the appropriate characters of that species being listed in the last column. However, these do not include all of the very highly characteristic features of *D. viminea* and three more are listed below the line. Also in each of these it can be seen that the characters of *D. muralis* are not inconsistent with the hypothesis that *D. tenuifolia* and *D. viminea* are its diploid ancestors. Furthermore, the chromosome count for *D. viminea* is reported to be $2n = c\ 20$ (Manton 1932).

In contrast to *D. tenuifolia* and *D. muralis*, *D. viminea* is not to be found in the British Isles either as a native or as an established, introduced plant, though casual plants have been recorded. It is native to the western Mediterranean area, and its distribution overlaps with that of *D. tenuifolia* over a large part of southern Europe. Experiences at Leeds with seed collections reputed to be *D. viminea* have been unfortunate—if the seeds grew vigorously they were not

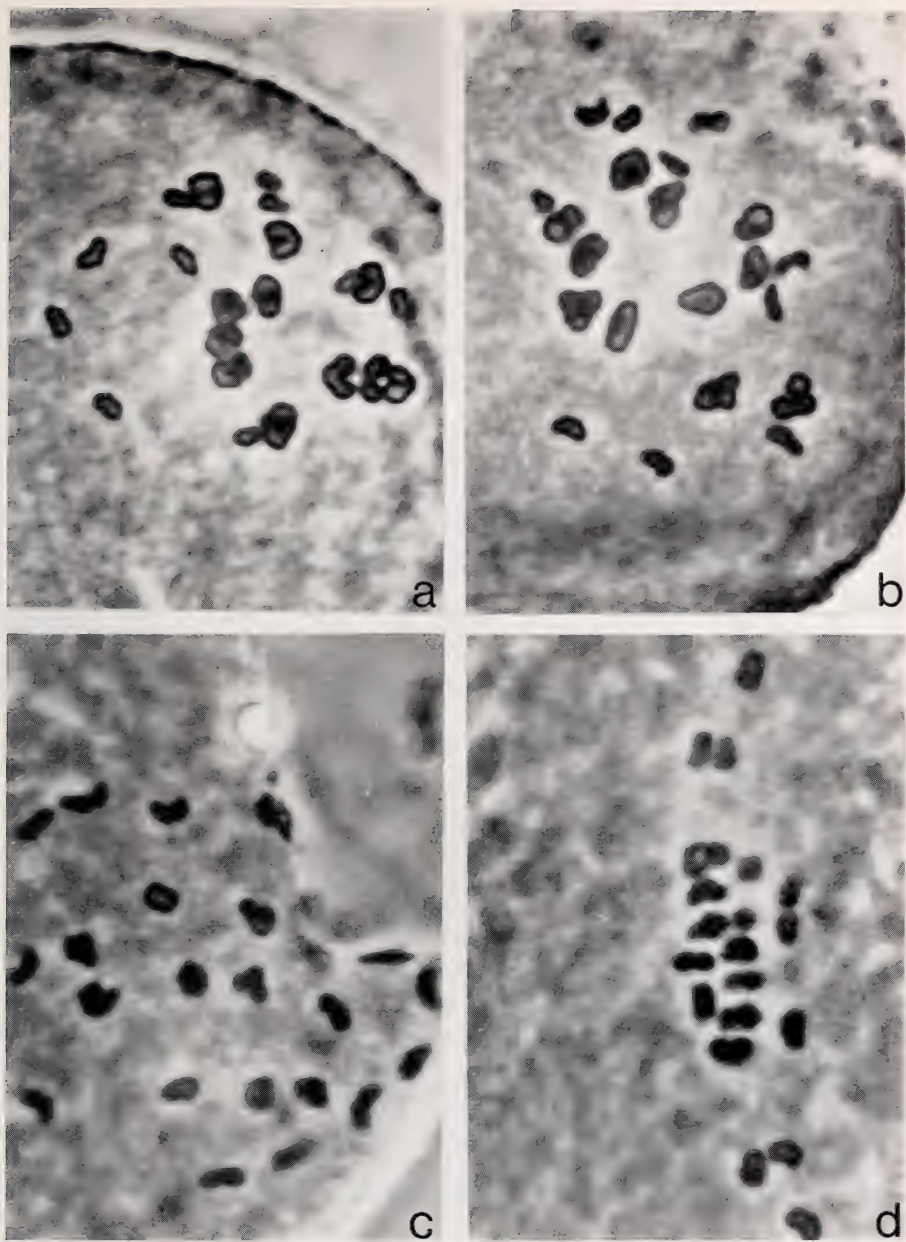


PLATE 1. Meiotic metaphases in *Diplotaxis* hybrids ($\times 3000$). (a & b) *D. muralis* $\times$ *D. tenuifolia*, showing 11 bivalents and 10 univalents. (c & d) *D. muralis* $\times$ *D. viminea*, showing 10 bivalents and 11 univalents.

TABLE 2. COMPARISON OF MORPHOLOGICAL CHARACTERS OF *DIPLOTAXIS MURALIS* AND ITS POSSIBLE DIPLOID PROGENITORS

Character	<i>D. tenuifolia</i>	<i>D. muralis</i>	other diploid parent	<i>D. viminea</i>
1. Life-span	perennial	short-lived perennial	annual?	annual
2. Leaf-position	cauline	mainly radical	radical	very few cauline leaves
3. Leaf-colour	glaucous	green	green	green
4. Petal-length	8-15mm	6-8mm	under 6mm?	3-4mm
5. Siliqua	stipitate	sessile	sessile	sessile
6. Fruiting pedicel	long (= fruit)	short ($\frac{3}{4}$ - $\frac{1}{2}$ length of fruit)	very short	$\frac{1}{4}$ length of fruit
7. Ovules per siliqua	70-100	46-60	c 40?	25-39
8. Outer stamens	normal	sometimes reduced		sterile or very small
9. Apex of valve of siliqua	rounded	sub-emarginate		emarginate
10. Style	moderate width, with a capitate stigma	broad, with large capitate stigma		broad, equalling in width the depressed stigma

D. viminea! Two such collections proved to be *D. muralis* var. *pseudoviminea* Schur, closely approaching *D. viminea* but clearly not of that species, and with the chromosome number $2n = 42$. However, one collection of seed giving rise to very weak plants had received little attention, and on growing a further sample with extra care it proved to be genuine *D. viminea* and to have the chromosome number $2n = 20$ (Harberd 1972).

The cross between *D. muralis* and *D. viminea* was easily produced and several hybrid plants of reasonable vigour were raised to maturity and found to have the expected chromosome number $2n = 31$. If the hypothesis that *D. viminea* is the other diploid ancestor of *D. muralis* is correct then this hybrid should form 10 bivalents and 11 univalents at the meiotic metaphase. Analysis of the hybrid proved to be difficult because in this material the bivalents are not much bigger than the univalents (Plates 1c & 1d) but the difference of shape and the positioning of the univalents in a peripheral sphere around the metaphase plate enabled interpretation in favourable preparations. Analysis of 43 cells gave 10 bivalents and 11 univalents in 42 cells, with 11 bivalents and 9 univalents in the remaining one. As in the earlier hybrid the constancy of the 10 bivalents corresponding to the haploid number of the diploid parent of the hybrid, and the high chiasma frequency per bivalent (though this could only be observed in this case in some of the bivalents) is very strong evidence that *D. viminea* is a diploid ancestor of *D. muralis*.

The interesting difference in size between bivalents and univalents in the two hybrids suggests that in *D. muralis* there are two chromosome sizes, the larger chromosomes being derived from *D. tenuifolia* and the smaller ones from *D. viminea*. If this were so then meiotic preparations of *D. muralis* itself should reveal 11 bivalents of the larger type and 10 of the smaller. In fact the bivalents of that species can be seen to be more variable in size than is common in the Brassicaceae but not clearly bimodal in size distribution. Thus it seems likely that there is a difference in average bivalent size between the two constituent diploids, but that the ranges overlap.

ACKNOWLEDGMENTS

Thanks are due to Professor J. H. Western of this Department for his continued encouragement, to Dr Myra Chu Chou for technical help in the preparation of the hybrid plants, to the Agricultural Research Council for grants enabling both Dr Chu Chou and one of us (E.D.M.) to work on the University of Leeds *Brassica* Research Programme, and to Sigma Xi for grants towards travelling expenses (E.D.M.) from America to Leeds.

REFERENCES

- BAEZ MAYOR, A. B. (1934). Estudio cariológico de algunas crucíferas y su interpretación en la sistemática. *Cavanillesia*, **6**: 59–103.
- CLAPHAM, A. R. (1952). *Diploxys*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, pp. 161–163. Cambridge.
- GADELLA, T. W. J. & KLIPHUIS, E. (1968). Chromosome numbers of flowering plants in the Netherlands, 4. *Proc. ned. Akad. Wet., ser. C*, **71**: 168–183.
- HARBERD, D. J. (1972). A contribution to the cyto-taxonomy of *Brassica* (Cruciferae) and its allies. *Bot. J. Linn. Soc.*, **65**: 1–23.
- IBARRA, F. E. & LA PORTE, J. (1947). Les Crucíferas del género *Diploxys* adventicias en la Argentina. *Revta. argent. Agron.*, **14**: 261–272.

- JARETSKY, R. (1932). Beziehungen zwischen Chromosomenzahl und Systematik bei den Cruciferen. *Jb. wiss. Bot.*, **76**: 485-527.
- LÖVE, A. & LÖVE, D. (1944). Cytotaxonomical studies on boreal plants, 3. Some new chromosome numbers of Scandinavian plants. *Ark. Bot.*, **31A**, 12: 1-22.
- LÜBBERT, G. (1951). Vergleichende cytologische, morphologische und physiologische Untersuchungen innerhalb der Gattung *Diplotaxis*. *Beitr. Biol. Pfl.*, **28**: 254-295.
- MANTON, I. (1932). Introduction to the general cytology of the Cruciferae. *Ann. Bot.*, **46**: 509-556.
- MAUDE, P. F. (1939). The Merton catalogue: a list of chromosome numerals of species of British flowering plants. *New Phytol.*, **38**: 1-31.
- MULLIGAN, G. A. (1959). Chromosome numbers of Canadian weeds. *Can. J. Bot.*, **37**: 81-92.
- SCHULZ, O. E. (1919). Cruciferae—Brassicaceae pars prima. Subtribus I. Brassicinae & II. Raphaninae, in ENGLER, A., ed. *Das Pflanzenreich*, **70** (IV, 105): 1-290.

(Accepted September 1971)



Short Notes

207/9. LATHYRUS PALUSTRIS L.—In Carmarthenshire.

On 29th May, 1971, Mr Stephen Evans (Assistant Regional Officer, Nature Conservancy, S. Wales) and myself, investigating areas of wetland between Kidwelly and Pembrey, found the Marsh Pea (*Lathyrus palustris*) locally abundant over a large area of poor quality fen. Parts of the fen were a pure and very dense *Phragmitetum* but this thinned out in other parts to a mixed community of *Phragmites communis*, *Equisetum fluviatile*, *Myosotis caespitosa*, *Mentha aquatica* and *Iris pseudacorus* with *Scutellaria galericulata* and *Glyceria maxima*, amongst which grew the *Lathyrus*.

It was not at that date in flower but was forward in bud and was, despite the fragility of its winged stems, maintaining itself perfectly upright by its tendrils clasping the horsetails and grasses on either side. It was abundant over a distance of 50 yards or more but full assessment of distribution was difficult owing to the treacherous nature of the swamp. On 26th June it was in full flower, the colour ranging between almost pure pink and almost pure blue through all the gamut of intermediates.

The area was visited for the third time on 29th July, when flowering was over except for two belated blooms. Seed pods were scarce but there had been considerable trampling by cattle which had had access owing to the exceptionally dry summer. These extensive wetlands lie below the rising ground of the coal measures from which small canals, now largely closed or choked, carried coal to the small coastal ports now also in decay.

Lathyrus palustris has not been recorded in Wales for many years; its Merioneth station is now believed extinct and for the Caernarvon record there is no voucher specimen in NMW.

In this new locality the farmer-owner of the land has promised cooperation in conserving the habitat.

I. M. VAUGHAN

A specimen collected in v.c. 49, Caernarvon, from a swampy field between Llandudno and Gloddaeth on 20th July, 1837, by J. E. Bowman is at LIV.

EDITOR

212/15. POTENTILLA REPTANS L.—Identification of its hybrids.

Vigorous natural hybrids with an obvious resemblance to *Potentilla reptans* are common. The species and hybrids occur in similar habitats, often on roadsides, and occasionally are found growing intermingled with one another. The hybrids are distinguished from *P. reptans* most easily by the number of leaflets and floral parts: *P. reptans* has 5-merous flowers and 5(-7)-nate leaves, whilst the hybrids have both 4- and 5-merous flowers and 3-, 4- and 5-nate cauline leaves. Some descriptions of *P. reptans* (e.g. Warburg 1962) state that its cauline leaves may have 3-4 leaflets. This is probably the result of confusion between the species and hybrids, since 3- and 4-nate leaves are extremely rare in *P. reptans*. The hybrids are variable, particularly in the relative proportions of 3-, 4- and 5-nate leaves and in overall size, but all are highly sterile and spread by means of runners. An earlier paper (Matfield, Jones & Ellis 1970) gave a full description of them and concluded that they are all hexaploids ($2n = 42$) and should be identified as *P. × mixta* Nolte. Their origin is uncertain. They may arise either by hybridization between *P. reptans* ($2n = 28$) and *P. anglica* ($2n = 56$) or by hybridization between *P. reptans* and *P. erecta* ($2n = 28$) with *P. reptans* contributing an unreduced gamete. Hexaploid hybrids have been made experi-

mentally by both of these routes and they seem to be identical with each other and with natural specimens.

The previous paper reported that no viable tetraploid hybrids between *P. reptans* and *P. erecta* had been produced, although many crosses had been made between plants from a variety of different British sources. Natural tetraploid hybrids were unknown, and were thought to be rare or even non-existent. However, Schwendener (1969) obtained three tetraploid hybrids from crosses between Swiss specimens of *P. reptans* and *P. erecta*. Unfortunately he did not publish full morphological descriptions. In 1969 the present author made four more cross pollinations using as the female parent a clone of *P. reptans* collected by Professor D. H. Valentine in County Durham. This plant had already been a successful seed parent in the normally highly incompatible cross between *P. reptans* and *P. anglica* (Valentine *pers. comm.*). Two seedlings were obtained from the *P. reptans* $\times$ *P. erecta* crosses but one died within a few weeks. The other formed only a rosette of basal leaves in its first year, and would probably not have survived in a natural habitat. In 1971 flowering stems were produced, one of which is illustrated in Fig. 1.

The plant was very small, with the largest leaflets only about 1 cm long. Its description is as follows:

Flowering stems to 8 cm, procumbent near the base, ascending at the tip, more frequently branched than in *P. reptans*, not rooting. Radical leaves petiolate with petioles about 1–2 cm, mostly palmate with 5 leaflets, the remainder 3- or 4-nate. Cauline leaves on shorter petioles or subsessile, mostly ternate but some of the lower ones 4- or 5-nate; leaflets obovate or oblong-obovate with 1–4 teeth each



FIGURE 1. The experimental tetraploid hybrid between *P. reptans* and *P. erecta*. A. Flowering stem. B. Radical leaf.

side in the upper part; stipules entire, bifid or trifid. Flowers 4- or 5-merous, 13-15 mm diameter; carpels c 25; highly male and female sterile. The average pollen stainability was 12% and only one seed was set by a total of 8 flowers after open pollination. $2n = 28$.

As only one specimen has been obtained, the range of morphology in the tetraploid hybrid is unknown. However, Schwendener (1969) stated that his three hybrids did not differ from each other substantially. The difference between the tetraploid hybrid described above and the hexaploid, $P. \times mixta$, is striking so that separation of the two taxa should be possible without a chromosome count. The discovery of natural tetraploid hybrids would be very significant but the weakness of the experimental hybrid confirms the opinion that they are rare or even non-existent, at least in the British Isles.

There is a second fairly common natural hexaploid hybrid, $P. \times suberecta$ Zimm. ($= P. erecta \times P. anglica$) (Matfield, Jones & Ellis 1970). This is distinguished from the $P. reptans$ hybrids by its more erect habit and general resemblance to $P. erecta$. As it does not normally root at the nodes it cannot spread vegetatively. Hence it is always found in association with the parental species, which makes it relatively easy to identify.

REFERENCES

- MATFIELD, B., JONES, J. K. & ELLIS, J. R. (1970). Natural and experimental hybridization in *Potentilla*. *New Phytol.*, **69**: 171-186.
 SCHWENDENER, J. (1969). Experimente zur Evolution von *Potentilla procumbens* Sibth. *Ber. schweiz. bot. Ges.*, **79**: 49-92.
 WARBURG, E. F. (1962). *Potentilla*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 380-389. Cambridge.

B. MATFIELD

220/1. *ALCHEMILLA ALPINA* L.—In Derbyshire.

On 7th August, 1971, I found a single plant of this species in Derbyshire (v.c. 57). The plant was growing on debris from a long-disused lead working in the south-east fork of Coombs Dale at an altitude of 750 ft. The plant had an unhealthy appearance, which is not surprising as the heaps are fairly toxic. The leaves were pale and yellow and only the younger, newly-expanded leaves looked healthy. There was no evidence that the plant had flowered that year. A small portion of the plant was collected and sent to Dr M. E. Bradshaw at Durham for confirmation.

The plant is well established in a *Festuca ovina* turf with *Agrostis tenuis*, *Anthoxanthum odoratum*, *Carex caryophyllea*, *Cerastium holosteoides*, *Linum catharticum*, *Minuartia verna*, *Teucrium scorodonia* (seedling) and *Thymus drucei* as its immediate associates. There are large areas of bare soil nearby on the slope, which has an angle of 30° and faces north-east.

This is the first record for v.c. 57 and represents a considerable extension of the range of species, as it has not previously been recorded (even as an introduction) in Britain south of the Lake District (Perring & Walters 1962). Some of the Carboniferous Limestone cliffs and outcrops in the immediate vicinity of the site have been checked as possible refugia for a colony, but no further plants have been found. There is the possibility that the plant may have arrived at its present site in Coombs Dale as a direct result of human agency. If this is not the case then the occurrence of this plant at the southern end of the Pennines on a lead mine spoil heap is all the more interesting. Warburg, in Clapham, Tutin & Warburg (1962), notes that the species occurs in mountain grassland, rock crevices, screes and mountain tops ascending to 4,000 ft in the Cairngorms and descending to sea level in Skye.

REFERENCES

- CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. (1962). *Flora of the British Isles*, 2nd ed., p. 396. Cambridge.
 PERRING, F. H. & WALTERS, S. M., eds. (1962). *Atlas of the British Flora*. London.

S. R. BAND

237/2. *CRASSULA AQUATICA* (L.) Schönk. IN v.c. 97—Further observations.

The small area of mud where *Crassula aquatica* was originally found in 1969 (*Watsonia*, 8: 294 (1971)) was revisited in 1970 and twice in 1971.

In 1970 the site had been badly trampled by cattle and was also submerged. No plants were seen. In August 1971, though the area was exposed, it was still badly disturbed and had only a very few scattered plants of *Crassula*. Similar, but less disturbed, muddy areas, about 250m from the original, were inspected and the plant, in seed, found to be well represented there.

The opportunity was taken to make the following list of accompanying plants:

<i>Ranunculus flammula</i>	<i>Alisma plantago-aquatica</i>
<i>Subularia aquatica</i>	<i>Juncus bulbosus</i>
<i>Callitriche hermaphroditica</i>	<i>Eleocharis palustris</i>
<i>Littorella uniflora</i>	<i>Glyceria fluitans</i>
<i>Lobelia dortmanna</i>	

A further visit to these new areas a fortnight later found them under about 30cm of water and so thick with a green algal growth that no plants of any species were visible.

It is apparent that, whatever its previous history, the 1969 growth, though above average in quantity, was not an ephemeral introduction and the plant is reasonably securely established. Also, from this admittedly limited experience, the sites are probably as frequently flooded as not.

A further question suggests itself. Does *Crassula aquatica* require a dry season in north-west Scotland or can it, like some other small annuals, complete its life-cycle completely submerged?

A. J. SOWTER, M. M. SOWTER & M. MCC. WEBSTER

254. NEW ZEALAND *EPILOBIUMS* IN BRITAIN.

Three species of small creeping pinkish-white-flowered willow-herbs which are fairly widespread in New Zealand, one in two forms, are known to be naturalised in Britain. Specimens of all four, both fresh and pressed, were on show at the Exhibition Meeting in November 1970.

E. brunnescens (Cockayne) Raven & Engelnhorn subsp. *brunnescens* (Earlier misidentified as *E. nummularifolium*, *E. pedunculare* and *E. nerteroides*.)

This is by far the commonest. Its first record is as a garden weed at Craigmillar Park, south of Edinburgh, where it had been known for some years in 1908 (note on specimen at BIRM). It was also known in the same year at Elmet Park, Roundhay, Leeds, where it was said to have been introduced with shrubby New Zealand Veronicas to the wild garden and had then been perfectly naturalised for many years. Other, later, records were set out by Davey (1953, 1961). Since then the plant has continued to spread rapidly and is now, for example, locally frequent among otherwise purely native vegetation high on many mountains. It reached the Channel Islands (Guernsey) in 1969, apparently with some heathers.

A form with generally smaller and much narrower leaves has been growing in my garden at Platt, Kent, for at least 14 years. Specimens were previously exhibited in 1957 (McClintock 1958). Two sheets of this now at BM were at one time labelled *E. inornatum*, which they are not. Since then I have usually been able to find plants of this form in two or three places in the garden, always uniform, and no longer as differing shoots on normal plants. No doubt they have propagated themselves vegetatively, as so far no seeds have been successfully harvested. Dr D. B. O. Savile of the Plant Research Institute, Ottawa, thinks this form is a teratological condition and is "tempted to believe" it may be due to a virus infection, adding that a plant growing in an unnatural environment may come in contact with unfamiliar virus vectors, occasionally with surprising results. Dr P. H. Raven agrees this is a plausible explanation, and I am grateful to both of them for the trouble they have taken over this.

Raven & Engelhorn (1971) say that this species differs from *E. nerteroides* (of which they ask me to note the correct spelling) in having leaves broadly to very broadly ovate (instead of broadly elliptic to ovate) and petioles 0.5–3 mm (and not 1–6 mm) long. In addition the stems of *E. nerteroides* are glabrous or nearly so, while those of *E. brunnescens* have evident lines of strigulose pubescence. The flowers tend to be erect rather than nodding. They say that true *E. nerteroides* is a rarer plant than *E. brunnescens* in New Zealand.

E. pedunculare A. Cunn. (Called at first *E. linnaeoides*.)

The first record of this species was from a garden at Helsby, Cheshire in 1938 (Gordon 1954a, Newton 1971). It was also collected in the same year from a garden in Co. Dublin by Miss Enoch (DBN and E, where there is another specimen from Miss O'Leary collected in August 1938). In 1953 it was found, by Miss V. Gordon, by the road to the west, a mile from Leenane, Co. Galway (Gordon 1954b). Later it was discovered much more plentifully at Aasleigh, a mile or two north of Leenane, just in Co. Mayo, where it grows with *E. brunnescens*. Its origin in that relatively remote district is not known, but '*E. linnaeoides*' is among rockery plants in Reuthe's nursery catalogue for 1930. The plant may also be seen as a mild weed in the rock garden in the Edinburgh Botanic Garden. In my own garden, where it has now been for 10 or 15 years (with a third of the rainfall of Leenane), it is no weed, but just maintains itself, in contrast to the spreading *E. brunnescens*. Incidentally, I have not yet noticed any apparent hybrid between any of the three species there. The record from Mrs Gregory in Newton (1971) is an error. This plant was named as this species from the first edition of the *Flora of the British Isles* (Clapham 1952) when *E. pedunculare* was the name used for *E. brunnescens*, in which error surely lies a moral.

E. komarovianum Léveillé

This is better known, in so far as it is known at all, as *E. inornatum* Melville. This Latin name was published by Melville (1960) and used for a plant from a gathering by E. N. Carrothers (K) (Melville 1962) from Lisburn in Northern Ireland in 1941. The wall on which this grew, so Mr Carrothers told me, was demolished some years ago and he himself was unaware of the fact that the plant had been given this name. I have seen it growing elsewhere in Northern Ireland, at Mount Stewart, Co. Down (v.c. H38), and have also seen it at Dartington Hall, South Devon (v.c. 3) and Ashbourne, Derbyshire (v.c. 57) (specimen in K), where it has been known for over 60 years. It was also on the Ladmanlow tip at Buxton for a few years. Both these occurrences appear in the recent *Flora of Derbyshire* (Clapham 1969) under *E. nerteroides*. It has also been sent me from Lanark (v.c. 77). It could easily be overlooked for the common species, but its rather smaller size, its more closely creeping habit, rooting at the nodes, its bronzed, prominently veined leaves, which are nearly always green beneath, and its almost entirely smooth seeds are distinctive characters. It is the only one of these three species in the Netherlands.

KEY

Based on leaf colour as observed in Britain.

1. Leaves (2.5-)6(-14) × (2.5-)8(-15) mm, serrate, rich purple with veins showing prominently beneath *E. pedunculare*
1. Leaves usually smaller, sub-entire or at most sinuate, not or less purple beneath
 2. Leaves thin, green or bronzey and smooth above, usually suffusing purplish with veins showing faintly beneath. Seeds papillose, 7.5-9.0 mm
 3. Leaves (4-)5(-12) × (3-)4(-12) mm, broadly ovate . . . *E. brunnescens*
 3. Leaves (4.5-) 5.0 × 2.0-3.0 mm, often elliptic . . . *E. brunnescens* var.
 2. Leaves (2-)5(-12) × (1.5-)3(-9) mm, thick, bronzey brown and rugose with prominent veins above, mostly green and veins not showing beneath. Seeds smooth, 5-9 mm *E. komarovianum*

Also exhibited was the taller, decumbent *E. pictum* Petrie. This is grown in some gardens for its undoubtedly pretty marbled grey leaves, purple beneath, but it easily spreads over-exuberantly and may one day be numbered among our garden weeds. The similar, more branched, longer-peduncled *E. alsinoides* Petrie has also been recorded as a garden weed, but the specimens are all *E. pictum*, Dr Raven tells me. It is endemic to the South Island of New Zealand.

I am grateful to Dr P. H. Raven for comments on this note, in which they are incorporated.

REFERENCES

- CLAPHAM, A. R., ed. (1969). *Flora of Derbyshire*, p. 209. Derby.
- CLAPHAM, A. R. (1952). *Epilobium* in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, p. 607. Cambridge.
- DAVEY, A. J. (1953). *Epilobium pedunculare* in Britain, in LOUSLEY, J. E., ed. *The Changing Flora of Britain*, pp. 164-167. Arbroath.
- DAVEY, A. J. (1961). *Epilobium nerterioides*, in Biological Flora of the British Isles. *J. Ecol.*, **49**: 753-759.
- GORDON, V. (1954a). *Epilobium linnaeoides*. *Proc. bot. Soc. Br. Isl.*, **1**: 37.
- GORDON, V. (1954b). *Epilobium linnaeoides* in Britain. *Proc. bot. Soc. Br. Isl.*, **1**: 93.
- MCCLINTOCK, D. (1958). A narrow-leaved form of *Epilobium pedunculare*. *Proc. bot. Soc. Br. Isl.*, **3**: 95.
- MELVILLE, R. (1960). *Epilobium pedunculare* and its allies. *Kew Bull.*, **14**: 296-300.
- MELVILLE, R. (1962). Some New Zealand Epilobia in Britain. *Kew Bull.*, **15**: 477.
- NEWTON, A. (1971). *Flora of Cheshire*, p. 112. Chester.
- RAVEN, P. H. & ENGELHORN, T. (1971). New taxa and new combinations in Australasian *Epilobium* (Onagraceae). *N.Z. J. Bot.*, **9**: 345-350.

D. MCCLINTOCK

667/l. MOLINIA LITORALIS Host.

Duplicate material of a giant variant of *M. caerulea* (L.) Moench, collected from Marham Fen, West Norfolk, in 1944, and given to Kew, is referred to this species by H. J. Conert (*Die Systematik und Anatomie der Arundineae*, Weinheim, p. 181 (1961)). In giving me this information, Dr Hubbard has kindly provided further particulars: 'Conert maintains this type as a distinct species, *M. litoralis* Host, from *M. caerulea*, distinguishing it by its taller growth (1.2-1.6m), except for *M. caerulea* var. *arundinacea*, and larger panicles (30-50cm), larger lowest lemmas (4.5-6.0mm long), the lemmas of *M. caerulea* being 3-4mm long. I have looked at your specimen; the panicle is 44cm long but the lowest lemma in each spikelet is only 4.0-4.5mm long'.

In addition to Norfolk, Conert records this species from Radnor, Berkshire, Oxfordshire, Essex, Surrey, Cornwall and Bedfordshire, 'all in the south and fitting in with a southern general distribution.' In his study Conert noted the following varieties of *M. caerulea* in West Norfolk: var. *caerulea*, var. *obtusae* (Peterm.) Aschers.

& Graebn., var. *arundinacea* (Schrank) Aschers., and var. *robusta* Prah1, all from Dersingham Common.

As *M. caerulea* is self-sterile Hubbard suspects that much of the variability in the southern half of Britain is due to past hybridisation, perhaps between a northern strain with a spicate panicle (true *M. caerulea*), and a southern variant, such as *M. litoralis* Host, with lax inflorescences and larger lemmas. Until it is proved to be cytologically distinct, Hubbard prefers to treat Conert's plant as var. *litoralis* (Host) Griseb.; it could also be called subsp. *litoralis* (Host) Paul.

E. L. SWANN

690/1. *GAUDINIA FRAGILIS* (L.) Beauv.

Gaudinia is basically a Mediterranean grass. Its status in the British Isles and just across the English Channel has been generally regarded as that of a fleeting adventive. Hegi (1935) and Fournier (1946) say it may come in with foreign seed, which it certainly has done in Germany, and Mullenders (1967) says it is introduced and inconstant in Belgium. But there are signs of permanence: introductions, it seems, can persist. In at least three areas, discussed below, it has done so for several years.

ISLE OF WIGHT

There is no mention of this species in any Island list until 1917 when it was collected by the late Mr J. W. Long. Mr B. Shepard comments to me (*in litt.*) 'that it may be significant that this first record was during the first world war, when there was considerable movement of men and material between here and the Middle East'. He goes on 'It is not conceivable that it existed in anything like its present abundance at that time and was overlooked by earlier recorders'.

He and Mr J. H. Bevis have concentrated their searches on the heavy clay area of the north-west, although it seems to be equally well established in the Haven Street/Ryde area. But with the exception of Miss Bullock's record from Brighthstone in 1966 all relate to the heavy clay on the north of the chalk ridge, and suggest that *Gaudinia* is widespread and very well established across that section of the island. One area from which I was sent specimens was a 16-acre field that had not been ploughed since the present farmer's family took over the farm in 1919. Here the *Gaudinia* is not merely present each year, but dominant in some parts. This and other meadows are mown regularly for hay towards the end of June. Another similar field is strip-grazed but contains an equal abundance of *Gaudinia*.

Miss G. Bullock has also kindly shared her notes with me. *Gaudinia* was amongst a collection of grasses she sent to Mr Long as long ago as 1937 from Haven Street, a meadow of 8-10 acres which contained quite as much *Gaudinia* as any other grass. She says it was also plentiful in a meadow on the other side of the village. Fr Higgins has also sent me his notes. Mrs Yule, the Recorder for the Hampshire Flora, in sending me some details says that the species is apparently still spreading. Thus it seems there is a continuous record of this species in the north of the Isle of Wight for over 50 years.

CHANNEL ISLANDS

Gaudinia was found in great quantity by the Grande Mare in Guernsey in 1928. Nobody saw it there again until 1970, and in 1971 it was found to be well established in a meadow in a closed community. A patch some 15 yards across of the species was found in 1970 in short, native, sandy turf near the Doyle Rock on L'Ancrese Common, nearly five miles to the north-east. Here the plants are small, mostly about 6 in high, and thus very easily passed by. It would be surprising if this grass had not been here for some considerable time, in an area moreover where no grass mixture would have been sown and no other possible introductions are to be seen.

All attempts to re-find *Gaudinia* in its original area in Alderney have failed, but it

has been seen annually since 1963 near the States Dairy despite rubble being dumped on it and other human interferences. It looked well established in 1963 and plants from there, and their seedlings, have all proved to be perennial when grown in a garden (McClintock 1967). The grass was also collected in sandy ground in Jersey in 1954, but was not to be seen in the following, or subsequent, years.

IRELAND

None of the three stations in Co. Limerick, so Dr A. M. O'Sullivan tells me, has been recently re-seeded, and two were very old pastures. He presumed the grass was perennial, in contradiction to what all books and even his paper (O'Sullivan & White 1967) say. Farragher (1968) found it by a relatively new ley, where it persisted, and suggests it was introduced in 'recent' years, perhaps as an impurity in some grass seed. Miss Scannell sent me a copy of a letter dated 2nd October, 1967, from Mr J. Mullin, of the Irish seed-testing station, who had reports of it from other counties, e.g. Wexford, and expected it to be much more widespread. He recorded that in the early 1960s some inferior rye grass seed had been 'dumped' from Portugal with such weeds as *Gaudinia* and *Chrysanthemum myconis*. The trade was stopped, but started again for a short while in Dutch bags via Holland.

Is this not very obvious grass being overlooked elsewhere? It deserves more than the curt three lines granted it by both Hubbard (1968) and Tutin (1962). The Appendix evidences its recorded history in the British Isles.

REFERENCES

- BOOTH, E. M. (1967). *Gaudinia fragilis* in Co. Clare. *Ir. Nat. J.*, **15**: 331.
 FARRAGHER, M. A. (1968). *Gaudinia fragilis* in another station. *Ir. Nat. J.*, **16**: 53.
 FOURNIER, P. (1946). *Les Quatre Flores de la France*, 2nd ed., p. 60. Paris.
 HEGI, G. (1935). *Illustrierte Flora von Mittel-Europa*, 2nd ed., **1**: 353-354. Munich.
 HUBBARD, C. E. (1968). *Grasses*, 2nd ed., p. 247. Harmondsworth.
 MCCLINTOCK, D. (1967). *Gaudinia fragilis*. *Proc. bot. Soc. Br. Isl.*, **6**: 391.
 MULLENDERS, W. (1967). *Flore de la Belgique, du nord de la France et des regions voisines*, p. 597. Liège.
 O'SULLIVAN, A. M. & WHITE, J. (1967). *Gaudinia fragilis* in Limerick grassland. *Ir. Nat. J.*, **15**: 343-345.
 SCANNELL, M. J. P. (1964). *Gaudinia fragilis* in Ireland. *Ir. Nat. J.*, **14**: 215-216.
 TUTIN, T. G. (1962). *Gaudinia*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., p. 1162. Cambridge.
 WEBSTER, M. McC. (1951). *Gaudinia fragilis*. *Watsonia*, **2**: 59.

APPENDIX

OCCURRENCES IN THE BRITISH ISLES OF *GAUDINIA FRAGILIS* (L.) Beauv.

Date	Vice-county	Details
June 1903	17 (Surrey)	New Reservoir works towards Molesey. A. H. Wolley Dod (BM).
27 June 1906	41 (Glamorgan)	On the shore near Barry (near Porthkey). H. J. Riddlesdell (NMW). "New to Britain". "Apparently far away from all possibility of introduction" (BM). <i>Rep. botl Soc. Exch. Club Br. Isl.</i> , 2 : 251.
3 July 1906	?	"Dr. Pettybridge, Ringsend. Comm. Miss M. Knowles" (K).
2 Aug. 1912	74 (Wigtown)	The shore, Stranraer, James Fraser. (Herb. Lousley.)
1914	2 (E. Cornwall)	"Charlestown, near St Austell's (sic), Cornwall E., W. Tressider ex C.C. Vigurs, vide sp." <i>Rep. botl Soc. Exch. Club Br. Isl.</i> , 3 : 397.

10 July 1917	10 (Isle of Wight)	Abundant in a meadow near Ryde, J. W. Long (BM, K, NMW). Still there 1931. <i>Rep. botl Soc. Exch. Club Br. Isl.</i> , 9 : 760; 11 : 415-416.
23 June 1926	41	Waste ground, Splott, Cardiff. A. E. Wade (NMW).
8 June 1928	0 (Channel Isles)	In great quantity in part of the Grande Mare, Guernsey (also described as meadow south of the Grande Mare). A. J. Wilmott and I. A. Williams (STP).
June 1928	34 (W. Gloucester)	Avonmouth Docks. C. I. Sandwith (K). The following two 1928 records may refer to the same place: Bristol, N. Somerset, N. Y. Sandwith. <i>Rep. botl Soc. Exch. Club Br. Isl.</i> , 8 : 766. Waste ground, Bedminster, C. I. Sandwith. <i>Ibid.</i> , 10 : 361.
28 May 1933	0	In some quantity in a grassy cutting in a field near Whitegates, Alderney, associated with <i>Lolium</i> (K). <i>J. Bot., Lond.</i> , 75 : 300. Apparently well established—but considered also an adventive. There is another sheet of the same date labelled "Bottom of a small dis-used quarry in a grassy cutting in abundance, with <i>Lolium</i> " (K). In some quantity near Whitegates in a kind of cutting or sunken track not far from Coastguard houses, Alderney. A. B. Jackson (K).
30 May 1933	0	Old quarry near Mauney, Alderney. A. B. Jackson (BM).
June 1936	10	Most remote part of the island. J. W. Long (K). <i>Rep. botl Soc. Exch. Club Br. Isl.</i> , 11 : 416.
1937	10	Meadow, Haven Street. Miss G. Bullock. "As much <i>Gaudinia</i> as any other grass".
27 May 1938	10	Haven Street, in a meadow, plentiful. J. W. Long (K).
June 1938	10	An abundant grass in old pasture, Haven Street. J. W. Long (K, NMW).
?	10	By Newtown River. J. W. Long.
pre-1940	1 (W. Cornwall)	Refuse heaps, Truro. W. Borlase (K).
Sept. 1942	44 (Carmarthen)	Fairly abundant in wettish hay meadow. F. E. Williams (K).
1949	4 (N. Devon)	Rough ground round small pond near the sea, Fremington, a small patch. Miss M. McC. Webster. <i>Watsonia</i> , 2 : 59.
1950	10	Quarr Abbey, N. Wootton. Fr J. Higgens. Still there 1971.
1951	10	Binstead. Miss G. Bullock. Still there 1971.
1951	10	Firestone Copse, S. Wootton Creek. A. W. Westrup. Still there 1971.
Aug. 1951	7 (N. Wilts)	Waste ground. Sandridge Hill. J. D. Grose (K).
29 June 1954	0	Pont Marquet, Jersey. Mrs F. le Sueur, Miss K. Rob and D. McClintock (JSY).
5 May 1957	7	Carrot field, Sandridge, near Melksham. Miss M. McC. Webster (BM).
14 May 1957	7	As above, in allotments (BM, K).
2 July 1960	14 (E. Sussex)	Roadside, Camp Hill, Ashdown Forest. D. W. Parry (K).
Sept. 1962	10	Good colony in small gravel pit at Quarr, near Binstead. A. W. Westrup (K).
1962	10	Gravel pit between Fishbourne and Puckhouse. Fr J. Higgens. Gone 1963 with removal of gravel.
Sept. 1962	10	Newnham Lane near Brickfields, Binstead, a mile distant; also Firestone Road, Haven Street. Miss G. Bullock (cf K).

5 June 1963	0	States Dairy, Alderney (persisting), D. McClintock. <i>Proc. bot. Soc. Br. Isl.</i> , 6 : 391.
17 July 1963	H3 (W. Cork)	Toomore, W. of Schull. Miss M. Scannell and J. E. O'Donovan (DBN, K). <i>Ir. Nat. J.</i> , 14 : 215. There also in 1964 and succeeding years.
15 July 1965	H8 (Limerick)	Intensively farmed pasture, Newboro', Patrickswell, seven miles S.W. of Limerick. Dr A. M. O'Sullivan and J. White (DBN). <i>Ibid.</i> , 15 : 343.
15 July 1965	H8	Two miles S. of Croom. Dr A. M. O'Sullivan and J. White. <i>Ibid.</i> , 15 : 343.
15 July 1965	H8	Newcastle West. Dr A. M. O'Sullivan and J. White. <i>Ibid.</i> , 15 : 344.
?	H4 (Mid Cork)	Lombardstown, W. of Mallow, edge of new ley. M. A. Farragher. <i>Ibid.</i> , 16 : 53. First noted about three years earlier in a new ley.
1966	10	Bank opposite Honnyhill Farm, Brighstone. Miss G. Bullock. Still there 1971.
?	10	Near Parkhurst Prison. Comm. Mrs Yule.
15 July 1966	H9 (Clare)	Roadside at 300 ft one mile east of Eagle's Rock, S. of Slievecarran Mountain and four miles S.W. of Kinvarra. Miss E. M. Booth (DBN). <i>Ir. Nat. J.</i> , 15 : 331.
1967	0	Roadside, Bray, Alderney.
29 June 1968	10	Thorness Bay, in considerable quantity – a field of it. J. H. Bevis and B. Shepard.
1969	10	Near Haven Street. Br G. Corcoran.
2 June 1970	0	Near the Grande Mare, Guernsey. Dr P. Macpherson <i>et alia</i> .
June 1970	?	New Forestry Commission plantation, near Crewkerne, along a freshly made-up ride. J. G. Keylock (K).
7 June 1970	0	Near Doyle Rock, L'Ancrese, Guernsey. Mrs P. Garratt.
June 1971	10	Ride in Parkhurst Forest. J. H. Bevis and B. Shepard.
June 1971	10	Grassy bank surrounding field, Werrar Farm, W. bank of River Medina. B. Shepard.
15 July 1971	10	Mersley Down, near Haven Street, very considerable quantity. J. H. Bevis, B. Shepard and Fr J. Higgins.
July 1971	10	Approach to Whittingham Crematorium. B. Shepard.

D. MCCLINTOCK

THE FLORA OF S.S. GREAT BRITAIN

On 19 July, 1970, after over 80 years in the Falkland Islands, S.S. *Great Britain* returned for restoration to the dry dock in Bristol from which she was launched in 1843 (Gregor 1971). The journey from the Falklands had taken three months.

A brief inspection of the ship's flora was made in May, 1971, in company with Dr D. H. Brown, and with the kind permission of Capt. J. R. Blake, R.N., of the *Great Britain* Project. On the decks and on the timbers beneath the ship's rail scattered vegetation was found growing in a 'soil' composed largely of decayed wood fragments, rust scales and coal dust. The 12 species of vascular plants found are listed below.

SPECIES OCCURRING IN THE BRITISH ISLES BUT NOT IN THE FALKLAND ISLANDS

Chamaenerion angustifolium (L.) Scop.

Deschampsia cespitosa (L.) Beauv.

Epilobium adenocaulon Hausskn.

E. parviflorum Schreb.

Pteridium aquilinum (L.) Kuhn

SPECIES OCCURRING BOTH IN THE BRITISH ISLES AND IN THE FALKLAND ISLANDS

Aira praecox L.
Holcus lanatus L.
Hypochoeris radicata L.
Poa annua L.
Scirpus cernuus Vahl

SPECIES OCCURRING IN THE FALKLAND ISLANDS BUT NOT IN THE BRITISH ISLES

Colobanthus quitensis (Kunth) Bartl. (Caryophyllaceae)
Empetrum rubrum Vahl

The most abundant species was *Poa annua*, occurring in two forms: one hummock-forming with short shoots and inflorescences; the other laxer and less branched. These differences persisted when the plants were grown in pots in a greenhouse, although each sort grew taller. *Poa annua* is naturalised on the Falklands, where it is common (Moore 1968). It is possible that the hummock-forming plants were derived from seed of a Falkland ecotype, but the other form was indistinguishable from British weedy *P. annua*.

Small plants of *Scirpus cernuus* were growing on the deck, together with larger, dead specimens. This species is not frequent around Bristol; on the other hand it is abundant in the Falklands (Moore 1968). The young plants had probably grown from seed shed in the Falklands, and the larger clumps may have been killed during the journey from there. Seeds of *Aira praecox*, *Holcus lanatus* and *Hypochoeris radicata* could have reached S.S. *Great Britain* when in dry dock at Bristol or when undergoing temporary repairs at Avonmouth.

A few plants of *Empetrum rubrum* were observed alongside the ship's rail. Some specimens were much-branched with stems that were thick at the base, and were evidently more than a year old. These individuals must have been established while the *Great Britain* was in Stanley Cove in the Falklands and have survived the passage to Bristol. The older plants were in poor condition by May, 1971, and an attempt to transplant one failed, probably due to the difficulty of disengaging its roots from the corroded base of a rail post. Some seedlings were successfully transplanted.

Young plants of *Colobanthus quitensis* were found in several places on the deck but none was likely to have been more than a year old, so that the species probably crossed the Equator as dormant seed. I am told by Dr D. M. Moore that *C. quitensis* grows abundantly in Stanley Cove. It and *Deschampsia antarctica* Desv. are the only two species of vascular plants native to the Antarctic continent, from which they have been recorded as far south as 68° 12'. *C. quitensis sensu lato* ranges widely among the islands of the sub-Antarctic and extends up the Andes into Mexico. Transplanted seedlings have grown rapidly in a greenhouse, flowering and setting seed in June and again in September. This behaviour is in accordance with the findings of Hultum & Greene (1967), who grew plants in a phytotron from seed gathered in South Georgia, and found that flowering was more frequent under regimes of fluctuating rather than stable temperatures, and that under these conditions there were two peaks of flowering about three months apart.

REFERENCES

- GREGOR, H. (1971). *The S.S. Great Britain*. London.
HOLTUM, A. & GREENE, S. W. (1967). The growth and reproduction of Antarctic flowering plants. *Phil. Trans. R. Soc., Ser. B*, 252: 323-337.
MOORE, D. M. (1968). The Vascular Flora of the Falkland Islands. *Brit. Antarct. Surv. Sci. Rep.*, 60: 1-202.

M. C. SMITH

Plant Records

Records for publication must be submitted in the form shown below to the appropriate vice-county Recorder (*Watsonia*, 8: 435-447 (1971)), and *not* to the Editors.

Records are arranged in the order given in the *List of British Vascular Plants* by J. E. Dandy (1958) and in his subsequent revision (*Watsonia*, 7: 157-178 (1969)). With the exception of collectors' initials, herbarium abbreviations are those used in *British Herbaria* by D. H. Kent (1958).

The following signs are used:

* before the record: to indicate a new vice-county record.

† before the species number: to indicate that the plant is not a native species of the British Isles.

‡ before the record: to indicate a species which, though native in some parts of the British Isles, is not so in the locality recorded.

[] enclosing a previously published record: to indicate that the record should be deleted.

1/1. LYCOPODIUM SELAGO L. 74, Wigtown: Craigarie Fell, GR 25/23.73. Rock-ledge, on hill top at 1000ft. H. Milne-Redhead, 1971, field record. 1st post-1930 record.

1/3. LYCOPODIUM ANNOTINUM L. 99, Dunbarton: Ben Vorlich, GR 27/29.12. Rock-ledge, 2500ft. A. McG. Stirling, 1968, field record. 1st record for c 100 years.

1/5. LYCOPODIUM ALPINUM L. 79, Selkirk: Capel Fell, Ettrick, GR 36/16.07. Mountain pasture on north-east side, 2050ft. R. W. M. Corner, 1971, herb. R.W.M.C. 1st post-1930 record.

2/1. SELAGINELLA SELAGINOIDES (L.) Link 74, Wigtown: Culvennan Fell, GR 25/30.64. Damp basic flush, 550ft. H. Milne-Redhead, 1971, field record. 1st post-1930 record.

4/1. EUISETUM HYEMALE L. 99, Dunbarton: Murroch Glen, Dumbarton, GR 26/41.78. Steep, waterlogged stream bank. J. Mitchell, 1969, field record. 2nd record.

4/4. EUISETUM VARIEGATUM Schleich. ex Weber & Mohr *72, Dumfries: Penton Linns, GR 35/43.77. C. W. Muirhead, 1951, field record.

9/1. CRYPTOGRAMMA CRISPA (L.) R.Br. ex Hook. 44, Carmarthen: near Llansadwrn, Cors Farlais, GR 22/67.34. Scree, 900ft. I. M. Vaughan, 1971, NMW. 2nd record. (*Nature Wales*, 13:45 (1972)).

15/6. ASPLENIUM VIRIDE Huds. 80, Roxburgh: Dinley Linns, Dinley Burn, Newcastleton, GR 35/46.95. Damp rock crevices, 650-1200ft. R. W. M. Corner, 1971, herb. R.W.M.C. 1st post-1930 record.

18/2. ATHYRIUM ALPESTRE (Hoppe) Rylands 108, W. Sutherland: scree on Foinaven, Coire Duail, GR 29/31.51. A. G. Kenneth, 1971, BM, det. A. C. Jermy. 2nd record.

22/2 × 22/1. POLYSTICHUM ACULEATUM (L.) Roth × P. SETIFERUM (Forsk.) Woynar *99, Dunbarton: Knockderry Castle, Cove, GR 26/21.84. Wooded raised-beach cliff. A. McG. Stirling, 1964, E, GL, det. A. Sleep.

24/3. THELYPTERIS PHEGopteris (L.) Slosson 45, Pembroke: 2km south of Brynberian, GR 22/10.33. Overhanging wet rock cleft, 875ft. T. A. W. Davis, 1971, field record. 2nd record. (*Nature Wales*, 13:46 (1972)).

25/1/2. *POLYPODIUM AUSTRALE* Fée **73**, Kirkcudbright: near Needle's Eye, below Clifton, Southwick, GR 25/91.56. Bushy cliffs near sea. A. McG. Stirling, 1971, **BM**, **CGE**, **DFS**, **E**, **GL**, conf. R. H. Roberts. 2nd record, 1st since 1850. (*Watsonia*, 9:40 (1972)). **75**, Ayrshire: near Northbank, Portencross, West Kilbride, GR 26/17.49. On Old Red Sandstone conglomerate. A. Rutherford, 1971, **BM**, **CGE**, **DBN**, **E**, **GL**, **NMW**, conf. R. H. Roberts. Confirmation of the 1st and only Ayrshire record, 1896. (*Watsonia*, 9:40 (1972)).

25/1/2 × 25/1/3. *POLYPODIUM AUSTRALE* Fée × *P. INTERJECTUM* Shivas ***73**, Kirkcudbright: near Needle's Eye, below Clifton, Southwick, GR 25/91.56. Bushy cliffs near sea. A. McG. Stirling, 1971, **herb. R. H. Roberts**, conf. R.H.R. 1st Scottish record.

25/1/3. *POLYPODIUM INTERJECTUM* Shivas ***H19**, Kildare: Maynooth, GR 03/9.9. Walltop. D. Doogue, 1970, **herb. D.D.**

28/1 *BOTRYCHIUM LUNARIA* (L.) Sw. **9**, Dorset: heathy path on Black Down, GR 30/61.87. H. J. M. Bowen, 1970, field record. 2nd record.

38/2. *HELLEBORUS VIRIDIS* L. †***73**, Kirkcudbright: 2 miles north of Gatehouse of Fleet, GR 25/59.59. Grassy field. O. M. Stewart, 1968, field record.

44/1. *PULSATILLA VULGARIS* Mill. **33**, E. Gloucs.: Hilcot, near Cheltenham, GR 32/0.1. C. S. Downer, 1971, field record. 1st post-1930 record.

46/10. *RANUNCULUS AURICOMUS* L. **99**, Dunbarton: Creinch Island, Loch Lomond, GR 26/39.88. Rocky shore under alders. A. McG. Stirling, 1971, field record. 1st-post 1930 record.

46/11. *RANUNCULUS LINGUA* L. **44**, Carmarthen: Moat Llandyry, near Kidwelly, GR 22/43.05. Pond verge. G. Tallwin, 1971, field record. 2nd record. (*Nature Wales*, 13: 45 (1972)).

46/24b. *RANUNCULUS FICARIA* L. subsp. *BULBIFER* Lawalrée ***42**, Brecon: near Pencelli, GR 32/09.24. Canal bank. M. Porter, 1968, **NMW**. Mile south of Crickadarn, GR 32/04.40. Shaded river bank. M. Porter, 1971, **NMW**. 2nd record. (Both records in *Nature Wales*, 13: 43 (1972)). ***46**, Cardigan: Tre'r-ddol, GR 22/65.92. Roadside, with subsp. *ficaria*. P. M. Benoit, 1971, **NMW**.

50/1. *THALICTRUM FLAVUM* L. **99**, Dunbarton: Ardmore Point, Cardcross, GR 26/32.78. Among grass near salt marsh. A. McG. Stirling, known for several years. 1st localised record.

50/2. *THALICTRUM ALPINUM* L. ***79**, Selkirk: White Shank to Range Cleuch Burn, Ettrick, GR 36/1.0–1.1. Flushes and burn sides, 1125–1900ft. R. W. M. Corner, 1971, **herb. R.W.M.C.**

50/3. *THALICTRUM MINUS* L. **80**, Roxburgh: Trows Craggs on River Tweed, Makerstoun, GR 36/66.31. Rock-ledges and steep banks. R. W. M. Corner, 1971, **herb. R.W.M.C.** 1st post-1930 record.

57/1. *CERATOPHYLLUM DEMERSUM* L. ***72**, Dumfries: Kirk Loch, Lochmaben, GR 35/07.82. J. D. Stuart Martin, 1971, **DFS**.

†58/6. *PAPAVER SOMNIFERUM* L. **H19**, Kildare: Louise Bridge, GR 13/0.9. Disturbed soil. D. Doogue, 1970, field record. 2nd record.

66/4. *FUMARIA BASTARDII* Bor. ***47**, Montgomery: wall in Montgomery Town, GR 32/22.96. D. Pugh, 1971, field record, det. P. M. Benoit. Between Tre-Wern and Cruggion, GR 33/27.13. Roadside verge. V. J. Macnair, 1971, field record, det. P. M. Benoit. 2nd record. (Both records in *Nature Wales*, 13: 47 (1972)).

66/8b. *FUMARIA OFFICINALIS* L. subsp. *WIRTGENII* (Koch) Arcangeli *75, Ayr: Montgomeryfield, Dreghorn, near Irvine, GR 26/34.37. Sandy waste ground. A. G. Kenneth, 1971, CGE, det. P. D. Sell.

†68/1. *ERUCASTRUM GALLICUM* (Willd.) O. E. Schulz *83, Edinburgh: Western Dock, Leith, GR 36/27.77. Waste ground. O. M. Stewart, 1970, E, conf. C. W. Muirhead.

75/1. *CRAMBE MARITIMA* L. *28, W. Norfolk: Snettisham beach, GR 53/64.31. E. L. Swann, 1971, field record.

†76/2. *RAPISTRUM RUGOSUM* (L.) All. 83, Edinburgh: Blackford quarry, Edinburgh, GR 36/26/70. Waste ground. O. M. Stewart, 1969, E, det. C. W. Muirhead. 2nd record.

84/1. *THLASPI ARVENSE* L. *42, Brecon: Penderyn, GR 22/94.07. Disturbed roadside verge, 700ft. M. Porter, 1971, NMW. (*Nature Wales*, 13: 43 (1972)). 73, Kirkcudbright: Glenstocken, Colvend, GR 25/87/53. Edge of field. O. M. Stewart, 1971, field record. 1st post-1930 record.

88/5. *COCHLEARIA DANICA* L. *H19, Kildare: east of Louise Bridge, GR 13/0.9. Railway ballast. D. Doogue, 1971, herb. D.D. Maynooth, GR 03/9.9. Railway ballast. D. Doogue, 1971, herb. D.D. 2nd record.

89/1. *SUBULARIA AQUATICA* L. 74, Wigtown: Loch Derry, GR 25/25.73. Submerged in shallow water, 550ft. H. Milne-Redhead, 1971, DFS. 1st post-1930 record.

94/3. *DRABA INCANA* L. 101, Kintyre: Largybaan Burn, GR 16/60.14. By waterfall, 500ft. A. G. Kenneth, 1969, CGE. 2nd record.

97/2. *CARDAMINE AMARA* L. 98, Argyll: Dubh Loch, Glen Shira, GR 27/11.11. Base-rich *Carex* swamp by loch. A. G. Kenneth, 1971, herb. A.G.K. Range extension.

†98/4. *BARBAREA VERNA* (Mill.) Aschers. *42, Brecon: Hay, GR 32/22.42. Disused railway line, 300ft. M. Porter, 1971, NMW. Cradoc, GR 32/01.30. Waste ground. A. P. Conolly, 1971, field record. (Both records in *Nature Wales*, 13: 43 (1972)). 68, Cheviot: north-west of Thirlings, GR 36/95.32. Roadside hedgebank. G. A. & M. Swan, 1970, herb. G.A.S. 1st record for over 100 years.

102/2 × 1. *RORIPPA × STERILIS* Airy Shaw *98, Argyll: Dubh Loch, Glen Shira, GR 27/11.11. A. G. Kenneth, 1971, herb. A.G.K.

102/3. *RORIPPA SYLVESTRIS* (L.) Bess. 50, Denbigh: by River Conway, Betws-y-Coed, GR 23/79.57. P. M. Benoit, 1971, NMW. 2nd record.

†108/4. *SISYMBRIUM ORIENTALE* L. H19, Kildare: Celbridge, GR 13/9.9. Disturbed ground. D. Doogue, 1970, field record. 2nd record.

109/1. *ARABIDOPSIS THALIANA* (L.) Heynh. H19, Kildare: Louise Bridge, Leixlip, GR 13/0.9. Railway line. D. Doogue, 1970, field record. 2nd record.

112/2. *RESEDA LUTEA* L. *47, Montgomery: near Montgomery station, GR 32/20.97. Disused coal wharf. V. J. Macnairn, 1971, field record. (*Nature Wales*, 13: 47 (1972)).

115/6 × 5. *HYPERICUM MACULATUM* Crantz × *H. PERFORATUM* L. 40, Shropshire: Craig Llwyn, near Llansilin, GR 33/23.27. Roadside. P. M. Benoit, 1971, BM, det. N. K. B. Robson. 2nd record. *47, Montgomery: near Arddleen, GR 33/25/15. Disused railway track. P. M. Benoit, 1971, BM, NMW, det. N. K. B. Robson. *48, Merioneth: Barmouth Junction, GR 23/62.13. Disused railway track. P. M. Benoit, 1971, BM, det. N. K. B. Robson. *50, Denbigh: Rhydycreua, Betws-y-Coed, GR 23/80.57. Among tall grass. P. M. Benoit, 1971, BM, NMW, det. N. K. B. Robson.

123/3. *SILENE CONICA* L. **44**, Carmarthen: Towyn Burrows, GR 22/35.06. Edge of salt marsh and sand dune. I. M. Vaughan, 1971, NMW. 2nd record.

133/3. *STELLARIA PALLIDA* (Dumort.) Piré **67**, S. Northumberland: near Colwell, GR 35/94.76. On basalt, 500ft. G. A. & M. Swan, 1967, *herb. G.A.S.* 1st record for over 100 years.

133/6. *STELLARIA PALUSTRIS* Retz. ***99**, Dunbarton: by River Leven, near Dalreoch, Dumbarton, GR 26/39.76. Marshy ground. A. McG. Stirling, 1971, field record.

141/2. *ARENARIA LEPTOCLADOS* (Reichb.) Guss. **H19**, Kildare: Maynooth, GR 03/9.9. Sandy roadside. D. Doogue, 1970, *herb. D.D.* 2nd record.

†149/3. *MONTIA SIBIRICA* (L.) Howell ***50**, Denbigh: by River Conway, near Betws-y-Coed, GR 23/79.57. P. M. Benoit, 1971, NMW.

154/14. *CHENOPODIUM RUBRUM* L. ***73**, Kirkcudbright: White Port, near Almorness Point, GR 25/84.51. Rock crevices by shore. O. M. Stewart, 1971, *DFS*.

160/4. *SALICORNIA RAMOSISSIMA* Woods ***101**, Kintyre: North Druimachro, Isle of Gigha, GR 16/65.48. A. G. Kenneth, 1971, field record, det. T. G. Tutin.

†163/5. *MALVA PUSILLA* Sm. **68**, Cheviot: Bamburgh Castle, GR 46/18.35. Waste ground. G. A. & M. Swan, 1970, *herb. G.A.S.*, det. N. K. B. Robson. 2nd, record.

168/2. *GERANIUM SYLVATICUM* L. ***43**, Radnor: Davy Morgans Dingle, Radnor Forest, GR 32/18.62. A. C. Powell, 1971, NMW, det. G. Ellis. (*Nature Wales*, 13:44 (1972)).

†171/4. *IMPATIENS GLANDULIFERA* Royle ***73**, Kirkcudbright: Kirkconnel, near New Abbey, GR 25/97.69. Wet ditch near Kirkconnel moss. O. M. & N. F. Stewart, 1971, field record. **H19**, Kildare: River Liffey, Celbridge, GR 03/9.9. D. Doogue, 1970, field record. 2nd record.

192/1. *TRIFOLIUM ORNITHOPODIOIDES* L. **42**, Brecon: mile south-west of Coelbren, GR 22/83.10. By colliery track, 750ft. M. E. Massey, 1971, NMW. 2nd record. (*Nature Wales*, 13: 43 (1972)).

192/10. *TRIFOLIUM STRIATUM* L. **73**, Kirkcudbright: near Gutter's Isle, Glenstocking shore, GR 25/86.52. In short grass. O. M. Stewart, 1971, *DFS*. 2nd record.

192/24. *TRIFOLIUM MICRANTHUM* Viv. **74**, Wigtown: Logan gardens, GR 25/09.42. On lawn. R. Mackechnie, 1971, field record. 2nd record.

205/1. *ONOBRYCHIS VICIFOLIA* Scop. **†57**, Derbys.: near Taddington, GR 43/13.71. Roadside, 1100ft. W. J. Clarke & C. Jones-Parry, 1968, field record. 1st record for over 50 years.

206/10. *VICIA SYLVATICA* L. **101**, Kintyre: Eas Daltot, Achnamara, GR 16/75.82. Limestone cliff, 500ft. A. G. Kenneth, 1970, *CGE*. Range extension.

207/9. *LATHYRUS PALUSTRIS* L. ***44**, Carmarthen: near Pembrey, GR 22/4.0. Poor fen. S. B. Evans & I. M. Vaughan, 1971, NMW, (see p. 137). (*Nature Wales*, 13: 45 (1972)).

211/11/21. *RUBUS BALFOURIANUS* Bloxam ex Bab. ***27**, E. Norfolk: Horsey Staithe, GR 63/46.24. A. L. Bull, 1970, *herb. A.L.B.*, conf. E. S. Eedes. ***28**, W. Norfolk: Swathing Marsh, Cranworth, GR 53/97.04. A. L. Bull, 1970, *herb. A.L.B.*, conf. E. S. Eedes.

211/11/27. *RUBUS TUBERCULATUS* Bab. *27, E. Norfolk: Kenninghall, GR 62/03.86. A. L. Bull, 1970, *herb. A.L.B.*, conf. E. S. Eedes.

211/11/101. *RUBUS ATROCAULIS* P. J. Muell. *27, E. Norfolk: Alderford Common, GR 63/12.19. A. L. Bull, 1970, *herb. A.L.B.*, conf. E. S. Eedes.

†211/11/139. *RUBUS PRO CERUS* P. J. Muell. *28, W. Norfolk: Hempton Green, near Fakenham, GR 53/90.28. A. L. Bull, 1970, *herb. A.L.B.*, conf. E. S. Eedes.

211/11/201. *RUBUS TAENIARUM* Lindeb. *73, Kirkcudbright: Killywhan Station, Beeswing, GR 25/88.69. Edge of disused track. O. M. Stewart, 1970, E, det. E. S. Eedes.

211/11/204. *RUBUS RADULA* Weihe ex Boenn. *28, W. Norfolk: Hempton Green, near Fakenham, GR 53/90.28, and Little Ellingham, GR 62/02.99. Both A. L. Bull, 1970, *herb. A. L. B.*, conf. E. S. Eedes.

211/11/223. *RUBUS FOLIOSUS* Weihe & Nees *28, W. Norfolk: Forty Acre Plantation, Kettlestone, GR 53/97.32. A. L. Bull, 1971, *herb. A.L.B.*, conf. E. S. Eedes.

211/11/284. *RUBUS RUFESCENS* Muell. & Lefèv. *27, E. Norfolk: Foxley Wood, GR 63/05.23. E. S. Eedes, 1970. *28, W. Norfolk: Kettlestone, GR 53/96.31, and Potter's Carr, Cranworth, GR 53/9.0. Both A. L. Bull, 1971, *herb. A.L.B.*, conf. E. S. Eedes.

211/11/348. *RUBUS HYLOCHARIS* W. C. R. Wats. *27, E. Norfolk: Foxley Hills, GR 63/05.23. A. L. Bull, 1970, *herb. A.L.B.*, conf. E. S. Eedes.

211/11/a. *RUBUS ACCRESCENS* A. Newton *57, Derbys.: north of Boarfold Farm, Chisworth, GR 33/98.92. A. Newton, 1971, field record.

211/11/d. *RUBUS DISTRACTIFORMIS* A. Newton *57, Derbys.: Aspenshaw, New Mills, GR 43/01.87. A. Newton, 1971, field record.

211/11/p. *RUBUS PORPHYROCAULIS* A. Newton *57, Derbys.: lane to Warhurst Fold, Chisworth, GR 33/99.93. A. Newton, 1971, field record.

211/11/r. *RUBUS ROBII* (W. C. R. Wats.) A. Newton *57, Derbys.: lane south-east of Low Leighton, GR 43/01.85. A. Newton, 1971, field record.

†212/9. *POTENTILLA INTERMEDIA* L. *28, W. Norfolk: Snake Wood, Weeting, GR 52/80.90. Forest ride. R. P. Libbey, 1971, *herb. E. L. Swann*. *83, Edinburgh: Seafield, Leith Docks, GR 36/28.76. Waste ground. O. M. Stewart, 1968, E. Site destroyed 1969.

212/14 × 13. *POTENTILLA ANGLICA* Laichard. × *P. ERECTA* (L.) Räusch. *27, E. Norfolk: Witton Heath, GR 63/34.32. Open woodland ride. R. P. Libbey & E. L. Swann, 1971, *herb. E.L.S.*

216/3 × 2. *GEUM* × *INTERMEDIUM* Ehrh. *101, Kintyre: near Gallachaille, Loch Sween, GR 16/76.89. Woodland. A. G. Kenneth, 1969, CGE. Probably 1st record.

†223/2. *POTERIUM POLYGAMUM* Waldst. & Kit. 42, Brecon: near Gilwern, GR 32/23.13. Roadside bank. M. Porter, 1970, field record. 2nd record. (*Nature Wales*, 13: 43 (1972)).

†226/5. *PRUNUS CERASUS* L. *74, Wigtown: by road A747 south of Glenluce, GR 25/22.55. O. M. Stewart, 1969, E, conf. C. W. Muirhead.

†227/4. *COTONEASTER MICROPHYLLUS* Wall. ex Lindl. *79, Selkirk: Tima Water by Gair Farm, GR 36/27.09. Basic rocks by road, 950ft. R. W. M. Corner, 1971, *herb. R.W.M.C.*

232/7. *SORBUS TORMINALIS* (L.) Crantz 42, Brecon: 2 miles south of Builth Wells, GR 32/03.48. Scrub on cliff, 600ft. W. J. H. Price, 1971, NMW. 2nd record. (*Nature Wales*, 13: 43 (1972)). *45, Pembroke: 2km E.S.E. of St Ishmael's, GR 12/85.06. Edge of Old Red Sandstone cliff. T. A. W. Davis, 1971, NMW. (*Nature Wales*, 13: 46 (1972)).

†235/6. *SEDUM ALBUM* L. *74, Wigtown: mile west of Monreith, GR 25/34.41. Shingle bank. O. M. Stewart, 1971, DFS.

235/8. *SEDUM ACRE* L. H19, Kildare: Maynooth, GR 03/9.9. Walltop. D. Doogue, 1970, herb. D.D. 2nd record.

238/1. *UMBILICUS RUPESTRIS* (Salisb.) Dandy 99, Dunbarton: Lang Craigs, Dumbarton, GR 26/43.75. Basalt crags. A. McG. Stirling, 1963, field record. 2nd record.

254/4. *EPILOBIUM LANCEOLATUM* Seb. & Mauri *28, West Norfolk: Beetley, GR 53/95.18. Gravel pit. E. L. Swann, 1971, herb. E.L.S.

†254/13. *EPILOBIUM NERTEROIDES* Cunn. 43, Radnor: Rhayader, GR 22/94.69. Roadside, 1000ft. Sir J. Holland, 1971, field record. 2nd record. (*Nature Wales*, 13: 44 (1972)). 34, W. Gloucs.: Mailscoth Wood, Forest of Dean, GR 32/5.1. Woodland ride. H. M. Caddick, 1969, field record. 2nd record.

†256/2. *OENOTHERA ERYTHROSPERMA* Borbás 42, Brecon: near Gilwern, GR 32/24.15. Roadside verge. G. Hargest, 1971, field record. 2nd record. (*Nature Wales*, 13:43 (1972)).

262/2. *CALLITRICHE PLATYCARPA* Kutz. *33, E. Gloucs.: Fairford, GR 41/1.9. Shallow water in Dudgrove gravel pit. S. C. Holland, 1971, field record, conf. R. D. Meikle.

288/1. *CICUTA VIROSA* L. *74, Wigtown: near Clayshant, Torrs Warren, Stranraer, GR 25/12.53. Marshes among dunes. A. McG. Stirling, 1971, field record.

297/1. *BERULA ERECTA* (Huds.) Coville 74, Wigtown: near Clayshant, Torrs Warren, Stranraer, GR 25/12.53. Marshy ground among dunes. A. McG. Stirling, 1971, field record. 1st post-1930 record.

300/4. *OENANTHE LACHENALII* C. C. Gmel. 99, Dunbarton: Ardmore Point, Cardross, GR 26/32.78. Grass above salt-marsh. A. McG. Stirling, 1971, field record. 1st post-1930 record.

304/1. *MEUM ATHAMANTICUM* Jacq. 99, Dunbarton: ½ mile north of Ardlui, GR 27/31.16. Grassy bank. F. G. Rodway & A. McG. Stirling, 1971, field record. 1st post-1930 record.

318/2. *MERCURIALIS ANNUA* L. H19, Kildare: Leixlip Town, GR 13/0.9. Disturbed soil. D. Doogue, 1970, field record. 2nd record.

320/5. *POLYGONUM VIVIPARUM* L. 79, Selkirk: north-east side of White Shank, Ettrick, GR 36/17.08. Basic flushes, 1850ft. R. W. M. Corner, 1971, field record. 2nd record.

320/12. *POLYGONUM HYDROPIPER* L. H19, Kildare: Castletown House, GR 03/9.9. Muddy river-bank. D. Doogue, 1970, field record. 2nd record.

320/16. *POLYGONUM DUMETORUM* L. †41, Glamorgan: Mountain Ash, GR 31/0.9. Hedgerow. A. M. Pell, 1970, NMW, conf. G. Ellis. 2nd record. (*Nature Wales*, 13:42 (1972)).

†320/20. *POLYGONUM SACHALINENSE* F. Schmidt *35, Monmouth: Bassaleg, Newport, GR 31/27.87. Side of lane. A. Rowlands, 1969, NMW. (*Nature Wales*, 13: 42 (1972)).

325/4. *RUMEX HYDROLAPATHUM* Huds. 43, Radnor: Stanage Park, near Knighton, GR 32/32.71. By pool. A. C. Powell, 1971, field record. 2nd record. (*Nature Wales*, 13: 44 (1972)). 74, Wigtown: near Clayshant, Torrs Warren, Stranraer, GR 23/12.53. Marshy ground among dunes. A. McG. Stirling, 1971, field record. 1st post-1930 record.

325/18. *RUMEX MARITIMUS* L. *101, Kintyre: north of Ferry Farm, Tayinloan, GR 16/69.48. Dried-up pool. A. G. Kenneth, 1971, field record.

343/5. *SALIX TRIANDRA* L. 42, Brecon: mile east of Pencelli, GR 32/10.24. Marshy ground by river, 400ft. M. Porter, 1970, NMW. 2nd record. (*Nature Wales*, 13: 43 (1972)).

343/14. *SALIX NIGRICANS* Sm. *108, W. Sutherland: Creagan Meall Horn, GR 29/35.45. Limestone ledge. A. G. Kenneth & A. McG. Stirling, 1971, field record.

343/16. *SALIX REPENS* L. *79, Selkirk: Range Cleuch Burn, Ettrick, GR 36/19.61. Rocks by burn, 1100ft. R. W. M. Corner, 1971, K, conf. R. D. Meikle.

350/1. *ANDROMEDA POLIFOLIA* L. 44, Carmarthen: Llangynog Bog, near Llangain, Carmarthen, GR 22/35.16. D. Davies, 1971, NMW. 2nd record. (*Nature Wales*, 13: 45 (1972)).

359/1. *PYROLA MINOR* L. 9, Dorset: Halstock, GR 31/51.07. Forestry plantation. W. G. Latham. 2nd record. (*Proc. Dorset Nat. Hist. Arch. Soc.*, 91: 134 (1965)).

359/2. *PYROLA MEDIA* Sw. *101, Kintyre: Glenhussa, Knapdale, GR 16/77.84. Streamside. A. G. Kenneth, 1971, field record.

360/1. *ORTHILIA SECUNDA* (L.) House 73, Kirkcudbright: Caldons, Glen Trool, GR 25/41.78. Ravine, 800ft. D. A. Ratcliffe, 1962, field record. 1st post-1930 record. 99, Dunbarton: lower slopes of Ben Vane, near Loch Sloy, GR 27/28.10. Rock-ledge, 1200ft. D. Henderson, 1968, field record. 2nd record.

365/5/3. *LIMONIUM TRANSWALLIANUM* (Pugs.) Pugs. 45, Pembroke: 2km south of Bosherton, GR 11/96.92. Limestone ledge, 100ft. T. A. W. Davis, 1971, NMW. 2nd record. (*Nature Wales*, 13: 46 (1972)).

387/1. *NYMPHOIDES PELTATA* (S. G. Gmel.) Kuntze *73, Kirkcudbright: Auchenskeoch Loch, near Southwick, GR 25/90.59. O. M. Stewart, 1967, field record.

†392/3. *SYMPHYTUM ORIENTALE* L. *67, S. Northumberland: near Acklington Park, south side of R. Coquet, GR 46/20.03. Woodland. G. A. & M. Swan, 1970, herb. G.A.S., conf. A. S. Wade.

400/3. *MYOSOTIS STOLONIFERA* (DC.) Gay ex Leresche & Levier *68, Cheviot: Bizzle, GR 36/89.22. Mossy stream-side, 1000ft. G. A. & M. Swan, 1970, herb. G.A.S. Bellyside Burn, GR 36/90.22. Mossy stream-side, 1100ft. G. A. & M. Swan, 1970, field record. 2nd record. Both conf. A. E. Wade.

†406/2. *CALYSTEGIA PULCHRA* Brummitt & Heywood *57, Derbys.: lane to Keepers Leys Farm, Ashbourne, GR 43/17.46. Hedgebank. K. Hollick, 1971, DBY, det. D. McClintock. Present for many years.

413/3. *SOLANUM NIGRUM* L. *42, Brecon: mile east of Llanbedr, GR 32/26.20. Edge of pasture, 700ft. M. Porter, 1971, NMW. (*Nature Wales*, 13: 43 (1972)).

416/3 × 1. *VERBASCUM PHLOMOIDES* L. × *V. THAPSUS* L. *22, Berkshire: Pusey, GR. 41/36.96. Old Sandpit. J. R. Palmer, 1970, field record.

†425/1. *MIMULUS GUTTATUS* DC. **H19**, Kildare: $\frac{1}{4}$ mile below Ballymore Eustace, GR 03/6.9. River bank. D. Doogue, 1970, field record. 2nd record.

430/20. *VERONICA HEDERIFOLIA* L. *sensu stricto* *40, Shropshire: Pant, near Oswestry, GR 33/27.22. Garden weed. P. M. Benoit, 1970, NMW. *46, Cardigan: Tanyllan, Llangynfelyn, GR 22/64.92. Roadside. P. M. Benoit, 1971, NMW. *48, Merioneth: Pant Canol, Dyffryn Ardudwy, GR 23/58.22. Garden weed. P. M. Benoit, 1970, CGE, NMW.

430/s. *VERONICA SUBLOBATA* M. Fischer *40, Shropshire: Pant, near Oswestry, GR 33/27.22. Garden weed. P. M. Benoit, 1970, CGE, NMW. *48, Merioneth: near Dyffryn Ardudwy Station, GR 23/58.23. P. M. Benoit, 1970, NMW. *50, Denbigh: Rhydycruea, Betws-y-Coed, GR 23/80.57. Garden weed. P. M. Benoit, 1971, NMW.

434/4. *MELAMPYRUM SYLVATICUM* L. *105, W. Ross: Alt a' Ghlas-Choire, Glen Lichd, Kintail, GR 28/04.16. Ledges by ravine, 1500ft. R. W. M. Corner, 1961, herb. R.W.M.C., conf. J. G. Roger. (*Trans. Proc. bot. Soc. Edinb.*, 40: 625 (1970)).

437/1. *PARENTUCELLIA VISCOSA* (L.) Caruel **101**, Kintyre: south of Ferry Farm, Tayinloan, GR 16/69.46. Short, damp grassland. A. G. Kenneth, 1971, field record. 2nd record.

439/1. *LATHRAEA SQUAMARIA* L. **H19**, Kildare: Mount Thunder, $\frac{1}{2}$ mile north of Leixlip, GR 13/0.9. Scrub. D. Doogue, 1970, herb. D.D. 2nd record.

442/4. *UTRICULARIA MINOR* L. *106, E. Ross: north-east of Loch Kinellan, near Strathpeffer, GR 28/4.5. In *Sphagnum* marsh. U. K. Duncan, 1967, herb. U.K.D.

†445/4 $\times$ 5. *MENTHA* $\times$ *PIPERITA* L. *73, Kirkcudbright: Ewanston, GR 25/67.77. Boggy field. J. McClure, 1968, field record, det. R. M. Harley.

462/3. *LAMIUM HYBRIDUM* Vill. **57**, Derbys.: Pocknedge Farm, near Holy Moor, GR 43/34.70. Manure heap. M. C. Hewitt, 1967, field record. 1st record for 50 years.

†475/5. *CAMPANULA PERSICIFOLIA* L. *73, Kirkcudbright: New Galloway, GR 25/63.77. Roadside, J. McClure, 1969, field record.

485/2. *GALIUM BOREALE* L. **68**, Cheviot: south bank of River Tweed, $\frac{1}{2}$ mile W.S.W. of Carham, GR 46/79.37. Rocks by the river. G. A. Swan, 1970, field record. 1st record for over 50 years.

485/3. *GALIUM MOLLUGO* L. *101, Kintyre: near Homeston Farm, between Southend and Campbeltown, GR 16/68.17. Roadside. A. G. Kenneth, 1970, herb. A.G.K.

488/3. *VIBURNUM OPULUS* L. †101, Kintyre: Canal bank road west of Bellanoch, GR 16/79.93. Single bush in scrub. A. G. Kenneth, 1971, herb. A.G.K. 2nd record.

494/2. *VALERIANELLA CARINATA* Lois. **49**, Caernarvon: Haulfre Gardens, Llandudno, GR 23/77.82. Garden weed. P. M. Benoit, 1971, NMW. Probably 2nd record.

497/1. *DIPSACUS FULLONUM* L. *42, Brecon: Llangynidr, GR 32/14.19. Canal bank. M. Porter, 1971, NMW. Talgarth, GR 32/16.32. Waste ground near tip, 750ft. M. Porter, 1971, field record. 2nd record. (Both records in *Nature Wales*, 13: 43 (1972)). *H19, Kildare: Rye Water, $\frac{1}{2}$ mile upstream from Louise Bridge Aqueduct, GR 03/9.9. River bank. D. Doogue, 1969, herb. D.D.

502/2. *BIDENS TRIPARTITA* L. **101**, Kintyre: near North Druimachro, Isle of Gigha, GR 16/65.48. Muddy ditch. A. G. Kenneth, 1971, herb. A.G.K. 2nd record.

†509/2. *PETASITES ALBUS* (L.) Gaertn. *101, Kintyre: Ronachan, Clachan, GR 16/74.55. Shady roadside. A. G. Kenneth, 1971, herb. A.G.K.

†521/5. *ERIGERON MUCRONATUS* DC. *82, Haddington: Biel, 2½ miles south-west of Dunbar, GR 36/63.76. Garden wall; established and spreading. O. M. Stewart, 1967, E.

†522/1. *CONYZA CANADENSIS* (L.) Cronq. 42, Brecon: Glangrwyney, GR 32/24.16. River bank. M. Porter, 1971, field record. 2nd record. (*Nature Wales*, 13: 43 (1972)).

527/1. *CHAMAEMELUM NOBILE* (L.) All. 28, W. Norfolk: Church Lane, Cranworth, GR 53/98.04. A. L. Bull. 1971, herb. E. L. Swan. 2nd record.

†535/2. *ARTEMISIA VERLITORUM* Lamotte *66, Durham: Monkwearmouth bridge, Sunderland, GR 45/39.57. Well established, on waste ground. A. J. Silverside, 1969, herb. G. G. Graham.

539/4. *CARDUUS ACANTHOIDES* L. 72, Dumfries: Lochmaben Castle, GR 35/08.81. Ruined castle grounds. H. Milne-Redhead, 1969, field record. 1st post-1930 record.

540/6. *CIRSIIUM ACAULON* (L.) Scop. *42, Brecon: Cwm Clydach, GR 32/22.13. Limestone grassland, 1200ft. M. Porter, 1968, NMW. Near Daren-felen, Cwm Clydach, GR 32/22.12. Disused limestone quarry, 900ft. M. Porter, 1968, field record. 2nd record. (Both records in *Nature Wales*, 13: 43 (1972)).

†541/1. *SILYBUM MARIANUM* (L.) Gaertn. 74, Wigtown: south of Sandhead, GR 25/10.48. Sea-shore, one plant. R. Mackechnie, 1971, field record. 2nd record.

543/1. *SAUSSUREA ALPINA* (L.) DC. *79, Selkirk: north-east side of White Shank, Ettrick, GR 37/17.08. Basic, stony flush, 1850ft. R. W. M. Corner, 1971, herb. R.W.M.C.

545/1. *SERRATULA TINCTORIA* L. *28, W. Norfolk: North Lopham, GR 62/02.82. Side of dyke. E. L. Swann, 1970, herb. E.L.S.

550/2 × 3. *LEONTODON HISPIDUS* L. × L. *TARAXACOIDES* (Vill.) Mérat *40, Shropshire: near Pant, Oswestry, GR 33/2.2. Calcareous grassland. P. M. Benoit, 1971, field record.

550/3. *LEONTODON TARAXACOIDES* (Vill.) Mérat 99, Dunbarton: Loch Sloy, GR 27/29.11. Disturbed ground near the dam. A. McG. Stirling, 1968, field record. 1st localised record.

551/1. *PICRIS ECHIOIDES* L. 42, Brecon: Talybont-on-Usk, GR 32/11.23. Garden weed. E. B. Jones, 1971, field record. 2nd record. (*Nature Wales*, 13: 43 (1972)).

552/1. *TRAGOPOGON PRATENSIS* L. *99, Dunbarton: Milton, Dumbarton, GR 26/42.74. Waste ground and verges. A. McG. Stirling, 1971, field record.

555/1. *MYCELIS MURALIS* (L.) Dumort. *73, Kirkcudbright: Ken Brig, New Galloway, GR 25/64.78. Stonework of bridge. J. McClure, 1970, DFS.

558/1/94. *HIERACIUM DURICEPS* F. J. Hanb. *72, Dumfries: Penton Linns, GR 35/43.77. Limestone rock. C. W. Muirhead, 1951, field record, det. P. D. Sell & C. West.

558/1/187. *HIERACIUM CAESIONIGRESCENS* Fries *99, Dunbarton: above road to Loch Humphrey, Kilpatrick Hills, GR 26/4.7. Basalt crags. A. McG. Stirling, 1970, CGE, det. C. West & P. D. Sell. 1st Scottish and 2nd British record.

558/1/205. *HIERACIUM LISSOLEPIUM* (Zahn) Roffey *73, Kirkcudbright: by River Urr, near Margley Farm, GR 25/76.72. O. M. Stewart, 1970, E, det. C. West.

563/2. *ALISMA LANCEOLATUM* With. *41, Glamorgan: Abercwmboi, Mountain Ash, GR 31/0.9. Stagnant water. A. M. Pell, 1970, NMW, conf. G. Ellis. (*Nature Wales*, 13: 42 (1972)). *99, Dunbarton: Forth and Clyde Canal, Temple, Glasgow, GR 26/54.69. Margin of timber basin. A. McG. Stirling, 1969, field record.

566/1. *BUTOMUS UMBELLATUS* L. †H19, Kildare: below Leixlip Dam, GR 13/0.9. D. Doogue & G. Sharkey, 1968, field record. 2nd record.

576/2. *ZOSTERA ANGUSTIFOLIA* (Hornem.) Reichb. 73, Kirkcudbright: Rockcliffe, GR 25/84.54. O. M. Stewart, 1970, E, det. H. Milne-Redhead. 2nd record.

576/3. *ZOSTERA NOLTII* Hornem. 68, Cheviot: Holy Island, GR 46/11.42. G. A. & M. Swan, 1970, herb. G.A.S., det. T. G. Tutin. 1st post-1930 record.

577/13. *POTAMOGETON PUSILLUS* L. *44, Carmarthen: River Towy, Dynevor, Llandeilo, GR 22/60.22. S. B. Evans, M. Humphrey & I. M. Vaughan, 1971, NMW, det. J. E. Dandy. (*Nature Wales*, 13: 46 (1972)). The earlier record (*Watsonia*, 8: 410 (1971)) was based on material subsequently identified by J. E. Dandy as *P. berchtoldii*.

577/14. *POTAMOGETON OBTUSIFOLIUS* Mert. & Koch *101, Kintyre: Loch Choille-Bharr, GR 26/09.96. Washed up at north end. A. G. Kenneth, 1968, BM, det. J. E. Dandy. Mill Loch, Isle of Gigha, GR 16/64.50. A. G. Kenneth & A. McG. Stirling, 1971, BM, det. J. E. Dandy. 2nd record.

577/20. *POTAMOGETON FILIFORMIS* Pers. 101, Kintyre: Machrihanish Water, GR 16/64.21. A. G. Kenneth, 1970, BM, det. J. E. Dandy. 2nd record.

579/1. *RUPPIA CIRRHOSA* (Petagna) Grande *48, Merioneth: Dwyryd estuary, GR 23/6.3. Pools in saltmarsh. P. M. Benoit, 1971, BM, NMW, det. J. E. Dandy. 1st definite record.

581/1. *NAIAS FLEXILIS* (Willd.) Rostk. & Schmidt *101, Kintyre: Loch nan Gad, Clachan, GR 16/78.57. A. G. Kenneth, 1971, field record, det. J. E. Dandy.

589/3. *POLYGONATUM MULTIFLORUM* (L.) All. †*28, W. Norfolk: Maiden's Walk, Kilverstone, GR 52/89.84. Woodland. R. M. Burton, 1967, field record.

606/7. *LUZULA ARCUATA* Sw. 108, W. Sutherland: Coire Duail, Foinaven, GR 29/31.50. East-facing flushes, 2700ft. R. W. M. Corner, 1969, herb. R.W.M.C. 1st definite record for over 100 years. (*Trans. Proc. bot. soc. Edinb.*, 41: 95 (1970)).

607/8. *ALLIUM SCHOENOPRASUM* L. *99, Dunbarton: Fraoch Eilean, Loch Lomond, GR 26/36.92. Rocky shore of island. P. Macpherson, 1967, herb. A. McG. Stirling.

607/12. *ALLIUM URSINUM* L. H19, Kildare: Mount Thunder, $\frac{1}{4}$ mile north of Leixlip, GR 13/0.9. D. Doogue, 1970, field record. 2nd record.

622/1. *TAMUS COMMUNIS* L. *68, Cheviot: near Lemmington Hall, GR 46/12.11. Roadside hedge. G. A. & M. Swan, 1970, herb. G.A.S.

625/1. *EPIPACTIS PALUSTRIS* (L.) Crantz 42, Brecon: Penderyn, GR 22/95.09. Rough, damp field, 900ft. M. E. Massey & M. Porter, 1971, field record. 2nd record.

631/1. *HAMMARBYA PALUDOSA* (L.) Kuntze 99, Dunbarton: near Auchengaich, Glen Fruin, GR 26/27.89. Peaty flush, 500ft. A. McG. Stirling, 1965, field record. 1st post-1930 record.

633/1. *CORALLORHIZA TRIFIDA* Chatel. *74, Wigtown: east end of Torrs Warren, Stranraer, GR 25/15.55. Dune slack. E. T. Idle, 1971, field record.

635/1 $\times$ 643/1. *COELOGLOSSUM VIRIDE* (L.) Hartm. $\times$ *DACTYLORHIZA FUCHSII* (Druce) Soó *57, Derbys.: Middleton-by-Wirksworth, GR 43/27.55. One plant in old limestone quarry, 1100ft. S. R. Band, 1971, photograph in *DBY*, det. P. F. Hunt.

636/1b. *GYMNADENIA CONOPSEA* (L.) R.Br. subsp. *DENSIFLORA* (Wahlenb.) G. Camus, Bergon & A. Camus *68, Cheviot: Embleton Quarry, GR 46/23.22. G. A. & M. Swan, 1970, field record.

643/1 $\times$ 2b. *DACTYLORHIZA FUCHSII* (Druce) Soó $\times$ *D. MACULATA* (L.) Soó subsp. *ERICETORUM* (E. F. Linton) Hunt & Summerh. *27, E. Norfolk: Upgate Common, Swannington, GR 63/12.19. A. L. Bull & G. Garrod, 1970, field record.

643/3b. *DACTYLORHIZA INCARNATA* (L.) Soó subsp. *PULCHELLA* (Druce) Soó *42. Brecon: mile west of Llandefalle, GR 32/09.34. Rough marshy field, 800ft. M. Porter, 1970, NMW, det. P. F. Hunt. 2 miles south-west of Llanfilo, GR 32/09.31. Rough, marshy field, 750ft. M. E. Massey, 1971, field record, det. P. F. Hunt. 2nd record. (Both records in *Nature Wales*, 13: 44 (1972)).

643/4. *DACTYLORHIZA PRAETERMISSA* (Druce) Soó 42, Brecon: near Coelbren, GR 22/85.11. Marshy field, 750ft. M. Porter, 1971, NMW, det. P. F. Hunt. 2nd record. (*Nature Wales*, 13: 44 (1972)).

650/2. *LEMNA TRISULCA* L. H19, Kildare: Royal Canal, Maynooth, GR 03/9.9. D. Doogue, 1970, field record. 2nd record.

652/3. *SPARGANIUM ANGUSTIFOLIUM* Michx. 42, Brecon: 5 miles north of Abergwesyn, GR 22/85.61. Mountain pool, 1750ft. M. Porter, 1970, NMW. 2nd record. (*Nature Wales*, 13: 44 (1972)).

655/4. *SCIRPUS SYLVATICUS* L. *98, Argyll: Dubh Loch, Glen Shira, GR 27/11.11. Base-rich *Carex* swamp. A. G. Kenneth, 1971, herb. A.G.K.

655/9. *SCIRPUS TABERNAEMONTANI* C. C. Gmel. 42, Brecon: mile north of Talybont-on-Usk, GR 32/10.24. Oxbow of River Usk. M. E. Massey & M. Porter, 1970, field record. 2nd record. (*Nature Wales*, 13: 44 (1972)).

655/12. *SCIRPUS FLUITANS* L. 42, Brecon: 2 miles south of Builth, GR 32/04.46. Mountain pool, 1400ft. M. Porter, 1971, NMW. 2nd record. (*Nature Wales*, 13: 44 (1972)).

660/1. *RHYNCHOSPORA ALBA* (L.) Vahl 99, Dunbarton: near Lochan Glas Laoigh, Garelochhead, GR 26/22.89. Peaty flush. A. McG. Stirling, 1971, field record. 1st post-1930 record.

663/4 $\times$ 7. *CAREX HOSTIANA* DC. $\times$ *C. LEPIDOCARPA* Tausch *27, E. Norfolk: fen at Seamere, near Hingham, GR 63/02.02. E. L. Swann, 1970, field record.

663/7. *CAREX LEPIDOCARPA* Tausch *H19, Kildare: Louise Bridge, Leixlip, GR 13/0.9. Calcareous marsh. D. Doogue, 1970, field record.

663/16 $\times$ 17. *CAREX ROSTRATA* Stokes $\times$ *C. VESICARIA* L. *98, Argyll: Dubh Loch, Glen Shira, GR 27/11.11. Base-rich *Carex* swamp. A. G. Kenneth, 1971, BM, det. A. C. Jermy.

663/20. *CAREX RIPARIA* Curt. 48, Merioneth: near Talsarnau, GR 23/60.34. P. M. Benoit, 1971, field record. 2nd record.

663/22. *CAREX PENDULA* Huds. 99, Dunbarton: near Boturich Castle, Balloch, Loch Lomond, GR 26/38.84. Marshy alder wood by shore. A. McG. Stirling, 1971, field record. 2nd record. H19, Kildare: Rye Water in Leixlip Demesne, GR 13/0.9. Shaded riverside. D. Doogue, 1970, field record. 2nd record.

663/23. *CAREX STRIGOSA* Huds. **42**, Brecon: mile south of Crickadarn, GR 32/09.40. Rocky bank of stream, 700ft. M. Porter, 1971, NMW. 2nd record. (*Nature Wales*, **13**: 44 (1972)).

663/33. *CAREX LASIOCARPA* Ehrh. **48**, Merioneth: Lasynys, Harlech, GR 23/5.3. Bog. P. M. Benoit, 1971, field record. Rediscovery of original Merioneth station.

663/52. *CAREX BIGELOWII* Torr. ex Schwein. ***67**, S. Northumberland: Peel Fell, GR 35/62.99. On bare peat on summit, 1970ft. G. A. Swan, 1970, herb. G.A.S. ***79**, Selkirk: north-east side of Capel Fell, Ettrick, GR 36/16.07. Mountain pasture, 2150ft. R. W. M. Corner, 1971, **BM**. Andrewhinney Hill, GR 36/19.13. Mountain pasture on south side, 2100ft. R. W. M. Corner, 1971, herb. R.W.M.C. 2nd record.

663/54. *CAREX PANICULATA* L. **99**, Dunbarton: Glen Loin, Arrochar, GR 27/30.06. Sedge swamp. A. McG. Stirling, 1969, field record. 1st post-1930 record.

663/55. *CAREX APPROPINQUATA* Schumach. ***79**, Selkirk: north side of Ale Water, west end of Ale Moor Loch, GR 36/38.14. Wet alluvium, 900ft. R. W. M. Corner, 1970, **BM**, **E**.

663/56. *CAREX DIANDRA* Schrank **99**, Dunbarton: Caldarvan Loch, Gartocharn, GR 26/41.83. Sedge swamp. A. McG. Stirling, 1968, field record. 1st post-1930 record.

663/67. *CAREX SPICATA* Huds. ***80**, Roxburgh: Smailholm Crag, GR 36/64.34. Foot of dry, south-facing cliff, 600ft. R. W. M. Corner, 1971, **BM**, det. A. C. Jermy.

663/68. *CAREX MURICATA* L. ***99**, Dunbarton: Milton, Dumbarton, GR 26/43.71. Grassy slope below basalt crag, 500ft. E. T. Idle and A. McG. Stirling, 1971, **E**, **GL**, det. A. C. Jermy.

663/69. *CAREX ELONGATA* L. ***99**, Dunbarton: Loch Lomond shore near Boturich Castle, Balloch, GR 26/38.84. Marshy alder wood. J. H. Penson, 1969, **BM**, **E**, **GL**, det. A. C. Jermy. 3rd Scottish record.

663/78. *CAREX PAUCIFLORA* Lightf. **99**, Dunbarton: Strath Dubh Uisge, Ardlui, GR 27/30.15. Peaty flushes, 1000ft. A. McG. Stirling, 1970, field record. 1st post-1930 record.

663/81. *CAREX DIOICA* L. **42**, Brecon: 3 miles south-west of Brecon, GR 22/96.25. Mountain bog, 1100ft. M. Porter, 1971, NMW. 2nd record. (*Nature Wales*, **13**: 44 (1972)).

670/3. *FESTUCA GIGANTEA* (L.) Vill. ***108**, W. Sutherland: below Drochaid Mhor, River Dionard, GR 29/36.60. Wooded river bank. A. G. Kenneth, 1971, field record, det. C. E. Hubbard.

†670/11. *FESTUCA LONGIFOLIA* Thuill. **33**, E. Gloucs.: Chedworth Nature Reserve, GR 42/0.1. Disused railway line. A. T. Ricketts, 1970, field record, conf. A. Melderis.

672/3. *VULPIA MYUROS* (L.) C. C. Gmel. **57**, Derbys.: Thorpe, GR 43/16.50. Railway ballast by disused station, 650ft. K. Hollick, 1971, **DBY**. 1st record for over 50 years.

676/6. *POA NEMORALIS* L. ***108**, W. Sutherland: Creagan Meall Horn, GR 29/34.46. Rock-ledge. A. G. Kenneth & A. McG. Stirling, 1971, field record, det. C. E. Hubbard.

676/9. *POA COMPRESSA* L. ***101**, Kintyre: Stonefield South Lodge, GR 16/86.76. Roadside wall. A. G. Kenneth, 1971, field record, det. C. E. Hubbard.

†676/15. *POA CHAIXII* Vill. ***28**, W. Norfolk: Sennowe Park, GR 63/00.26. Woodland ride by lake. A. L. Bull, 1970, field record.

686/1. *ELYMUS ARENARIUS* L. *99, Dunbarton: Kilcreggan, GR 26/24.80. Shingle beach. A. McG. Stirling, 1971, field record.

†692/1. *AVENA FATUA* L. *45, Pembroke: 3km east of Crymych, GR 22/21.32. Cornfields. T. A. W. Davis, 1971, field record. Persisted since c 1965. (*Nature Wales*, 13: 50 (1972)).

†692/2. *AVENA LUDOVICIANA* Durieu *28, W. Norfolk: Boal Quay, King's Lynn, GR 53/61.19. R. P. Libbey, 1971, herb. E. L. Swann, conf. C. E. Hubbard.

700/1. *CALAMAGROSTIS EPIGEJOS* (L.) Roth *44, Carmarthen: Llangennech, GR 22/56.01. Ditch and railway bank by marsh. S. B. Evans, M. Humphrey & I. M. Vaughan, 1971, NMW. 1st definite record. (*Nature Wales*, 13: 46 (1972)).

701/4. *AGROSTIS GIGANTEA* Roth 106, E. Ross: Saltburn, near Invergordon, GR 28/7.7. Rough ground by aluminium factory. U. K. Duncan, 1971, herb. U.K.D., conf. M. McC. Webster. 2nd record.

†713/2. *PHALARIS CANARIENSIS* L. *42, Brecon: near Penderyn, GR 22/95.08. Disturbed road verge. M. Porter, 1971, field record. (*Nature Wales*, 13: 44 (1972)).

Book Reviews

The Diversity of Green Plants. Peter Bell and Christopher Woodcock. 2nd edition. Pp. ix + 374. Edward Arnold, London. 1971. Price £5 (boards), £2.50 (paper).

This is the second and revised edition of the popular text-book of morphology, the first edition of which appeared only two years ago (see review in *Watsonia*, 7: 179 (1969)). As predicted in the first review, the abundant clear diagrams appeal strongly to first year undergraduates. In this revised edition over ten per cent of the text-figures have been either completely redrawn or else revised, thus greatly improving the value of the book. Hence most of the criticisms concerning the figures in the first edition, especially those of Bryophytes in chapter 4, have now been completely met.

The text has not been greatly altered but a number of passages have been skilfully redrafted. The introduction to chapter 2 has been largely rewritten, as has the cytology of the Cyanophyta, including a reference to nitrogen fixation by heterocysts. The authors have tried to place more emphasis on the developmental morphology, and the section on *Acetabularia* has been expanded from six to 25 lines. On this theme one can also note the new section in chapter 8 on 'Correlation within the plant body' and the mention of the growth of plants from single cells in culture experiments. However, as with most subjects covered in this book, this one is only very briefly touched on and the enquiring student will have to resort to the bibliography. The bibliography has been expanded from the original 86 to 107 references (these having been inserted with suffixes, *a*, *b*, so that the numbers still end at 86). The reference on p. 39 to no. 98 is thus an error. Both editions of this work have been singularly free from simple errors of this sort.

The evolutionary treatment has also received considerable reappraisal, with the rewriting of most of the passages concerned; e.g. chapter 4, 'The evolution of the Marchantiales'; chapter 5, 'The early Sphenopsida' and 'The origin of the sphenopsids'; 'The evolution of the Psilopsida' and, in chapter 6, 'The origin of the Filicinae' in which mention is made of Bierhorst's work on the genera *Stomatopteris* and *Tmesipteris*. In chapter 7, the morphology of the Progymnosperms *Archaeopteris* and *Archaeosperma* is discussed in relation to the evolution of the Gymnosperms.

Although the revisions cited may not seem at first sight to amount to much, they have added considerably to the value of the text. Thus this edition is a big improvement on the first and will without doubt be in even greater demand among sixth form and undergraduate students of botany.

P. D. W. BARNARD

Bibliographia Botanica Čechoslovaca 1965-1966. Z. Neuhäuslová-Novotná, O. Winkler and M. Pivoňková. Pp. 441 and map. Botanický ústav ČSAV, Průhonice and Prague. 1970. Price not stated.

This is the latest of a long series of bibliographic compilations which cover literature relating to the botany of Czechoslovakia from 1918 onwards. The more recent parts are cyclostyled with a printed cover, and are considerably larger and more detailed than those up to 1955. The present part contains references to 3528 papers and books. It covers a wide range of botany, including taxonomy, phytogeography, phytosociology, floristics, morphology, anatomy, applied botany, biography, botanical techniques, etc., and covers cryptograms as well as flowering plants. The entries are arranged in a hierarchical classification and alphabetically by authors in the lowest groupings. Cross-referenced indexes are given at the end for all authors and all plant groups

mentioned in the titles. The series is an important source of information on published work concerning the flora of central Europe, and it is gratifying to see that the time lag between the period being covered and the date of publication of the bibliography is gradually being shortened by Mme Neuhäuslová-Novotná and her collaborators as each succeeding part appears.

R. K. BRUMMITT

Flora of Cheshire. Alan Newton. Edited by J. Cullen. Pp. 258 + 16 plates, 8 coloured. Cheshire Community Council Publications Trust Limited, Chester. 1971. Price £2.80 + 20p postage.

It is a pleasure to see another important addition made to the list of British county Floras. Cheshire has hitherto been covered by only one previous Flora, that of Lord de Tabley, published in 1899 and now long out of print and very difficult or impossible to obtain. De Tabley's Flora was based on a manuscript completed about 1875, and this new Flora is thus effectively the first account of the plants of Cheshire for just short of 100 years.

Anybody expecting merely a new edition or updating of de Tabley will be in for a surprise, for Mr Newton's publication is one of a new style of county Flora which has appeared on the British botanical scene in the last few years. It aims to be essentially an account of the Flora as it appears at the present time, with very limited reference to past distributions or early records of plants. The information presented is based very largely on an impressive amount of field work carried out by the author and a team of collaborators over a relatively short period, 1964 to 1969, recording being done in the modern fashion using a grid system. Some 42 of the 258 pages are devoted to distribution maps, and with the first 66 pages being taken up with general chapters, only 108 pages, considerably less than half the book, are left for the traditional listing of species and citation of distributions. It is in fact the sort of Flora which would have been regarded by past generations of botanists with amazement and dismay, but those brought up in the computer age of botany may perhaps find the new style more pleasing and instructive than the verbose traditional county Flora. The inclusion of both colour and black-and-white photographs will, however, be welcomed by all.

The early chapters start with a brief three-page sketch of geology and physical features, followed by an important assessment of 'Gains and losses, 1875-1969', which proves to be a sad commentary on man's failure to conserve the native flora. The analyses of different habitats which occupy the next 45 pages should assist a future generation to compare the vegetation they know with that of the 1960's, but they do fill a considerable part of the book with unreadable matter which I suspect will be of little or no interest to most readers. From pages 38 to 56 we are presented with nothing but long lists of species recorded from different habitats or localities. When the space is at a premium owing to printing costs, is a county Flora really the place to record such lists? Could they not better be accommodated in some local natural history journal or deposited unpublished in some library archives, with an appropriate reference given in the published work?

Grid distribution maps are a welcome feature of the modern Flora. The intensive field survey carried out since 1964 has been based on a 5km grid which gives a total of 110 squares for the county, and in the text the frequency of occurrence in these squares is indicated for every species. Since the necessary data were thus evidently available, it is a pity that maps are published for only 412 out of approximately 1000 species recorded in the text. Some other matter could surely have been advantageously omitted to make room for more maps. Those who already have access to the *Atlas of the British Flora* (1962) and its *Critical Supplement* (1968), which map all species on a 10km grid, may find that the maps given here represent only a marginal improvement of coverage, the 5km grid giving only four times as much detail and less than half the species of the county being shown. The reproduction of the maps is not always as

clear as it might have been, and the dots come in two conspicuously different sizes of apparently no significance. I must also record my exasperation over the order of the maps, which are arranged in 28 successive alphabetical sequences designed to group together plants with similar distribution patterns, so that on one page we have, in order, isolated species of *Galium*, *Acer*, *Hypericum*, *Ranunculus*, *Viola*, *Carex*, *Genista*, *Ophioglossum*, *Pimpinella* and *Sanguisorba*. No cross reference is given in the text, and to find the map of any one species (if in fact it is given) one has to check the general index at the back. How much easier to use if the maps had been in systematic or one alphabetic sequence, when the species lists occupying pages 176 to 181 (but still not 181–183) would have been useful and meaningful instead of largely superfluous!

Valuable though distribution maps are, one wonders whether they compensate for the really very brief distributions given in the text. Apart from *Rubus* (which receives excellent detailed treatment reflecting the author's own specialist interest), only nine species receive more than five lines of comment, the majority receiving only two or three lines. The result is a very terse and dry account, with little to spark off the reader's interest or fire his enthusiasm. Compare for example the entry for *Euonymus europaeus*—'Rare. 4. Old woods on Keuper marl, 66 SE! 44! 78 SE, 88 SE, P. Newton' (and no accompanying distribution map)—with the detailed localities and interesting comments provided by de Tabley for the same species. Named localities are omitted in too many cases, and numbers and letters will not always satisfy the user. Entries such as that for *Malva moschata*—'Local. 10. Shaded river banks 44! 57 NE!; canal bank 65 SW; roadsides or casual elsewhere' (with distribution map)—or for *Stratiotes aloides*—'Rare 4. Apparently introduced in three ponds in Wirral, one near Chester, and one near Alderley Edge' (no distribution map)—will leave the field botanist frustrated and thirsting for more detail. How can any population be recognised in the future from such sketchy information? The need to protect rare plants from the depredations of collectors must always be borne in mind but does not convince me that a county Flora should be reduced to providing information so vague as to be of no use and little interest.

It is difficult to ascertain to what extent sources of information were consulted outside the particular field survey of the compilers. Certainly pre-1964 records are few and far between. Occasional earlier literature references are given, but, again excluding *Rubus*, I could find herbarium specimens cited for no more than five species. The *Atlas* and its *Critical Supplement* have evidently been consulted, but where records from these are mentioned there has been no effort to localise them beyond their 10 km square even though further details could presumably have been obtained by return of post from Monkswood. Thus to those who look for past history of the flora this book has little to offer, and for almost a century since de Tabley we still have little botanical record of the county. For many introductions not mentioned in de Tabley but now common, such as *Impatiens glandulifera*, *Polygonum cuspidatum* or *Calystegia silvatica*, there is no attempt to give their rate of spread or earliest record, though this is given for *Senecio squalidus* and *Matricaria matricarioides*. For both *Oenothera erythrosepala* and *Galinsoga parviflora* a literature reference is given for the first record, but amazingly no date is mentioned. Generally there is no indication whether the species is native or not. Even more disappointing is the omission of any information at all beyond the species name for many 'apparently extinct' plants. Although the Explanatory Notes tell us that 'last records have been inserted . . . where traced' this luxury is in fact rarely afforded. Bare statements such as 'Species apparently extinct: 382/6 *Centaureum littorale* (Turner) Gilmour: 385/1 *Gentianella campestris* (L.) Börner' leave one gasping for even a crumb of information about where they once occurred and should now be looked for (extensive details are of course given by de Tabley) or when they were last seen. There are even species recorded as native in de Tabley which are not even mentioned in the new Flora, as for example *Agrimonia odorata*, *Pyrola media* and *P. minor* and *Allium scorodoprasum*. We are left wondering whether such records are now considered erroneous, as pre-

sumably is de Tabley's uncertain inclusion of *Arctostaphylos uva-ursi* in Cheshire, or whether they have been overlooked.

In summary one may say that, as a factual record of six years of hard and painstaking field study, this book represents an excellent piece of work providing a much needed and valuable account of the present day flora of Cheshire. If, however, one prefers to view it in the light of a long tradition of British county Floras it may be found to leave a lot to be desired. It does not make entertaining or inspiring reading to the average person interested in the flora of the county, but then probably its author never intended that it should. It is a great pity if the economics of present-day printing and publishing dictate that an author with so much information at hand as Mr Newton must clearly have should produce a mere skeleton instead of the meaty and juicy offerings of so many county Floras of past decades.

R. K. BRUMMITT

New Research in Plant Anatomy. Edited by N. K. B. Robson, D. F. Cutler & M. Gregory. Pp. xii + 250. Published for the Linnean Society of London by Academic Press, London. 1970. Price. £6.00.

It was a happy idea of the Linnean Society to hold a symposium on plant anatomy in honour of Dr C. R. Metcalfe. The seven papers read, together with thirteen others, are now published in book form. They give some idea of the range of current activities in this discipline (though the developmental field is not represented), and are sufficiently diverse to nonplus the reviewer. I choose to comment on a few and leave the list of contents to the advertiser.

More than half of the papers have a taxonomic flavour, and the taxonomist is naturally interested in variability. C. A. Stace says of *Juncus effusus* and *J. conglomeratus* that one can usually distinguish between the species in any one locality; but the whole range of variation in different areas shows that the characters of the two species overlap. 'This state of affairs is exactly paralleled by the anatomical features.' Much labour must lie hidden in that brief sentence. Anatomical examination is more time-consuming than looking at characters that are visible with a hand lens; also there may be, at least amongst taxonomists, a slight tendency to think that anatomical characters are, somehow, less variable. Here, in *Juncus*, is one warning against quick judgements: another surprising one comes from R. A. Howard's valuable study of nodes with split-lateral traces. Amongst the species studied one proved variable: 20 shoots of *Alloplectus ambiguus* (Gesneriaceae) showed a constant pattern in the field, but the species produced no less than 9 variant patterns when grown in the greenhouse.

N. H. Brittan presents an account of anatomical species differences in *Thysanotus* and in general finds that the variation is between species and not within them; but in one case anatomical variation is present and may support recognition of two subspecies. However one is bound to notice here that the material of some species consisted of only a single collecting, and we are not told whether the populations were extensively sampled.

I. Kukkonen has compared *Carex microglochis* (5 specimens) and *C. camptoglochis* (2 specimens) anatomically and concludes that both are good species and occur in Tierra del Fuego, while *C. microglochis* is also in the northern hemisphere. Much wider samples of material, especially from Tierra del Fuego, are obviously desirable. E. S. Ayensu neatly uses anatomical characters to discriminate between two West African yams, *Dioscorea rotundata* and *D. cayenensis*. The material studied came from both Ghana and Nigeria, but how extensive it was and how it was sampled is not recorded. It is going to be just as important to give such information in species-level anatomy as it is to say how many species of a genus have been studied when reporting at a higher taxonomic level.

In the present volume generic-level work is represented by an account of *Ribes* by W. L. Stein, E. M. Sweitzer and R. E. Phipps, based on some 60 (out of c 150)

species representing all subgenera and sections. It is interesting that so large a genus shows considerable anatomical uniformity. M. Y. Stant discusses the affinities of the monocotyledonous saprophyte *Petrosavia*, which shares some interesting 'pseudodicotyledonous' features with another saprophytic group, Triuridaceae. A pigment-comparison would be worthwhile here, because *Petrosavia* is a pale yellow plant whereas all the Triuridaceae I have seen have a red colour throughout the plant body.

H. T. Clifford's numerical study of classification in the monocotyledons has the position of the grasses as its main theme. The conclusion that they are related to the palms is an interesting one and Clifford will no doubt have been greatly encouraged by A. P. Khokhriakov (*Bot. Zh. SSSR*, **56** (7): 932-938 (1971)), who expresses the same view: it is clearly worth following up. Clifford notes that the numerical study places a group of genera, including *Juncus*, *Rapatea*, *Sparganium* and *Typha*, close to the grasses and that they are mostly wind-pollinated plants of swampy habitats. He adds 'Neither of these attributes was included in the original data and so the results reinforce the suggestion that the plants are related.' That is his reaction. My own is to see a great red flag break from the masthead of his cluster diagrams. How many of the characters used could be correlated with wind-pollination? Certainly ovule number, anther attachment, some pollen characters and absence of nectaries are suspect.

Two interesting papers dealing with structure and activities of individual cells are those by Scott & Bystrom on mucilaginous idioblasts in *Hibiscus* and by Fahn and Rachmilievitz on nectar secretion in *Lonicera*. S. Carlquist considers the wood anatomy of some Euphorbias in relation to his previously expressed views on trends towards juvenilism: Tomlinson establishes true dichotomous branching in *Flagellaria*: Kaplan describes the rhachis leaves of Umbelliferae: Philipson considers some characteristics of Araliaceae. And at this point the reviewer apologises to those authors still unmentioned.

Earlier in this review I tried to spin a slender thread of anatomical variability in order to give some continuity. No such thread is supplied, for the papers are in no discernible order. The title itself is misleading; it might imply a *survey* of new research, not merely a *sample*. Admirable as these papers are, there is no scientific reason for publication as a book, rather than individually in a journal. That may seem an unfair criticism of a volume that is virtually a *Festschrift*. But a symposium is a meeting of minds, not just a conglomeration of papers. If this symposium was a success, as I have heard, there must have been some worthwhile comments or ideas thrown up in discussion. At very least an eye-witness account, summarizing the main points made, should have been added to the record. The Society must take to heart the old saying 'Four walls do not a prison make, nor two hard boards a book.' Books are expensive, and it is little less than a confidence trick to sell just another number of a journal in book form.

B. L. BURTT

Plant Anatomy: Experiment and Interpretation. Part 2. Organs. Elizabeth G. Cutter. Pp. viii + 343 with 184 figures. Edward Arnold, London. 1971. Price £6.50 (boards), £3.25 (paper).

The first part of this two volume work was reviewed in *Watsonia*, **8**: 169 (1970). In that review I looked forward to seeing the second volume, which promised to be both interesting and valuable. I have not been disappointed. The second volume covers the basic histology of organs in a fairly brief way. Its main value lies in the comprehensive treatment of developmental studies which helps to bring the whole subject to life for the student.

Printed on more suitable paper than the first volume, the well chosen photographs are in general of a higher standard of reproduction; line drawings are clear.

By careful selection of material and lucid writing, the author has produced a readable

work. Her enthusiasm for the subject is apparent and this has prevented the book from becoming merely a review paper.

The need for further research in so many aspects of developmental plant anatomy is made most obvious by this book. New, interesting lines of research are indicated. In my opinion it cannot fail to encourage others to engage in anatomical research. This book maintains the wide appeal of the first volume.

D. F. CUTLER

The Flora of Monmouthshire. A. E. Wade. Pp. 236, with two plates and two maps. National Museum of Wales, Cardiff. 1970. Price £2.25.

This is the first Flora to include the whole of the county of Monmouth (v.c. 35), though two earlier works have claimed the title: Clark (1868) and Hamilton (1909). Clark listed 671 flowering plants and 22 ferns, Hamilton 626 plants and 23 ferns and fern allies. A more important contribution to the county's botany is Shoolbred's *The Flora of Chepstow* (1920), in which 1004 vascular plants found within a radius of about twelve miles round Chepstow are listed: approximately half the area covered is in Monmouthshire and half in West Gloucestershire.

The Introduction opens with a detailed history of the study of the Monmouthshire flora from Parkinson (1640) and John Ray (1662) to Shoolbred (1920) and the thorough explorations of the north-eastern part of the county by S. G. Charles between 1924 and 1951: most of Charles's field records are supported by specimens in the National Museum of Wales. Mr Wade's exploration of the county's botany extended over 45 years. He served in the National Museum for 42 years, from 1942 until his retirement in 1961 as Assistant Keeper of Botany. Such experience enabled him to write this Flora with the assistance only of his ready access to the National Herbarium's collection and records from casual field observers.

The county is divided into five botanical districts. A short description of each relates the occurrence of characteristic types of vegetation to their geology and topography, mentioning some of the noteworthy and local species to be found in them. The account of the districts is followed by a longer chapter on the Geology of Monmouthshire contributed by D. Emlyn Evans. Two folding maps show the division of the county into botanical districts and its solid geology respectively. They open to face one another so that the distribution of the geological formations in the districts can readily be appreciated. The geology is treated rather from the geologist's than the botanist's point of view. We are told that glacial deposits 'cover large tracts of the county' and alluvial deposits the lower parts of the valleys, but their distribution is not shown. The descriptions of the districts are very brief and do not show the full range of habitats and plant communities to be found in each of them. They are given only five pages whereas the geology gets thirteen and the history deservedly eight. The necessity to economise on space and to keep the cost at a reasonable figure is appreciated, but half that given to the geology could have been better used in fuller descriptions of the districts. For instance, it would have been interesting to hear more about the Honddu Valley and Lady Park Wood in District 1, the particularly interesting marsh in District 3 and the native woodlands on the limestone and the limestone grasslands of District 4. Threats to some interesting communities are mentioned, but nothing is said about what efforts are being made to protect at least selected examples of threatened types of vegetation, such as the Nature Conservancy's Forest Nature Reserve at Wynd Cliff and Blackcliff on the limestone of the Wye Valley. The Monmouthshire Naturalists' Trust also has nature reserves.

The arrangement of the systematic list follows Dandy (1958) and the nomenclature of that work brought up to date by revisions published in this journal (Dandy 1969). English names are those given in Hyde & Wade (1957) and Hyde, Wade & Harrison (1969). For each species the habitats in which it has been seen in the county, its frequency, status and the botanical districts in which it has been recorded are given.

Localities within the districts are given for species other than common ones, with the recorder's name and, in the case of those supported by a specimen, the herbarium indicated by a sign. A list of recorders in the Introduction (which includes authors of published records) has the date or period during which they contributed records, so that the approximate date of any record can be found readily. The terms used to denote status are clearly defined. There are no distribution maps or references to the National Grid. The map of the botanical districts based on the quarter inch Ordnance Survey map has the 10km grid lines, but they are not numbered. The reason for no use having been made of the grid may well be that too great a proportion of the records cannot be fitted accurately in it. This, the principal part of the *Flora*, is clear and concise. There is a full bibliography in which 74 references are cited. The plates show woodland and Carboniferous Limestone cliff in the Wye valley and estuarine clay flats.

Botanists who experienced the prompt and careful check Mr Wade made of specimens they sent to the National Museum while he worked there will not be surprised at the excellence of this generally well planned *Flora*. The reproduction, lay-out and printing are good and it is a valuable contribution to Welsh botany; good value at the price.

REFERENCES

- CLARK, J. H. (1868). *The Flora of Monmouthshire*. Usk.
 DANDY, J. E. (1958). *List of British Vascular Plants*. London.
 DANDY, J. E. (1969). Nomenclatural changes in the *List of British Vascular Plants*. *Watsonia*, 7: 157-178.
 HAMILTON, S. (1909). *The Flora of Monmouthshire*. Newport.
 HYDE, H. A. & WADE, A. E. (1957). *Welsh Flowering Plants*. Cardiff.
 HYDE, H. A., WADE, A. E. & HARRISON, S. G. (1969). *Welsh Ferns, Clubmosses, Quillworts and Horsetails*. Cardiff.
 PARKINSON, J. (1640). *Theatrum Botanicum*.
 RAY, J. (1662). Itinerary iii. In *Memorials of John Ray* edited by E. Lancaster, 1846. London.
 SHOOLBRED, W. A. (1920). *The Flora of Chepstow*. London.

T. A. W. DAVIS

Flora of New Zealand. Volume II. Indigenous Tracheophyta. Monocotyledons except Gramineae. Lucy B. Moore and Elizabeth Edgar. Pp. 354. A. R. Shearer, Government Printer, Wellington. 1970. Price \$4.50.

The British botanist might be forgiven for dismissing a *Flora of New Zealand* as being of little interest. However, this second volume, covering the monocotyledon families but excluding the grasses, contains much concise, accurate and often carefully illustrated information relating to many genera well known in the north temperate flora as for example *Carex*, *Juncus* and *Luzula*. A number of genera often cultivated in the British Isles, among them *Libertia*, *Cordyline* and *Phormium*, add further interest.

The format follows closely that of Volume I by H. H. Allan, which covers the dicotyledons. There are full family, generic and specific descriptions, good keys and clear distributional notes; and in most cases the nomenclatural type is cited. The text is often enriched with annotations on the nomenclature or taxonomy and an explanation of the treatment adopted is sometimes included. A very full synonymy is cited and this adds considerably to the value of the work. Difficult aspects of morphology, as for example the more complex structures of the Orchidaceae, and salient features are illustrated with clear and simple line drawings. It would perhaps have been useful if more illustrations of *Carex*, especially of the utricle, had been included.

Within the various treatments I am pleased to see that Dr Edgar adopts a conservative view of *Scirpus* and mainly follows Koyama in recognising sections and

not segregate genera. However, somewhat in contrast, Dr Moore has segregated *Sparganium* and *Typha* into separate families.

It is a pity that the authors had to include new combinations and taxonomic and nomenclatural changes in the volume when they had already published the majority of their newly recognised taxa in a series of precursory papers. Publication of such nomenclatural changes in the text of a flora of this kind is regarded today by many workers as unsatisfactory.

In addition to the main text there is a bibliography of taxonomic literature relating to the New Zealand flora between 1959–1968, complementing and continuing that found in Volume I. This is additionally useful in being cross-referenced both alphabetically by author and systematically by family. Inevitably these ‘annals’ are not exhaustive, which would be an almost impossible task, as some recent important references seem to have been omitted. However, this list, together with a list of chromosome numbers for all New Zealand flowering plants, will be an invaluable compilation for workers on the flora of the region and it is to be hoped that provision can be made for both to be kept up and published at intervals in the future.

This work may be recommended to both the Flora writer and the Flora user as a model of its kind and Dr Moore and Dr Edgar must be congratulated on such an excellent production. We look forward to seeing the series completed in the not too distant future.

I. K. FERGUSON

Andalusian Flowers and Countryside. Lt.-Cdr. C. M. Stocken. Edited by A. P. Hamilton. Pp. 184, with 128 plates (14 in colour) and 17 pages of maps. Mrs E. M. Stocken, Mariners, Thurlestone, S. Devon. 1969. Price £1·00, including packing and postage.

Lt.-Cdr. Stocken was an outstanding plantsman who managed throughout his naval career to maintain an active interest in botany and horticulture. This posthumous publication arose out of his posting to Gibraltar between 1961 and 1965, which enabled him to make extensive travels in the adjacent parts of Andalucía where he studied the wild and cultivated flora and made many photographic records.

His tragic death while leading the Royal Navy Expedition to East Greenland in 1966 came before the manuscript of this book was completed. Fortunately Anthony Hamilton, who had been involved in the early stage of its planning, undertook to complete the manuscript, revise it and prepare it for publication. This is always a difficult job and we must all be grateful to him for undertaking this labour of love and making Lt.-Cdr. Stocken's work available.

The book is difficult to describe. Basically it is a discursive guide to botanically interesting areas of Andalucía, liberally spiced with information on geography, history, customs, ornithology and other topics. The style is like that of plant-collecting articles in the *Journal of the Royal Horticultural Society* and the *Bulletin of the Alpine Garden Society*. The information is generally accurate and is certain to be of value to botanists planning to travel in the region.

The book is extremely well illustrated with 64 pages of plates, five of which are in colour. Most of them are portraits of plants or of vegetation and several are of gardens. They form a valuable collection and greatly enhance the value of the work. There are also numerous topographic maps prepared by the editor which cover the areas described in the text. It is unfortunate that the lettering is often almost too small to be legible without a magnifying glass.

In addition to the main sections on Andalucía, there is a chapter on Morocco and another on ‘Gardens and Gardening on the Costa del Sol’, plus an appendix listing the plants commonly grown there and another listing the wild and naturalised plants by month. There is a short bibliography of botanical references for the areas covered and a bibliography of articles written by Lt.-Cdr. Stocken or by other authors referring to plants he collected. A comprehensive index completes the book.

Altogether this is a delightful book which no botanist, amateur or professional, visiting the south of Spain should fail to purchase. It can also be generally recommended for the intelligent tourist.

V. H. HEYWOOD

The Flowering Plants and Ferns of the Isle of Man; an annotated List. D. E. Allen. Pp. 101. The Manx Museum and National Trust, Douglas. 1969. Price 30p.

No published Flora of the Isle of Man exists, and nearly 40 years have elapsed since the publication of C. I. Paton's *A list of flowering plants, ferns and horsetails of the Isle of Man*. The appearance, therefore, of D. E. Allen's annotated list of the vascular plants of the island, the forerunner of a comprehensive Flora, is most welcome.

The booklet commences with a brief account of the geography and topography of Man, and follows with a systematic list of the plants found on the island with popular, Manx and scientific names, together with data on status, habitat preference and frequency, and precise localities for the rarer species.

Two appendices are provided, the first treating conifers widely planted by the Forestry Board, and the second being a list of species and subspecies which are as yet unrecorded for Man but may yet be found to occur there.

The work is well produced and very reasonably priced and is a 'must' for botanists visiting the island.

D. H. KENT

Finding Wild Flowers. R. S. R. Fitter. Pp. 415 + 32 half-tone plates. Collins, London. 1971. Price £2.00

This book is a companion to the excellent *Pocket Guide to Wild Flowers* by David McClintock and R. S. R. Fitter published in 1956. Divided into three parts, the first is a brief introduction to books, equipment and classification. Of the recommended books on plant ecology, two are far above the level of the beginner and the third off-putting on account of its size and cost. There is no mention of Tansley's very readable *Britain's Green Mantle*, of which the 1968 edition provides an ideal, inexpensive, and up-to-date introduction.

Part II of the book is described as 'a complete key, based on flower-shape and colour and leaf-shape, to British flowering plants and ferns', and runs to 219 pages. Starting with a primary division into Woody and Non-Woody Plants, the user has to make a series of decisions leading in some cases to a genus, or part of a genus, in others to a selection of quite unrelated species. The value of this can only be tested by the people for whom it is intended but there can be little doubt that, if they persevere far enough, they will benefit from the apt descriptions of species. Here Mr Fitter's mastery of words comes into its own with such phrases as '*Rapistrum orientale* . . . like Charlock but with pods shaped like Chianti bottles . . .', and '*Silene acaulis* . . . whose bright rose-pink flowers star its rich green leafy pincushions on our higher mountains . . .'.

The third part, of 142 pages, 'Where to Look', is a 'Topographical Guide' preceded by a brief account of the main habitat types. The half-tone plates provide superb photographs of plants characteristic of these habitats. For each county in the 'Guide' there is a general description, list of habitats, an account of special plants, local societies, museums, etc., and literature. This is entirely new and the compilation, even with the help of a long list of county correspondents, a heavy task spread over a good many years. Many localities are listed which are little known except to local naturalists, and an especially welcome feature is the provision of quick reference to the ownership of reserves and the need for permits for access or deviation from public paths.

In many respects this book is commendably up to date, in others surprisingly out of

touch with the current position. Users of the *Pocket Guide* will be puzzled by changes in scientific names and the introduction of some new English ones—such as ‘Arctic Bladder Fern’. The literature cited county by county is based on Perring’s 1964 list and some important accounts published since are not included—such as Le Sueur & McClintock’s *Alderney Check List*, 1964 and Wade’s *Flora of Monmouthshire*, 1970. One would wish that more of the statements on the lines of ‘more plentiful here than anywhere else in Britain’ were still true, and that rarities were still in old localities cited. One example which can be given without conservation risk is *Pinguicula grandiflora*, which is said to be ‘established on Tremithick, Trungle’ (spelt ‘Tringle’) ‘and several other W. Cornish moors’ (p. 271). It is 35 years since I was shown the last sickly plant known to Penzance botanists, and in 1971 a search in Devon, or at two localities in Somerset, would be more likely to be rewarded with success.

Mr Fitter is to be congratulated on compressing so much information into a convenient volume, and the publishers on making it available at such a modest price at a time of rapidly rising costs.

J. E. LOUSLEY

Pollen: Development and Physiology. Edited by J. Heslop-Harrison. Pp. xi + 338. Butterworth, London. 1971. Price £7.00

This book is based upon papers presented at three meetings on aspects of pollen physiology, biochemistry, structure and genetics held in the U.S.A. in 1969. Review papers and abstracts of research reports are presented under five headings: Nucleus and cytoplasm in microsporogenesis; Pollen development and the pollen grain wall; Pollen and pollen tube metabolism; Pistil-pollen interactions; Incompatibility. But the volume is not simply a verbatim record; the authors of the principal papers have, it says in the preface, extended their texts and have included additional material to cover certain topics not touched on in the meetings. The book is, therefore, rather more than a volume of proceedings.

In palynology, as in almost every other discipline, there has been in the last decade a considerable increase in research activity and it has become difficult for those who are only moderately interested or involved in only one aspect of the subject to keep abreast of the literature announcing the discoveries. It is to these people that review papers are of especial value and they will not be disappointed by those in this volume. They are clear in expression and arrangement and, refreshingly, easily intelligible.

The twenty-five research reports on the other hand are somewhat variable, both in content and presentation. As might be expected, the significance of the information presented in some will be understood only by those who are themselves involved in similar research. A deficiency here, perhaps, is the exclusion of the general discussion which probably took place after each presentation, for such discussion often enhances the value of a paper for a general reader. Nevertheless, the publication of these reports will be welcomed by those who are working in pollen physiology, biochemistry, structure or genetics and who were not at the meetings.

The review papers and their authors are: Physiology and biochemistry of meiosis in the anther (J. J. Sauter); The cytoplasm and its organelles during meiosis (J. Heslop-Harrison); The role of the tapetum during microsporogenesis of angiosperms (P. Echlin); The pollen wall: structure and development (J. Heslop-Harrison); Recent developments in the chemistry, biochemistry, geochemistry and post-tetrad ontogeny of sporopollenins derived from pollen and spore exines (J. Brooks and G. Shaw); Pollen chemistry and tube growth (R. G. Stanley); Pollen enzymes and isoenzymes (J. L. Brewbaker); Pollen tube growth and fine structure (W. G. Rosen); RNA and protein synthesis during pollen development and tube growth (J. P. Mascarenhas); Pistil-pollen interaction in *Lilium* (W. G. Rosen); Advances in the study of incompatibility (C. E. Townsend).

J. M. PETTIT

Oxford Biology Readers. Edited by J. J. Head and O. E. Lowenstein. Pp. 16. Oxford University Press, London. 1971. Price 20p.

No. 3. *The Mysterious Origin of Flowering Plants* by K. R. Sporne.

No. 9. *Photosynthesis* by C. P. Whittingham.

No. 10. *Studying the Past by Pollen Analysis* by R. G. West.

No. 12. *Mycorrhiza* by J. L. Harley.

No. 15. *Phloem* by F. B. P. Wooding.

This series of *Readers* covers a wide range of topics in biology, in all of which active and important researches are taking place. Each booklet is written by an acknowledged expert in his chosen subject, and presents an up-to-date picture of present-day knowledge. It is only possible to do this within the compass of sixteen pages by assuming a basic knowledge on the part of the reader, using technical terms, and by a thorough sifting of all the matter that might be included. In consequence these booklets are not for the beginner, but they afford useful summaries for a trained person, or anyone in training, who wishes to know what is going on in branches of science not immediately his own. The booklets are well produced, effectively illustrated and are good value at the price of 20p.

It is clear that the more physiological the topic discussed, the more it depends on advanced concepts of physics and chemistry, and the harder it becomes for the average reader to follow the arguments and to assimilate the results. An easily comprehended account of photosynthesis in 16 pages is an impossibility, and had Professor Whittingham attempted rather less a more successful *Reader* might have emerged, however excellent his summary is. To a lesser extent the same is true of Dr Wooding's 'Phloem', where the discussion is so dependent on an up-to-date knowledge of cell structure as revealed by electron microscope studies. Two of the remainder, namely those by Dr R. West (on pollen analysis) and Dr K. R. Sporne (on the flowering plants), depend for their full impact on a considerable amount of specialised knowledge, in the first of pollen formation and diversity, and in the second of a number of rare groups of plants, some fossil, which comparatively few people have seen or know. Both booklets, however, show how alive these subjects can be; this is particularly true of Dr Sporne's *Reader*, where a subject involving traditional morphology, anatomy and palaeobotany is shown to be capable of yielding fresh results with the aid of new and complex techniques.

Perhaps *Mycorrhiza* by Professor Harley is the most satisfactory of the five. Maybe the subject is one that intrinsically has a greater appeal and of which our knowledge has not yet attained too great a complexity. In these circumstances it becomes an ideal subject for this series.

C. T. PRIME

Advances in Botanical Research. Volume 3. Edited by R. D. Preston. Pp. xi + 309. Academic Press, London & New York. 1970. Price £4.75.

The first two volumes of this series appeared in 1963 and 1965 and it is therefore surprising that the third volume, published five years later, should contain only four articles each covering only a very restricted field. Nevertheless one of these, 'Monocotyledons—Towards an Understanding of their Morphology and Anatomy', by P. D. Tomlinson (pp. 207–292), is of considerable interest to taxonomists and complements an earlier review on the same topic by C. R. Metcalfe in Volume 1.

Tomlinson's paper is neither a review of past work nor a progress report, but rather a strong argument in favour of a realignment of thought on monocotyledons, both in research and teaching, based on the belief that tropical groups such as Palmae, Scitamineae and Bromeliaceae have a great deal more to tell us than the familiar but relatively specialized lilies, orchids and grasses. His main topics are growth habits (with emphasis on arboreal examples), the axis, and the inflorescence. Many ideas on

monocotyledon evolution are debunked, and although alternative theories are not always provided one is left with an overall impression of refreshing clear-sightedness.

It is not to be expected, of course, that a reviewer will find himself in complete agreement with every idea put forward, and it is perhaps not profitable to point out specific areas of discordance. In two places, however, serious lapses in checking or editing have been found. In a series of figures (p.216) purporting to illustrate the growth of a dicotyledonous tree the distance of the lowest branch from the ground has, by some unnamed process, increased by about 50 per cent. On p. 285 a short paragraph headed 'Basipetal Sequences' discusses only acropetal development which is, surely in error, said to be the rule.

The detection and eradication by the reader of these shortcomings are a small price to pay for such a stimulating discussion.

C. A. STACE

Chemotaxonomy and Serotaxonomy. Edited by J. G. Hawkes. Pp. xvi + 299. Academic Press, London. 1968. Price £4.20.

It may be queried why one should review a book three years after its publication. After all, reviewers often grumble about delays in the production of Symposia volumes, so it is likely that those responsible for this excellent book might rightly take umbrage at the tardiness of a Reviewer who delays producing his comments for as long as this. But I am glad I did. Too often as a Reviewer one puts one's first impressions, 'a worthwhile addition', 'a well-produced volume', in the clichés of the Art. A longer and closer association with a book might be more profitable. And this is exactly what has happened in this case. I have used much of the information the volume contains in teaching over the last three years and, as a result, can really recommend that it should be read (and re-read) by all interested in systematic problems. By dealing with many different aspects of the application of biochemistry to phylogeny and taxonomy in all kingdoms of organisms, it gives an all-round view which has not changed with the years. I hope that all those who haven't read it will do so, and that those others who may perhaps have glanced at it when it first appeared return to it for refreshment as I do continually, finding something new. The production is good, the choice of subjects and their treatment could not have been bettered, and the result is a book which is a landmark in the area.

T. SWAIN

Speciation in Tropical Environments. Edited by R. H. Lowe-McConnell. Pp. 246, with 9 tables, 52 text figures and 3 plates (2 coloured). Academic Press, London & New York. 1969. Price £4.00.

The 15 papers contained in this volume, which is a hard-backed edition of Volume I, numbers 1 and 2 of the *Biological Journal of the Linnean Society*, were given by invited contributors to a symposium held in 1968 and organized by the Linnean Society of London and the Tropical Group of the British Ecological Society.

Eight papers are by botanists. They cover a wide range of topics—Ashton on tropical forest trees, Brieger on neotropical orchids, Hedberg on the Afro-alpine flora, Mantón on evolutionary mechanisms in tropical ferns, Richards on tropical rain forest, van der Pijl on evolutionary action of tropical animals on the reproduction of plants, van Steenis on non-adaptive saltatory evolution and Whitmore on evolution in Malaysian *Macaranga*.

Tropical vegetation is both complex and imperfectly understood, and, on the evidence presented here, seems to lend itself more to speculation and ill-supported generalisations than to critical study.

Studies of speciation should be based on a comprehensive, not superficial, knowledge of the variation of *entire species and their closest relatives* and not merely, as

is the case of most modern work on North Temperate plants—a few Californian endemics excepted—on geographically limited parts of species. Unless the breeding systems are known the interpretation of such knowledge is hazardous. In interpreting geographical patterns of variation or geographical or ecological distributions, the known facts of Pleistocene (and earlier) climatic change should be taken into account. Too often in this symposium it has been assumed (by botanists) that tropical rain forest represents ‘a conservative homoeostatic environment’ (p. 85), ‘a constant ecological environment’ (p. 111), or ‘a seasonal and geological stability of climate’ (p. 155). This is only true for those parts of the tropics that have enjoyed a rain forest climate throughout the Pleistocene, but, as zoologists are aware (see for instance Mayr’s paper in this volume, and Moreau’s book, *The Bird Faunas of Africa and its Islands*, discussed by Cain in his summing up), extensive areas in the tropics that are occupied by rain forest today recently supported other vegetation types.

Comprehensive studies of particular groups or specific ecological problems have more to contribute than broad surveys based on eclectically selected and sometimes erroneous facts and suppositions. Although all the botanical papers in this symposium contain some stimulating ideas and interesting facts, it is those with more limited objectives that are most successful, especially Hedberg’s.

Ambitious explanations of complex phenomena should be based on accurate facts or should at least be consistent with what is known. Unfortunately one’s confidence in some of the interpretations offered in this volume is undermined by the frequent occurrence of contradictory statements (both by the same and by different authors), unsupported generalisations, and in some cases erroneous facts. A few examples must suffice.

Malaya and Borneo, according to Whitmore (p. 223), were last separated in the Pleistocene, but Ashton implies (p. 189) that Borneo has been ecologically isolated from Malaya since the mid-Tertiary. Van Steenis (p. 103) suggests that some unusual structures, like the pitcher of *Nepenthes*, which may be teratological in origin, have survived because of the ‘low competitive intensity’ of tropical rain forest, but Ashton (p. 173) emphasises the importance of competition, especially intra-specific competition within the first few years of growth.

Our ignorance of the breeding systems and pollination ecology of tropical plants is abysmal. This has not prevented Fedorov (*J. Ecol.*, **54**: 1–11 (1966)), disregarding what little evidence there is, from postulating that in tropical rain forest cross-pollination is difficult and that genetic drift prevails over natural selection. Speculation plays such an important part in tropical botany that Fedorov’s paper is taken seriously by all four contributors to this volume who deal with general topics. The longest paper (Ashton’s) is chiefly concerned with refuting Fedorov, but the refutation is largely (and avowedly) speculative, and Ashton is far from clear as to the importance of autogamy—‘mechanisms favouring autogamy appear to be extremely rare among rain forest trees’ (p. 178), and yet ‘tropical tree taxa as exemplified by South Asian Dipterocarpaceae possess . . . an unspecialized pollination mechanism in which autogamy is usual’ (pp. 155, 189–190).

So much for contradictions. The factual basis of some of the arguments is also false.

According to Ashton (p. 172), ‘many temperate tree species . . . have far wider ecological ranges than any tropical tree species’. This simply is not true; witness *Symphonia globulifera*, *Parinari excelsa*, *Trema orientalis*, *Diospyros ferrea*, *Dodonaea viscosa* and countless others. Cain’s reference (p. 233) to Mercator’s projection may be relevant here. Richards cites the well-known fact that a very large number of *Shorea* spp. and other ‘nearly related’ groups of Dipterocarps occur in the A storey of tropical rain forest in south-east Asia, adding (*inter alia*) that in Africa the occurrence of numerous congeneric species of *Diospyros* in the B and C storeys is *equally* striking. This is indeed new, but totally at variance with the facts. Brunei (area 2226 square miles) has 152 Dipterocarp species of which 75 belong to *Shorea*. The entire Guineo-Congolian rain forest region of Africa (area approximately 700,000 square miles)

has fewer than 90 species of *Diospyros* since that is the total number known for Africa as a whole. Furthermore the rain forest species cannot, by any stretch of the imagination, be regarded as 'morphologically similar', nor biologically similar.

In contrast the zoological papers are more successful, possibly because they are concerned with well-defined aspects of speciation, illustrated by particular groups—land snails (Clarke & Murray), African Blackflies (McCrae), tropical fresh-water fishes (Lowe-McConnell) and Madagascar lemurs (Petter), and two papers on birds (Mayr, MacArthur).

In his lucid summing up Cain quotes the jibe that the evolutionary thinking of botanists is 50 years behind that of zoologists. Botanists certainly have much to learn from zoologists, but it must be remembered that the task of the zoologist is infinitely simpler. Not only are his taxa usually more sharply defined and less variable, but he is concerned with faunas which have established their distributions since the last major climatic change of the Pleistocene. For the tropics, unlike most of the North Temperate zone, recent patterns of plant distribution and variation are often superimposed upon the remnants of earlier patterns, sometimes possibly of remote origin.

F. WHITE

Variation et spéciation chez les végétaux supérieurs. M. Bidault. Pp. viii + 145 + 47 figures. Doin Editeurs, Paris. 1971. Price not stated.

In the last few years, several short texts on experimental taxonomy or biosystematics have appeared. The book under review, by Dr M. Bidault, formerly at the University of Paris (Orsay) and now at the University of Besançon, is particularly welcome as the first of its kind to be published in France. Dr Bidault is known for his distinguished work on the experimental and numerical taxonomy of *Festuca ovina* agg. and, as he shows in his book, he is very well qualified as an exponent of modern views on variation and evolution in higher plants.

The book is divided into three sections. The first deals systematically with the different kinds of characters which are used by the taxonomist and the student of evolution in classifying variation, and with the ways in which these characters are distributed in individuals, populations and species.

The second part deals with the origins of variation, distinguishing first phenotypic from genotypic variation and then going on to discuss the different kinds of cytological and genetical factors involved, extending to hybridization and introgression. The action of the environment and the role of natural selection are then considered, and there is a description of ecotypic variation.

The third part deals with speciation and with taxonomic units and methods. Speciation is discussed mainly under the headings of the different kinds of isolating factors. There is a fairly detailed account of taxonomic units, centred mainly on the species; and a good deal of space is devoted, under method, to numerical taxonomy.

It is obvious that the area covered is very wide, so that treatment in depth can rarely be given; but everything is very well set out, the treatment is thoughtful and critical, and the examples are well chosen. The 47 figures, mainly graphs and line-diagrams, are clear and to the point. The work has a flexible cover and is well bound.

To those who wish to have a bird's eye view of the modern systematics of higher plants, this book can be thoroughly recommended; schools and universities will certainly find it useful. Not all recent developments are included and it would be easy to suggest additions, but given the limitations of space, the job is well done.

D. H. VALENTINE

Obituaries

ROGER WILLIAM BUTCHER

(1897-1971)

Roger William Butcher, D.Sc., B.Sc., Ph.D., F.L.S., F.Inst.Biol., died on 13th October, 1971 in Weymouth Hospital at the age of 74. He was the last surviving member of the Advisory Committee appointed in 1930 by Dr G. C. Druce to organise the affairs of this Society on his death, well known to members for his illustrated books and work on British flowering plants and ferns, and to others for his professional work on algae and pollution.

Butcher was born on 25th July, 1897, at Ashbourne, Derbyshire, where he was educated at the Grammar School. His first job was with the Tomato Diseases Laboratory at Cheshunt, which he left after nine months to work in the Herbarium at the Royal Botanic Gardens, Kew. His crabby writing is still familiar there on species covers, etc., and changed little during the rest of his life. On 1st July, 1925, he joined the Ministry of Agriculture and Fisheries as Assistant Naturalist and was stationed at Cambridge, where he worked on sugar beet pollution of the River Lark below Icklingham. On transfer to Barnard Castle he used a laborious technique of counting certain species of algae as an index to pollution of the River Tees. A move to Alresford, Hants., followed and there, about 1936, he had access to fishery tanks with controlled water flow which enabled him to carry out experimental work on water crowfoots, while he continued with his professional duties on pollution in the Bristol Avon and other rivers. From about 1939 to 1953 he lived at Bramcote, Notts., working in a laboratory with the Trent River Authority and using algae to assess pollution in the Rivers Trent and Ancholme. After a short stay at Conway he moved on 5th October, 1953, to the Fisheries Laboratory, Burnham-on-Crouch to work on marine flagellates until his retirement on 30th June, 1963, when he moved to Weymouth. His friends in the BSBI knew little of his work on marine algae which followed and I am grateful to Dr H. A. Cole for his appreciation which appears below.

Roger Butcher's interest in British field botany was characterised by a dynamism and single-mindedness which overcame all difficulties. By the time he went to Cheshunt he had a good working knowledge of flowering plants and recorded a number of interesting Middlesex flowers. Well before he was 30 he started on the preparation of *Further Illustrations of British Plants*, which was published in 1930. In this he had the happy collaboration of Florence Strudwick, a brilliant botanical artist who had the rare ability to combine extreme accuracy with a vivid and immediately recognisable impression of the living plant. Butcher carefully selected suitable material and provided detailed instructions about the characters to be shown. Together they set a new standard for the illustration of British plants which has yet to be equalled.

The difficulties he overcame in collecting material were so great that they are difficult to appreciate in this motorised age. For example, he travelled to the Isle of Arran for the two Sorbi overnight in a third-class railway carriage and back the next night. His stay in Arran was so short that he claimed to have persuaded the railway company to issue a day excursion ticket from London for the first time. During the preparation of *Further Illustrations* he became much interested in *Thalictrum* and described and illustrated three 'new species'. A further account, which appeared in 1934, was notable for the inclusion of distribution maps and had support from some

cultivation experiments (*J. Bot., Lond.*, **72**: 153–165 (1934)). Although his conclusions were challenged he remained convinced of their validity to the end. In the early thirties the decrease of eel-grass (*Zostera*) was causing great concern and Butcher worked on this, publishing two papers in 1934 (*J. Cons. perm. int. Explor. Mer*, **9**: 49–65, & *Rep. botl Soc. Exch. Club Br. Isl.*, **10**: 592–7), and another in 1941 (*Int. Wildfowl Inquiry*, **1**, 29–49). He was not the first to experiment on the effect of submergence on British batrachian ranunculi (Curnow, for example, experimented much earlier) but Butcher's paper published in 1940 was important, and he wrote again on these in 1949 and 1960 (*Proc. Linn. Soc. Lond.*, **152**: 180–189; in Wilmott, A. J., *British Flowering Plants and Modern Systematic Methods*: 46–47; *Naturalist*, **1960**: 123–5).

His *magnum opus* (literally!) was *A New Illustrated British Flora* in two fat volumes published in 1961. Using the Strudwick drawings as a nucleus, the remaining species were drawn by a devoted team to an almost equally high standard. The outstanding feature of this book, as a leading botanist recently reminded me, is that it reflects Butcher's familiarity with plants in the field and his independence in not copying what appeared in earlier works. The specimens drawn were preserved and are still with his herbarium in the possession of Mrs Butcher.

Butcher joined the Botanical Society and Exchange Club of the British Isles (as the BSBI was then known) in 1921 and was soon accepted by the close group of friends, including Lady Davy and Gertrude Bacon (later Mrs T. J. Foggitt) associated with George Claridge Druce, the only officer. Only a fortnight after the death of Druce, the Advisory Committee he had named met on 15th March, 1932, when they were joined by other leading members. For the first time the affairs of the Society were placed on a democratic basis, and we owe a great debt to their decisions, in which Butcher played a very active part. He served on the General Committee until 1939, on the Excursions and Field Work Committee from 1937 to 1939, and as Vice-President from 1951 to 1955. At our meetings he remained a much-loved figure, and not less so for his stubbornness in raising awkward questions and persisting against all opposition. His gravelly voice, holding forth on such subjects as the iniquities of charging fees for field meetings, will be familiar to members who attended Annual General Meetings. Even when he was wrong he rendered a great service by breaking the silence arising from apathy and provoking member participation in the Society's affairs. Roger Butcher served the Society for half a century and made a substantial contribution to British botany.

I am very much indebted to his widow, Margaret, to Dr Mary Parke of The Laboratory, Citadel Hill, Plymouth, to P. C. Wood of the Fisheries Laboratory, Burnham-on-Crouch and to Dr H. A. Cole of the Fisheries Laboratory, Lowestoft for their assistance in the preparation of this appreciation.

J. E. LOUSLEY

When Dr R. W. Butcher moved to the Fisheries Experiment Station, Conway in 1953, and later that year to the Fisheries Laboratory, Burnham-on-Crouch, he began work on the systematics and ecology of the smaller marine flagellates, especially those found in coastal and estuarine waters. This was a difficult field in which very little work had been done. Studies of the food needed by the smaller marine larvae, especially research on oysters by Cole at Conway, and by Bruce, Knight and Parke at Port Erin, had shown that these small algae were the essential food on which the success or failure of molluscan spatfalls depended. Work on the life-histories of these flagellates was continued at Plymouth by Dr M. W. Parke in cooperation with Professor Manton at Leeds, but Butcher set himself the task of forming a substantial collection from the coastal waters of the United Kingdom and of describing them in a systematic manner. He planned the production of a new series in the well-known Fishery Investigations publications of the Ministry of Agriculture, Fisheries and Food and when he retired had completed Parts I, IV and VIII dealing respectively with the Chlorophyceae, Cryptophyceae and Euglenophyceae. Each part was illustrated by coloured figures

and photographs of living cultures and, although the series is still incomplete, it has had added to it a fine volume on the Diatoms by N. Ingram Hendey (a close friend of Butcher's), and a section dealing with the dinoflagellates is in preparation. There is no doubt that the work done by Butcher on this important and difficult field of the very small marine algae has greatly stimulated work on both their taxonomy and ecology. In these days when cultures of *Isochrysis galbana* Parke and *Dunaliella tertiolecta* Butcher are used almost all over the world in laboratory rearing studies, one is inclined to forget the earlier days when these invaluable algae were not merely undescribed but almost unstudied. Butcher's collection has been transferred to the Cambridge Culture Collection of Algae and Protozoa, and further descriptions of the material he collected are being prepared by scientists working there. It is good to see his pioneer work come to fruition in this manner.

H. A. COLE

WALTER HENRY HARDAKER

(1877–1970)

Walter Hardaker died on 19th November, 1970, at the age of 93. He was already, both by training and inclination, an experienced field botanist when he joined the Society in 1935—not 1953 as given in the *List of members and subscribers* (1969).

Born at Yeadon near Leeds on 6th July, 1877, he received his early training at Leeds University, where he obtained a B.Sc. degree, proceeding to a Masters degree at Birmingham University in 1910.

After graduation at Leeds he went first to teach at a school in the Isle of Man, but in 1902 he moved to Birmingham, joining the staff of Handsworth Technical School to teach general science, chemistry and botany. Here he remained until his retirement in 1938 at the age of 60.

Throughout his long, active life he was an enthusiastic and tireless field botanist—probably one of the few remaining of the non-motoring school, whose explorations, throughout the British Isles, were done mainly on foot. As one would expect he was a sympathetic guide; always ready to help and encourage his younger companions, provided they had the stamina and endurance to keep up with him over those many miles of countryside which he was easily capable of covering in a day, sometimes to the positive distress of students many years his junior.

He contributed many records to the Society's publications, some of which demonstrated his meticulous observation of minor differences. He seems so often to have sought for something more definite than a plain binomial and in 'Plant Records' such an example as '*Cirsium arvense* (L.) Scop. var. *setosum* C. A. Mey. subvar. *integrifolium* (Koch) f. *incanum* Ledeb.' is indicative of this precision, if not, perhaps remarkable for its botanical significance.

He did a large amount of recording for the Birmingham Natural History Society. The new Flora of Warwickshire (*A Computer-mapped Flora* by D. A. Cadbury, J. G. Hawkes and R. C. Readett), published in December, 1971, for that Society by Academic Press, would have been much the poorer if the lists he compiled, during half a century, had not been available. His contributions may also be noted on other midland Floras and in the *Atlas*. His own copies of both local and national Floras are interesting and indeed remarkable for his interpolations, on every other page, of localities or infraspecific taxa. Just as he has done for Warwickshire, so when a new Flora of Worcestershire arrives, his annotated copy of Amphlett & Rea (*The Botany of Worcestershire* by J. Amphlett and C. Rea, Birmingham (1909)) will have been an invaluable source book. These will all provide a more fitting memorial to his enthusiasm and skill.

C. E. A. ANDREWS

JOHANNES LID

(1886–1971)

Dr Lid died in Oslo on 29th September 1971, in his eighty-sixth year.

Johannes Lid was born at Voss, in southern Norway, where he received his early education, and in 1912 took his degree. In 1918 he was assistant in botany at the Norwegian Agricultural College, and the following year became a curator at the Botanical Museum in Oslo. Thus began an association which lasted for nearly forty years; he became Principal Curator in 1951 and retired from that post at the age of seventy, in 1956.

The list of his published works includes some seventy items and spans the fifty odd years of his professional life. Most of his articles were published in the scientific journals of his own country, and dealt with the ecology and taxonomy of flowering plants, but some dealt with ferns and bryophytes; on a visit to Scotland in 1925 he added two species of *Sphagnum* to the British list (*J. Bot., Lond.*, 67: 170 (1929)).

His main interest was in the flora of Norway, especially the mountain flora, and that of various arctic and near-arctic regions; his work on arctic botany earned for him the Nansen Award, which reached him just two days before he died. His most famous single work, *Norsk Flora*, was first published in 1944 and reached its third edition (as *Norsk og Svensk Flora*) in 1963. Dr Lid was one of my contacts before the C.S.S.F. field meeting in Norway in that year; he sent valuable advice about our choice of route, and the *Flora* was our reference book; but during the few days we spent in Oslo he was elsewhere, so we did not meet. In later years he became interested in the flora of the Canary Islands, an area which must have provided a striking contrast to the arctic botanising of his younger days.

Dr Lid was president of the Norwegian Botanical Association from 1935 till 1941 and was elected to honorary membership of that body; in 1955 our own Society paid him a similar tribute.

For almost all the biographical material contained in this notice I am much indebted to Dr Per Sunding, of the Oslo Botanic Garden, who will be warmly remembered by all who attended the 1963 meeting.

R. MACKECHNIE

WILLIAM JOCELYN LEWIS PALMER

(1894–1971)

The Hon. William Jocelyn Lewis Palmer, 3rd son of the 2nd Earl of Selborne, died in Guernsey on Trinity Sunday, 6th June, 1971 at the age of 76. He was educated at Winchester and Oxford, and after service in the first world war, worked in business in London. He was also a County Councillor and Alderman for Hampshire for many years, and a Magistrate; and twice Master of the Mercer's Company. But he was, as well, one of the country's finest plantsmen—and a plantsman is one who loves flowers of all sorts for their own sakes. His work on *Agapanthus* resulted in the Headbourne hybrids, and *Philadelphus* 'Beauclerc' was his. He hybridised daffodils, and shortly before he died 'Larkwhistle' received an Award of Merit. In addition to these creations, he held office with the Royal Horticultural Society for many years, including that of Treasurer for 12 years from 1953. He received the VMH in 1954.

But his interest in, and enthusiasm for, plants, as befits the best plantsmen, was wide, his great knowledge belied by his quiet modesty. His wife, Dorothy (née Loder), was the daughter of the 1st Baron Wakehurst, the maker of the garden in Sussex now being run by Kew. He came in fact to garden plants via wild ones, and was a member of our Society for all but 40 years. He moved from Headbourne Worthy to Guernsey in 1968, where he was at once a valued collaborator. He seemed especially attracted

by the minute, and was regularly to be seen prone, or on hands and knees, looking for, and after, *Ophioglossum lusitanicum* and *Exaculum pusillum*. His is the only indubitable record for the island of *Salicornia europaea*. He noticed the first *Epilobium nerteroides* among some imported heathers in his garden, and forbore to eradicate it. Yet, ever-welcome as such assistance was, he will enduringly be remembered with gratitude by all sorts of people for what he personally was, a man of special kindness, charm, gentle wit and humour. Contact with him meant one was constantly learning something worth while, for his wisdom and shrewdness were great, if unobtrusive: many were privileged and enriched by the friendship of Luly, as he was so widely called. By no means all settlers in the Channel Islands get accepted, but he and Dorothy fitted in from the start, and looked as though they had always belonged there, he with his Gallic blue beret. Although he was always being asked to identify plants, he had difficulty in remembering the faces of his friends. There are many amusing stories about Luly getting them mixed up, which always distressed him. Once he was heard to murmur: 'If only they were as different as snowdrops, it would be so easy'!

D. MCCLINTOCK

Reports

SPECIAL GENERAL MEETING, 27TH NOVEMBER, 1971

A Special General Meeting of the Society was held in the Department of Botany, British Museum (Natural History) on Saturday, 27th November 1971, during the Annual Exhibition Meeting. The President, Mr D. McClintock was in the chair, and some 150 members were present.

The President said that, due to increasing costs in postage and printing, the Council of the Society with regret deemed it necessary to recommend the following changes in annual subscriptions.

Ordinary members	£3.00 (increased from £2.00)
Family members	£0.50 (remains unchanged)
Junior members	£1.00 (increased from 75p)
Subscriber members	£3.00 (increased from £2.00)

These increases were approved by the meeting.

An amendment was proposed from the floor by Professor J. H. Fremlin: 'That persons who have been members of the Society for 40 years or more should have their annual subscription fixed at the rate current on their attaining 40 years of membership'.

The Treasurer, Mr M. Walpole, informed the meeting that at present 22 members would benefit from this proposed amendment, which was unanimously approved by the meeting.

There being no further business the meeting closed.

I. K. FERGUSON, *Hon. General Secretary*

CONFERENCE REPORTS

ANNUAL GENERAL MEETING MAY 1971

The following three papers are synopses of ones delivered in connection with the Annual General Meeting of the Society held at the University of York on the 8th May, 1971.

VARIATION IN OAKS

The origin of the variational patterns observed within populations of the two British oak species, *Quercus robur* L. and *Quercus petraea* (Matt.) Liebl. was discussed in relation to field and experimental results. It was argued that introgressed oak populations should contain two types of trees:

1. Fertile non-hybrids
2. Relatively infertile F_1 and back-cross hybrids.

Results from five populations in which pollen viability and hybrid status were assessed for each tree suggested that morphologically intermediate trees of suspected hybrid status showed lower percentage pollen viabilities than morphologically 'pure' trees.

Leaf samples from different positions within single oak canopies showed a considerable range of morphological and anatomical variation. Many leaf characters including those which have been used in taxonomic and evolutionary studies followed gradients of light intensity within the canopies such that generally sun leaves were

more *robur*-like and shade leaves more *petraea*-like. Similar results were obtained for oak seedlings under a range of light intensities.

It was emphasised that only with a complete understanding of the factors influencing leaf morphology and anatomy and of the floral biology and reproductive behaviour within oaks could the significance and origin of variation within British oak populations be accurately assessed.

B. S. RUSHTON

POLLINATOR DISCRIMINATION BELOW THE PLANT SPECIES LEVEL

The work reported here is part of a study on the extent to which floral genetic variants can influence the behaviour of pollinators.

In *Pentas lanceolata* (Rubiaceae), a tropical ornamental, variants include long and short style and differences in flower colour and pollen fertility. (This last refers to the proportion of pollen grains having stainable or protoplasmic contents.)

Plots five feet square were set out on the University of the West Indies Campus, Kingston, Jamaica, with six clones each represented by six plants in a randomised arrangement. Using both marked and unmarked bees, visits to flowers together with the forage (pollen or nectar) were recorded. Data were obtained from 336 flights representing 12,367 individual flower visits. Of these, 271 flights were for pollen, 41 for nectar and 24 were of doubtful significance.

Results showed that those clones with the highest proportion of 'good' i.e. stainable, pollen received the most visits. Data gathered over several days with marked bees showed that they either collected good pollen initially or changed over to it during the period of observations. Bees were observed to visit usually only two or three of the six available clones during any one flight.

Bee visits, therefore, particularly among pollen gatherers, were apparently influenced by dissimilarities among the various clones. Such discrimination would only be significant where a plant species is monopolised by relatively few kinds of pollinator.

G. P. CHAPMAN

CALAMAGROSTIS STRICTA AND ITS HYBRIDIZATION WITH *C. CANESCENS*

The world distribution and habitat requirements of *Calamagrostis stricta*, *C. canescens* and *C. stricta* × *C. canescens* were discussed and theories advanced to explain the present British distribution of both species, including the conditions required for the survival of *C. stricta* at the southern edge of its range where climatic conditions are likely to be critical.

Characters of the parents and the hybrid as found at Leven, east Yorkshire, in 1951, were compared. Conditions for hybridization and isolating factors separating the two species were discussed. Following recent drastic disturbance of the habitat and the subsequent extension of hybridization, a biosystematic study of the Leven *Calamagrostis* populations was commenced in 1970. Two distinct hybrid populations were sampled as well as populations of the species and a scatter diagram produced; this diagram was discussed. One of these hybrid populations resembled the 1951 intermediates, whilst the second more nearly resembled *C. stricta* in general appearance, but the position of its individual members on the scatter diagram and the result of examination by hybrid index methods suggested that the population was the result of a backcross to *C. stricta*.

A second scatter diagram for four different British *C. stricta* populations, using the same features as axes, was shown. The position of individuals on this diagram, from at least two of the populations examined, was strongly suggestive of past hybridisation and introgression, as were a number of other observations concerning British *C. stricta* populations.

The Leven studies are believed to be important in providing the means by which past hybridisation and introgression can be detected, but the problem can only be resolved by the extension of biosystematic studies to include other British *C. stricta* populations. It is possible that hybridisation and introgression have played a significant part in the production of the *C. stricta* variants in the British Isles as well as the probable necessary adaptation to different habitats.

F. E. CRACKLES

TAXONOMY AND PHYTOGEOGRAPHY OF HIGHER PLANTS IN RELATION TO EVOLUTION

The Conference under this title was organised for the B.S.B.I., the Linnean Society and the International Organization of Plant Biosystematists by Professor D. H. Valentine, at whose invitation it was held in the University of Manchester from 9th–12th September, 1971. He also opened the proceedings.

The first three days were taken up with 23 papers given by a distinguished gathering of scientists from Europe, America and Japan. The breadth of topics attracted a wide audience, and each of the sessions was attended by between 180 and 240 people from all five continents. Almost all the papers were of broad general interest and seven of them were related directly to the European flora. The evolution of species in the Aegean region was discussed by Dr W. Greuter (Geneva) for Crete and by Dr A. Strid (Lund) for the Cyclades. Professor C. Favarger (Neuchâtel) surveyed the distributions and origins of endemics in the southern European mountains, and Professor T. W. Böcher (Copenhagen) provided a similar theme relating to the arctic regions of Europe. Dr S. M. Walters (Cambridge) described the pattern of distribution and variation shown by the largely apomictic genus *Alchemilla*. Dr F. Rose (London) discussed the importance of the Somme Valley of northern France in relation to the migration of species into Britain, and concluded that the English Channel had been very much less of a barrier than was often claimed. Dr E. Jäger (Halle) outlined progress in the project to map all the European species; the second volume of their valuable atlas will appear in 1972. A more detailed report of the papers has appeared in *Nature*, Lond., 233: 309 (1971), and they will be published in full in a volume to be produced by Academic Press.

During the conference a selection of exhibits based on the theme of the conference was staged in the Department of Botany. The exhibitors were: A. Conolly, Leicester (Scanning electron micrographs of seed characters in *Saxifraga*), R. Cotton, Manchester (Polyploidy, morphology and geography in species of *Vulpia*), D. M. Cranston, Manchester (Card index of British chromosome counts of higher plants), D. H. Dalby, London (The status of *Braya linearis* in southern Norway), A. S. Gardiner, Merlewood (Regional population differentiation in *Betula* species), A. J. C. Grierson, Edinburgh (A new Mexican *Anaphalis*?), F. N. Hepper, Kew (Distribution patterns in western tropical Africa), J. N. Mills, Manchester (*Hieracium* section *Alpestris* in mainland Britain), A. J. Richards, Newcastle (The origin of modern dandelions), M. C. Smith, Bristol (The geography of *Sempervivum* in Spain), W. T. Stearn, British Museum (The phytogeographical linkage of tropical America, continental Africa and Madagascar), C. A. Stace, Manchester (Some anatomical characters in the Combrétaceae), P. A. Thompson, Kew (Germination of the seed of *Agrostemma githago* in relation to its success and failure as a weed), D. L. Wigston, Coventry (*Quercus* hybrids in Britain). The library of the University also staged a small exhibition of interesting botanical works, classical works such as Linnaeus' *Hortus Cliffortianus* and Humboldt's *Geographie der Pflanzen* rubbing shoulders with *Flora Europaea* and the *Atlas of the British Flora*. Many people visited the rich collection of the herbarium of Manchester Museum, in which a demonstration of some important old collections, e.g. Spruce's south American types, was held. Other participants took time off to

investigate the plants of some adjacent building sites, where *Senecio squalidus* × *vulgaris* and *Ceratochloa carinata* proved of interest.

On the first evening a reception and sherry party for all conference participants was given by the Vice-Chancellor of the University, and on the second evening the conference dinner was preceded by a visit to The Firs, the experimental gardens and glasshouses of the Department of Botany. Nearly 200 people took part in these events.

On the fourth day about 70 of the participants went on a coach tour of the Peak District, visiting four contrasting sites in this rich and beautiful area. The first stop was on Snake Pass to observe the *Eriophorum* moorland developed on peat at 1600 to 2000 feet. Two dioecious species, *Empetrum nigrum* and *Rubus chamaemorus*, are particularly abundant in areas of peat erosion. The second stop at Burbage Moor was to examine heather moorland at about 1250 feet. *Empetrum* and *Vaccinium myrtillus* and *V. vitis-idaea* were still in fruit, and the continental botanists were pleased to see Atlantic species such as *Erica cinerea*, *E. tetralix*, *Ulex europaeus* and *U. gallii*. After lunch Padley Woods was inspected. These are fine examples of sessile oakwood developed on millstone grit, and support a wide range of habitats of varying moistness. *Corydalis claviculata*, another Atlantic species, and the luxuriant ferns attracted most attention. To contrast with these acid areas the excursion ended with a brief visit to Monsal Dale, one of the botanically rich and famous limestone Derbyshire Dales. Here the marked absence of several southern species was noted, but the presence of northerners such as *Galium sternerii* and *Rubus saxatilis* adequately compensated.

C. A. STACE

FIELD MEETINGS, 1971

ENGLAND

HEREFORD. 9TH–12TH APRIL

On Thursday, 8th April, fifteen members of the B.S.B.I. gathered in Hereford with the purpose of studying the distribution of mistletoe (*Viscum album*) in the county. Five groups were organised and a leader in each group was given a 10 km square of the national grid and instructions to examine each of the 25 'tetrads' in their search. This meant some ingenious planning and occasional rough travelling.

On Friday each group set off independently to criss-cross their 10 km square. In the evening a meeting was held to report the day's happenings, followed by discussion and comparison. Saturday and Monday followed the same pattern except that the personnel had the 'all-change' each day.

By Monday afternoon a picture of mistletoe distribution began to emerge: the centre of the county had plenty of mistletoe but to the north and west it gradually disappeared. The Black Mountains and the absence of trees in them may account for the cessation in part of the west, and Radnorshire with a somewhat similar terrain may be in the same class, though it was found that even when there were orchards it was unusual to find any mistletoe. Breconshire and Monmouthshire have a slightly higher number of records, while Worcestershire and Gloucestershire have plenty. It is not possible to compare the density of mistletoe in these two counties with Herefordshire until a similar survey has been undertaken.

As expected the commonest host proved to be apple (*Malus sylvestris*) followed closely by hawthorn (*Crataegus monogyna*) and poplar (*Populus* spp.). A total of thirty hosts was recorded, the rarest being wych elm (*Ulmus glabra*), birch (*Betula* spp.), hazel (*Corylus avellana*), dog rose (*Rosa canina*) and holly (*Ilex aquifolium*).

The oak of Druid legend is not common as a host, but of the five or six records found about 1860–1870, three are still living; one tree is nearly dead and consequently so is its mistletoe, another found in 1870 is still a beautiful tree with a dozen or more bunches in various stages of growth, the third I have not seen recently but it is reported

well. One known mistletoe oak found in 1869 has apparently conquered its parasite and it is now without it.

It was decided that altitude had some influence on distribution. The usual limit was between 700ft and 800ft but there was one record for 900ft.

Sunday was taken as a 'day off' and a visit to the Great Doward was arranged. This is the only area of carboniferous limestone in the county and *Carex montana*, *C. digitata* and *C. humilis* were found in the old quarries and on the sunny rocks overlooking the Wye Gorge.

The party moved on to the Little Doward later. This is a private estate but permission was willingly given to visit the rocks on which *Hornungia petraea* has been known since 1847. It was very small, perhaps owing to the lack of rain at that time; better specimens were found on another outcrop later.

A few notes were also made on the distribution of holly and *Colchicum* during the weekend.

L. WHITEHEAD

CLIVEDEN AND WINTER HILL, BUCKS. 26TH JUNE

The main purpose of this meeting, attended by 36 members, was to study the grasses on the Cliveden Estate, an area of 263 acres of considerable scenic beauty. It is well-known for its hanging woods, extensive pleasure grounds, natural and planted woodlands and grasslands, partly on chalk and partly on sand and gravel. Permission to explore the Estate was kindly given by the National Trust. The area is rich in grasses, particularly in shade-loving species along the woodland margins and glades, as well as in the coarse grasslands and meadows. *Dactylis polygama* and *Festuca heterophylla*, discovered there on the 1951 excursion of the Society, were still flourishing, the first scattered along the margins of glades, but *Festuca altissima*, found there in 1965 by Mr B. Ryves, could not be located in the time available. The other woodland grasses seen included *Agropyron caninum*, *Bromus ramosus*, *Brachypodium sylvaticum*, *Festuca gigantea*, *Melica uniflora*, *Poa nemoralis* and *Milium effusum*.

The journey to Winter Hill was broken at Cookham to examine a small area of low-lying grassland and stream-margins where, among other aquatics, *Glyceria fluitans*, *G. plicata*, *G. maxima* and *Phalaris arundinacea* were noted. The steep slopes of Winter Hill, now becoming overgrown with thorns, roses, etc., provided a good mixture of the species found in chalk grassland, including *Bromus erectus*, *Briza media*, *Dactylis glomerata*, *Festuca rubra* subsp. *rubra*, *Helictotrichon pratense*, *H. pubescens*, *Koeleria cristata* and *Poa angustifolia*. In the adjacent Quarry Wood, the usual shade grasses were seen, with the addition of *Hordelymus europaeus* and the rare *Bromus benekenii*. The latter was growing with *Bromus ramosus*, but was readily distinguished by its more slender growth, less hairy leaf-sheaths, and contracted nodding panicles, with shorter branches.

During the day, fifty-one species of Gramineae and various varieties and forms of these plants provided those taking part with a wide range of the British grasses.

C. E. HUBBARD

GUERNSEY. 9TH-18TH JULY

Well over 100 people have attended the three annual field meetings in Guernsey and the fillip to our knowledge of the island's botany has been immense. How could the two eyes of an Englishman on his holidays hope to see a fraction of what these two-hundred plus eyes could and did see. Any way, largely thanks to the efforts of these visitors, and to the intrinsic richness of the island's flora, a promising basis now exists for a reasonable account of its wild flowers.

This year's visit followed the pattern of the past two. The attendance however was slightly down because the date was a week too early for most schools. But, as before, there was widespread evidence of enjoyment of the island, its weather, its flowers

and the accompanying company. The activities of the visitors were twice featured, with photographs, in the local press and once in the Jersey paper. The opening meeting, joint with the Société Guernesiaise, had an address by the leader on the history of Guernsey botany, which ended up picturesquely with some of John Bichard's superb slides of its flowers. Recent discoveries have already invalidated some of the statements made at the lecture, notably in that it now seems the excellent Joshua Gosselin was no botanist!

The great failure of all concerned, the leader worst of all, who after all had been at the original discovery of the British Pteridological Society meeting on the 22nd April (see p. 204), was to find no fresh tufts of the new *Asplenium* $\times$ *sarniense*. One reason doubtless is the baffling difficulty of distinguishing it from *A. adiantum-nigrum*, but another may well be that it is not common, for suitable hedgebanks with both parents proved to be surprisingly scarce. But considerable efforts were made to find it, with authentic specimens and Dr Sleep's own notes in the car and consulted on the spot. But against this, two more stations were added for *Microsorium diversifolium*, both under trees, and three more for *Cyrtomium falcatum*.

Perhaps the best find was made by Mrs Garratt when she found a small colony of a broomrape with pale yellow stems and lavender blue flowers just off Bulwer Avenue; and a similar colony was found a few days later a few hundred yards to the north by the St Sampsons Quarry. Attempts to trace its host in the dense turf were unsuccessful, but its bracts, and yarrow nearby, suggested it might be the long-lost *Orobanche purpurea*; and so Dr Hambler confirmed it to be. But who has ever seen this plant in these colours?

Next best I think was the pleasure Miss Caddick gave on the first evening, when she produced *Gastridium ventricosum* from the Rue du Gain in St Peters, which was matched shortly after when Dr Taylor found a single plant by the St Peters Post Office, a mile and a half away. Only one other record was then known of this plant during this century. A close third was the nearest to *Hypericum linarifolium* seen for very many years. Until recently I knew of no proof of this species occurring in Guernsey at all, all the vouchers being of intermediates. But now two valid collections are known, in 1881 and 1894, from Moulin Huet. The species has been claimed on numerous occasions, the position being aggravated by a majority (? all) of the island's *H. humifusum* being of the var. *decumbens* with glandular sepals. It is possible that some at least of these intermediate plants may come under its var. *ambiguum*, of Gillot—and these intermediates are still regularly seen. This year's discovery was made by Mr R. D. English near Kings Mills, his specimen being first thought by Dr Robson to be pure *H. linarifolium*, an opinion subsequently modified to 95%—and this is the first record away from the south cliffs. Just as good, if not even more welcome, was a species long-sought in the island and hitherto always claimed in vain. But Mr Milne-Redhead collected willowherbs, and Dr T. Pennington confirmed that two gatherings were, at last, *Epilobium adenocaulon* and there were also some hybrids.

There was a single war-time record of *Alopecurus myosuroides*, but Miss Sturdy and Miss Caddick found it in two places in July, neither rediscovered, so it cannot be plentiful. I knew no record of *Knautia arvensis* since the *Flora* of 1901, so when I was sent by Miss Mauger to the Blicqs area, even the single plant I saw gave me great satisfaction—and more were seen later. Hornworts had been rarely and unsatisfactorily recorded and only one specimen existed, which proved to be wrongly named. So the only indubitable *Ceratophyllum demersum* is what was in the goldfish pond at Four Cabot—and *C. submersum* was in a similar pond at the Grange Hotel. But such plants are only aquatic oxygenators prospering.

All the new species found were aliens, casuals or escapes although the status of at least two more was more permanent. Lady Anne Brewis lit on a glorious billow of *Vicia varia* at the edge of the St Sampsons Quarry; and Mr J. B. Marshall proved it was *Senecio grandiflorus* which was thickly established in grass near a garden, and had sown itself further down, at Fermain Bay and was also in a grassy field at Haute-

ville. Mr E. Milne-Redhead early on pointed out to us that *Calystegia* $\times$ *lucana* was apparently widespread. Here it is in various guises, but not always certainly distinguishable from forms of one or other parent. He and Mr C. Hare found a lovely *Sisyrinchium*, cowering under a burdock leaf by a dump, which he later proved to be *S. iridiflorum* from South America, not known to be in cultivation. *Solanum dulcamara* was seen with all its leaves richly edged with a cream colour, *Antirrhinum majus* in a striking pink and yellow peloric form, and *Epilobium palustre* with white flowers. *Portulaca oleracea* had gone from its only known garden, so it was very satisfactory when Mrs Holland found it in plenty in another garden in the Vale, where it had been known for many years. It is frequent in Jersey, so why not here too? *Solanum ottonis* was feared to have gone, but was happily refound hiding safely behind a shed. *Selaginella kraussiana* was not to be seen in either of its previous localities, so its discovery in the Fermain Valley was particularly welcome.

As usual we are indebted to several specialists who have dealt with critical material. It was comforting that even Dr Brummitt was puzzled where to place the dozen or so gatherings of pink-flowered *Calystegia*, which seemed to cover the whole gamut from *C. sepium* to *C. pulchra*, and included a schizopetalous form from Perelle found by Lady Anne Brewis. She also most carefully made several collections of *Rubi*, but few could be named. Clearly the Channel Island's brambles are as special as we thought and need special study. A *Euphrasia* from L'Ancrese Dr Yeo agreed came close to *E. stricta*—but none of us is yet sure of recognising this in the field. Channel Island *Euphrasias*, notably *E. tetraquetra*, also seem to differ from English ones. Miss M. E. de Putron proved to be a local devotee of old Roses and named from Fort Saumarez the 'Apothecary's Rose', and 'May Queen', which have thriven in the scrub there in full face of the sea for well over 40 years; and 'Seven Sisters' and 'Jean Guichard' were doing the same on a low cliff at Cobo. And the prettiest plant of all? Large-flowered, very dwarf (because it was eaten down by goats) *Dianthus armeria*, a very rare plant in the island and in quite a new locality here on L'Ancrese, jewels in the sun, much better than when they are on long thin stalks!

Of course there were lots, and lots, more. But the leader is sincerely grateful for the excellent work of this excellent company. He still hopes to repay it with an account of the flowers in 1973.

D. McCLINTOCK

LEWES, SUSSEX. 16TH-18TH JULY

The ancient county town of East Sussex attracted twenty-six members and friends to devote a weekend to an area which provided a good range of habitats and plants.

In warm sunshine, seventeen 'tetrads' were visited, with an overall total of nearly 4000 records being made, including *Erucastrum gallicum*, *Callitriche platycarpa*, *Scandix pecten-veneris*, *Torilis arvensis*, *Nymphoides peltata*, *Chrysanthemum segetum*, *Silybum marianum*, *Baldellia ranunculoides* and *Alisma lanceolatum*.

The Sussex Flora Committee is grateful to all who contributed to this most worthwhile meeting.

P. C. HALL

PECKFORTON HILLS, CHESHIRE. 1ST AUGUST

A party of eight enthusiasts and friends gathered at Gallantry Bank near Harthill, Cheshire to study the local *Rubus* flora. A key to the local species, which was being used in the field for the first time, was provided. After making initial acquaintance with *R. ulmifolius* and section *Triviales* in the hedgerow the first stop was made at Higher Burwardsley where bushes of the widespread *R. dasyphyllus*, *R. selmeri*, *R. lindleianus* and *R. cardiophyllus* were present in sufficient quantity to enable some of the salient points of *Rubus* physiognomy to be studied, along with *R. incurvatus*, primarily a bramble of North Wales, and *R. adenanthoides*, a local species common in this area of Cheshire.

Lunch was taken at Gallantry Bank and further acquaintance was made with the four widespread species which together with *R. carpinifolius*, *R. sprengelii*, *R. robii*, *R. polyanthemus* and *R. murrayi* grow on the rough slope above the road. Here the opportunity was taken to study the growth forms of the different plants in favourable circumstances free from lopping and cutting, and various field characters were demonstrated. *R. murrayi*, which is a rare species in the county and apparently at the northern extremity of its range, was first found here by A. H. Wolley-Dod c 1895 (as *R. adornatus*) and was collected by H. J. Riddlesdell in 1926. It still thrives.

The lane from Harthill to Dropping Stone house was then visited where, on either side, the brambles were in excellent condition but care was necessary to associate correct panicles with non-flowering stems. This is the type of locality for *R. adenanthoides*, which was well shown together with *R. hylocharis*, *R. lindleianus*, *R. polyanthemus*, *R. robii*, *R. castrensis*, and the high-arching purple prickly stems of a plant indistinguishable from *R. curvispinis* W.C.R. Wats., which had the previous week been the subject of close scrutiny on the southern borders of the New Forest. A certain sense of familiarity now having been achieved with these plants, a disused railway bank near Handley was visited where several species grow in great luxuriance and quantity, including the newly described *R. wirralensis*, together with *R. vestitus*, *R. rubristylus*, *R. murrayi*, *R. leightonii* and *R. wolley-dodii*, in addition to *R. ulmifolius* and plants belonging to the section Triviales. Exploration and explanation here took longer than anticipated, it was a warm afternoon and the party deemed it wise to return to Gallantry Bank where two members graciously dispensed tea from the rear of a Dormobile, fully equipped with all the necessities for a botanist's intellectual and physical comfort.

The key was voted a cautious success, 21 of the 28 species described were seen, and it was encouragingly evident from the zeal shown in collecting and concentration particularly by the younger members that *Rubus* studies will not be neglected in the future.

A. NEWTON

THETFORD, NORFOLK. 6TH–8TH AUGUST

Twenty-six members and guests gathered at the Anchor Hotel, Thetford, on the evening of 6th August to receive the plan of campaign for the weekend. Six parties were assigned for field mapping the following day; an introduction to the terrain was given by P. Wright, Deputy Regional Officer of the Nature Conservancy, and some colourful slides were shown by Miss G. Tuck of the landscapes and species peculiar to the district.

Each party was given two 1 km squares to survey, for which not only an indication of presence but also a coded statement of habitat and frequency was required for each species. It is open to question whether the results of this procedure will justify the elaborate and arduous recording burden involved for each square, since every estimate of frequency and habitat will be subjective. The 'frequent' of one recorder may easily be synonymous with the 'common' of another, the 'wood border' of one may represent the 'scrub' of another and so on. It is arguable in any case whether the various habitat categories used are so clearly delineated in nature.

Those squares now occupied exclusively by even-age conifer stands were found to yield only 70–100 species, but those which include more open rides, an arable field or two, a few roadsides and a damp spot can achieve 150+. The commonest plants of clay soils, e.g. *Prunella vulgaris* and *Ranunculus acris*, are exceedingly scarce, ferns are rare, *Rubi* are confined to the most widespread species such as *R. selmeri*, *R. polyanthemus*, and the bird-sown *R. procerus*, but xerophilous species such as *Koeleria cristata*, *Knautia arvensis* and *Ornithopus perpusillus* are widespread, and *Medicago falcata* was visible in abundance.

Some heavy showers were experienced but representative lists were produced and

enough specimens to exercise diagnostic capacities until 10 p.m. on the Saturday. The Euphrasias in particular are a puzzling group in Breckland.

On the Sunday a comprehensive tour of Breckland localities was arranged by Mr Wright and Miss Tuck during which most of the specialities of the area could be seen. At Barnham Cross Common *Artemisia campestris*, *Phleum phleoides*, *Silene otites* and *Turritis glabra* were all in excellent condition and the close association of *Cirsium acaulon* and *Helictotrichon pratense* with *Senecio sylvaticus* was an interesting feature. *Veronica spicata* and *Dianthus deltoides* were admired near Weeting, where a project for the study of reversion from arable to breck was described by Mr Wright. Plots of some scarce and local species raised from seed are also maintained here.

At Lakenheath, where the chalk is very near the surface and the soil is very thin, a most interesting community was seen containing predominantly lichens but also *Galium verum*, *Astragalus danicus*, *Asperula cynanchica*, *Gentianella amarella*, *Carex ericetorum*, *Botrychium lunaria* and *Silene otites*. Near Eriswell, two colonies of *Scleranthus perennis* and one of *Thymus serpyllum* were visited. In one place the presence of American children illustrated the precarious conditions in which the former species must rely: the open conditions induced by scrabbling feet will encourage vigour so long as the insignificance of the flowering plant protects it from depredation.

Several members enquired about the publication of their efforts and it is to be hoped that the Breckland group will not be content to retain these data within the sterile confines of computer storage but will make every effort to publish at least distribution maps for the species present in this most interesting area, and thus make its features accessible to a wider public.

A. NEWTON

ALIEN HUNT. 25TH-26TH SEPTEMBER

With the aid of a hired coach, forty-five BSBI/London Natural History Society members explored four refuse-tips to the east of London. All the sites proved to be of considerable interest and much more time could have been profitably spent on each, but rapid inspection of the more promising areas provided an excellent assortment of unusual aliens.

BARKING TIP, ESSEX. Members soon familiarised themselves with a wide variety of typical bird-seed aliens including *Melilotus indica* and *Guizotia abyssinica* in full flower, while among the less common species were *Lythrum junceum* (= *L. meonantherum*), *Cicer arietinum* (Chick Pea), *Vicia villosa* subsp. *varia*, *Amaranthus quitensis* and *Solanum rostratum* (a prickly plant with large yellow flowers which pleased the photographers). An immature plant, probably of *Achyranthes aspera*, was spotted, but still awaits final determination. Two thrills, even for the experts in the party, were the American grass *Brachiaria platyphylla* (only the second British specimen that Dr C. E. Hubbard has encountered) and the Cucurbitaceous *Momordica charantia* (det. C. Jeffrey). A small white-flowered Umbellifer with filiform leaf-segments turned out to be *Cuminum cyminum*. *Cleome spinosa* was a pretty sight, although somewhat smaller in all its parts than the plant in cultivation. *Phalaris minor* and *Bidens pilosa* were spotted by a few sharp eyes. Both the annual *Sorghum bicolor sensu lato* and the rhizomatous perennial *S. halepense* were present. Two aliens well-established in the neighbourhood, *Hirshfeldia incana* and *Sisymbrium loeselii*, were also noted.

DAGENHAM TIP, ESSEX. The tipping of ashes from the foundry of the Ford Motor Works has provided an outstanding example of an established alien flora community the composition of which has probably remained relatively unchanged since first observed at Dagenham by Mr J. E. Lousley in 1934. *Salsola pestifer* still dominates large areas of ground, with scattered colonies of *Amaranthus albus*, *Sisymbrium loeselii* and *Solanum sarrachoides* breaking the monotony. A few plants of *Abutilon theophrasti* (fruiting well) and one clump of *Hordeum jubatum* were also found. *Rumex patientia* and *Heracleum mantegazzianum* were frequent nearby.

NORTHFLEET TIP, KENT. Lone plants of *Trigonella corniculata* (not unlike a small Melilot) and *T. foenum-graecum* aroused considerable interest, as did some tiny plants of *Plantago afra* (= *P. psyllium*; det. C. C. Townsend), a plant which has probably been sometimes mis-named as *P. indica*. *Amaranthus blitoides*, *Aptenia cordifolia* (leaves only, but the root was grown on in a greenhouse and the flowers have confirmed this name), *Digitaria sanguinalis*, *Hibiscus trionum*, *Reseda alba* and *Salvia reflexa* were also found. The opportunity to compare *Setaria geniculata* with the similar *Setaria lutescens* which was growing a few yards away was appreciated.

CRAYFORD TIP, KENT. Three grasses, *Urochloa panicoides*, *Panicum laevifolium* and *Echinochloa colonum*, were eagerly collected, the first-named being much the scarcest species on our tips. *Ridolfia segetum* (distinguished from the similar yellow-flowered Umbellifers Fennel and Dill by its much smaller fruits—only about 2mm long), *Ammi visnaga* and *Vigna mungo* (Mung Bean) were also seen. The tip terminated within a few yards of a colony of the native *Sonchus palustris*, but we were able to confirm that the plants were not in any obvious danger.

The following day a small party of six members leisurely explored three tips to the north-west of London, none of which was found to be rich in aliens.

SHEPPERTON TIP, MIDDLESEX. Several plants of *Agrostis scabra* were the highlight here, although it was pleasing to see *Arachis hypogea* (Peanut), *Lens culinaris* (Lentil) and *Brassica juncea* (frequent on tips but easily overlooked).

IVER TIP, BUCKINGHAMSHIRE. *Polygonum pulchellum* and the rampant garden *Comelina coelestis* (presumably) were found.

GERRARDS CROSS TIP, BUCKINGHAMSHIRE. Some fifty plants of *Trachyspermum ammi* was a remarkable sight here (although nowadays frequent on tips numbers are usually small). Two very large fruiting specimens of *Anethum graveolens* (Dill) and a colony of *Kochia scoparia* also attracted attention, but a plant of *Physalis ixocarpa* which was present on a previous visit had unfortunately been destroyed.

ACKNOWLEDGMENTS

The leaders would like to express their thanks to the Greater London Council and the Ford Motor Company Ltd. for their kind permission to visit the land-reclamation sites and to the staff at the Royal Botanic Gardens, Kew, for help with determining specimens.

E. J. CLEMENTS & T. B. RYVES

WALES

MEIFOD, MONTGOMERYSHIRE. 22ND MAY

Members of the B.S.B.I. were joined by members of the Montgomeryshire Field Society at Pont Robert, where they were met and conducted around the Pendugwm woodlands by the owner, Mr Langshaw Rowland.

The woods cover some 244 acres and contain a variety of species including many fine beeches. In 1970 about 8 acres were generously donated to the North Wales Naturalists' Trust and Montgomeryshire Field Society by Mr Rowland, a former President of the Royal Forestry Society. He gave an interesting talk, and impressed members by his desire to enhance the beauty and wildlife interest of his woods and to encourage the recording of the plants and animals they contain. A 'Linear Arboretum', containing 46 exotic tree species, mainly from the Pacific coast of N. and S. America, has been created alongside a woodland track. The ground flora has been

recorded by Mrs W. R. Parr. On this occasion a colony of *Ophioglossum vulgatum* and a fine stand of *Equisetum sylvaticum* were noted.

A bog at Llanfihangel where *Dactylorhiza incarnata* has been found was visited next. Unfortunately the bog had been burnt, but, even though it was too early to identify all the remaining species, the area obviously merits a further visit. It was rather surprising to see such an abundance of *Vaccinium oxycoccus* still in fruit.

V. J. MACNAIR

WEST RADNORSHIRE, 19TH JUNE

This was a joint meeting with members of Hereford Botanical Society, attended by 19 people.

A visit was first made to see a colony of *Dianthus deltoides*, unfortunately not quite in flower, on an outcrop of igneous rock near Llansantffraed-in-Elvel Church.

The party then moved on to a valley bog, known locally as the Cors, near Cefnbychan farm, where the main purpose of the meeting was to record the area for a report to the South Wales Region of the Nature Conservancy on its possible interest.

Mr P. Thomson gave a brief outline of the geology and possible origin of the bog, and provided sketch maps. This valley is very secluded at 775–800 ft and enclosed by hills. On the west of the Carneddau range of shales and volcanic rocks of Ordovician age rise to 1458 ft and on the east Gilwern hill and Castle bank, 1254 ft.

The bog covers the shallow peat-filled lake and shows well the transition from fen through areas of *Phragmites*, *Juncus*, *Menyanthes* and *Carex rostrata* to a type of raised bog with *Sphagnum*.

In a grazed meadow bordering the bog were quantities of *Platanthera bifolia*, also *Dactylorhiza fuchsii* with *Genista tinctoria*, *G. anglica* and *Cirsium dissectum*. *Dactylorhiza maculata* subsp. *ericetorum*, *D. incarnata* and *D. incarnata* subsp. *pulchella* were nearer the bog, and a good deal of time was spent discussing possible hybrids.

The *Sphagnum* areas produced *Pinguicula vulgaris* and *Drosera rotundifolia*. Also noted were *Lythrum salicaria*, *Scutellaria galericulata*, *Ranunculus lenormandii* and *Potentilla palustris*.

A. C. POWELL

LLEYN PENINSULA. 3RD–4TH JULY

The leaders on both days were Dr W. S. Lacey and Miss Ann Conolly. On Saturday 3rd July, 14 members visited the National Trust property at Porth Ysgo and the cliffs around Gallt y Mor. *Geranium sanguineum* and *Rubia peregrina* were abundant and in full flower; *Carex punctata* was confirmed, growing on the cliffs with *C. distans*. *Crambe maritima* was also observed on the cliffs—an unusual habitat for it?

Mynydd Cilau was visited next and several interesting aquatics, including *Pilularia globulifera*, were seen in the pools.

On the following very wet Sunday morning 15 members assembled in Rhyd-y-clafdy to explore Cors Geirch. Many of the typical fen species were seen: *Cladium mariscus*, *Juncus subnodulosus* and *Schoenus nigricans* were common and *Selaginella selaginoides*, *Utricularia intermedia* and *Hypericum elodes* frequent. *Dactylorhiza traunsteineri* was still in flower.

The day concluded with a visit to the coastal heath at Cwmister, between Morfa Nevin and Tudweilog. Much of the heath had disappeared due to ploughing and re-seeding with rye-grass and clover, but *Cicendia filiformis* remained in small quantity in ruts and vehicle tracks.

The leaders wish to express their thanks to Mr A. Vaughan Jones and Mr R. H. Roberts for help with these excursions.

W. S. LACEY

SCOTLAND

FLANDERS MOSS, PERTHSHIRE. 30TH MAY

The 23 participants assembled at South Flanders Farm at 11.00 hrs in rainy weather which improved enough to make the work amenable. Carrying numerous items of peat boring gear the party proceeded on to the raised bog where some four hours quickly passed.

First, brief attention was given to the flora of the mire which supports, as is well-known, *Andromeda polifolia* and *Ledum groenlandicum*. During lunch the leader expatiated on the geological and vegetational history of the area as revealed not just by the work of Durno, Turner and Sissons, but also by Cambridge radiocarbon dates.

With the help of sturdy research students from the University of Edinburgh, the leader used three types of peat samplers to reveal the stratigraphy of the mire; at the point studied, some 3m of raised bog peat overlies c 0.25m of wood/fen peat on c 7.50m of Carse Clay which rests on a lower layer of oligotrophic peat.

Plant remains in the uppermost 3.50m were identified where possible. Embedded in the top of the Carse Clay were seeds of *Suaeda maritima* (det. Mrs C. A. Dickson), a species with few fossil occurrences.

After a vote of thanks handsomely delivered by Dr W. W. Newey, the party took leave of the mire. This time sundry peat and clay samples were additional burdens.

J. H. DICKSON

ACHNACREE MOSS, BENDERLOCH, AND GLEN LONAN, TAYNUILT, ARGYLL. 13TH JUNE

There was an attendance of 11 at this meeting, organised by the C.S.S.F. jointly with the Andersonian Naturalists of Glasgow.

Before lunch an area of acid bog in Achnacree Moss was visited, from which 74 species were recorded. *Drosera anglica* and *Isoetes lacustris* were the most noteworthy. Later in the day, in the less acid conditions of upland pasture in Glen Lonan near Taynuilt, *Trollius europaeus* and *Saxifraga hypnoides* were the most interesting plants in a total of 82 species.

E. R. T. CONACHER

LETHANS DEN AND KNOCK HILL, FIFE. 19TH JUNE

The main object of the meeting, attended by two members and two guests, was to attempt to rediscover a number of rare species recorded over a century ago. This met with only limited success, for unfortunately the most sought after were not seen, among them *Cryptogramma crispa*, *Thelypteris phegopteris*, *Equisetum hyemale*, *E. pratense*, *Drosera anglica* and/or *D. intermedia*, *Pyrola media*, *P. rotundifolia*, *Paris quadrifolia*, *Gymnadenia conopsea*, *Leucorchis albida*, *Carex paupercula* and *C. pauciflora*. In compensation, however, several species uncommon in Fife were seen. The upper part of the Den yielded *Rubus saxatilis*, *Melampyrum pratense*, *Carex hostiana* and *C. pallescens*, and in the wooded area about the waterfall (Swallow Craig Den) there were sheets of *Stellaria nemorum* and a few shrubs of *Corylus avellana* and *Viburnum opulus*—both rare as natives. In the meadows by the Black Devon River were *Trollius europaeus*, *Cirsium heterophyllum*, stands of *Carex acutiformis* and a little *C. paniculata*, and on shady banks *Thelypteris dryopteris*. Clumps of *Rumex alpinus* were also present further downstream.

Time did not permit an ascent of Knock Hill (a later visit indicated that intensive grazing seemed to have eliminated likely plants), but a brief survey of neighbouring Din Moss revealed *Vaccinium oxycoccus* and, sparingly, *Trientalis europaea* and *Dryopteris carthusiana*. It took a further visit to come across *Drosera rotundifolia* in very small quantity. The hybrid orchid *Dactylorhiza maculata* subsp. *ericetorum* × *D. purpurella* was also noted.

A total of some 200 species was recorded for the appropriate 5km square of 36/09 during the day, including over 100 additions to that square, which, like most Fife squares, was badly under-recorded for the *Atlas*.

G. H. BALLANTYNE

MEALL GHAORDIE AND CREAG LAOGHAIN, PERTH. 20TH JUNE

The objects of this meeting, held jointly with the Perthshire Society of Natural Science, were to compile data for the rare species survey on *Cystopteris montana*, *Salix lanata*, *Veronica fruticans* and *Bartsia alpina*, and to compile records for the 5km grid square 27/54 SW.

The meeting as advertised had to be cancelled owing to the very unfavourable conditions prevailing on the morning of the 20th June for a mountain excursion. The only visiting member and a small party of P.S.N.S. members covered instead, between heavy showers, a short stretch of the River Earn near Crieff, making additions to the 5km square card.

A visit was however made on 4th July to the location advertised attended by 12 persons, a member of the P.S.N.S. and the leader representing the B.S.B.I., and an attempt was made to carry out the objects of the original meeting. In deteriorating weather conditions *Cystopteris montana*, *Veronica fruticans* and *Bartsia alpina* were seen on the cliffs of Creag Laoghain, the latter in full flower, but it was impossible to adequately complete the Rare Species Survey as required. Another visit will be necessary. Most of the commoner alpine species and many lowland ones were nevertheless recorded for the P.S.N.S. 5km square records.

A. W. ROBSON

KINDROGAN FIELD CENTRE, PERTHSHIRE. 23RD-30TH JUNE

This course on Mountain Flowers was attended by 16 persons, most of whom were B.S.B.I. members. On the evening of the 23rd the party was welcomed by the Warden, Mr Brian Brookes, and a programme for the week was discussed. It was arranged to have an excursion each day to a place of particular interest.

On 24th June Ben Vrackie (2757 ft) was climbed by the track from Moulin, Pitlochry. During the approach across moorland above 1000 ft species of local occurrence noted were *Trientalis europaea*, *Antennaria dioica*, *Listera cordata*, *Tofieldia pusilla*, *Juncus triglumis* and *Eriophorum latifolium*, while on a crag near the path at 1650 ft were *Arabis hirsuta*, *Helianthemum chamaecistus* and *Rubus saxatilis*. Of special interest near the summit were *Astragalus alpinus*, *Oxytropis halleri*, *Potentilla crantzii*, *Draba incana* and *Cerastium alpinum*, and a number of other montane plants were also noted.

The Cairnwell (3059 ft) was climbed on 25th June from the highest point of the 'Devil's Elbow' road (A93), after the party had stopped in Glen Shee to see fine colonies of *Meum athamanticum*. During the ascent *Rubus chamaemorus*, *Chamaepericlymenum suecicum* and *Vaccinium uliginosum* were seen on east-facing slopes, with *Juncus trifidus* and *Carex biglowii* on the more exposed parts. On a small outcrop of limestone *Minuartia rubella*, *Dryas octopetala*, *Polygonum viviparum* and *Carex rupestris* were seen.

On 26th June the party joined the Alpine Section of the Botanical Society of Edinburgh in an excursion to Glas Tulaichean (3449 ft), approaching from the head of Glen Fearnach and finding *Betula nana* en route at about 2500 ft. On an outcrop of lime-rich crags at about 3000 ft were *Trollius europaea*, *Silene acaulis*, *Saxifraga hypnoides*, *S. oppositifolia*, *Salix lanata*, *Carex atrata* and *Poa alpina*.

The rocky slopes rising from the east shore of Loch Loch were visited on the 27th June. Among the species found, mainly between 1600 and 1800 ft, were *Draba incana*, *Arabis hirsuta*, *Helianthemum chamaecistus*, *Geranium sylvaticum*, *Oxytropis cam-*

pestris, *Potentilla crantzii*, *Galium boreale*, *G. sternerii* and *Veronica fruticans*. The *Oxytropis*, which is well established here, was flowering in profusion and great beauty.

Glas Maol and Caenlochan Glen were visited on the 28th, the approach being made from the 'Devil's Elbow' road once again. On Glas Maol the more noteworthy plants seen were *Veronica alpina*, *V. humifusa*, *Juncus castaneus* and *Alopecurus alpinus*, while on the well-known cliffs of Caenlochan most of the montane plants for which the area is noted were seen, including *Thlaspi alpestre*, *Dryas octopetala*, *Salix lanata* and *S. myrsinites*.

The last day of the course was devoted to Ben Lawers (3984 ft), which was climbed from the National Trust car park and information centre on the slopes of Ben Ghlas. A large proportion of the plants for which the Ben is well known were seen, including good specimens of *Saxifraga cernua*. Unfortunately, persistent cold weather seemed to have hindered the flowering of some species, e.g. *Gentiana nivalis*.

It is fitting to remark that the kind co-operation and help given by Mr Brian Brookes and his staff contributed greatly to the success and enjoyment of the course.

J. GRANT ROGER

INVERGARRY, INVERNESS. 10TH-17TH JULY

Eleven members and friends explored the neighbourhood of Glen Garry, Loch Oich, and Loch Lochy. The weather was phenomenally co-operative, with only one wet morning. Altogether 14 5km squares were visited, and two members, who stayed a little longer, visited a 15th square. A total of 2293 records were made, an average of 168 per square. Most of these were common heath and wet moorland plants with a sprinkling of weeds of disturbed ground, but four elevated areas were visited in five squares and these provided many arctic-alpine species, some of which were also recorded washed down elsewhere. A number of species unusual in v.c. 97 were encountered and of these the following may be mentioned:

Asplenium viride in Glen Buck; *Polystichum lonchitis* on base-rich crags about 700m; *Botrychium lunaria* seen in four distinct and widely separated places; *Ranunculus auricomus* growing with *Epilobium anagallidifolium* in two flushes from some base-rich rocks at about 600m; *Teesdalia nudicaulis* abundant beside some forestry roads; *Subularia aquatica* in the R. Garry; *Elatine hexandra* in a pool of the R. Garry not far from Loch Quoich; *Spergularia rubra* growing in the middle of a weedy lay-by on a forestry road; *Oxalis europaea*, a garden weed at Craigard; *Potentilla crantzii* in a small area of base-rich rock with *Trollius europaeus* and *Silene acaulis*; *P. anglica* in the grass around Craigard Hotel; *Betula nana* in the peat hags of Coire Glas and Sron a' Choire Gairbh; *Oxycoccus palustris* in Coire Glas; *Veronica montana* in two localities, both rocky, grassy areas; *Melampyrum sylvaticum* in a rocky gorge of Glen Buck; *Hammabrya paludosa* beside Loch a Choire Beithe, a colony of many plants, seventeen flowering; *Scirpus fluitans* in the R. Garry; *Carex atrata* on base-rich crags at 700m with *Polystichum lonchitis* nearby; *Festuca altissima* in three places, each a rocky gorge, near a waterfall; *Agropyron caninum* in Glen Buck; *Milium effusum* in a rocky gorge of the R. Garry with *Hymenophyllum wilsonii* and *Galium odoratum*.

Day by day the meet went as follows:

On 10th July one member arrived early and took a walk to Loch Lundie. *Carex lasiocarpa* here set a pattern for the week.

On Sunday 11th July, the party, now ten strong, traversed forestry roads south of Loch Garry.

Monday 12th July was devoted to Gleouraich (1030m (3395 ft)) and Spidean Mialach (992m (3268 ft)). These proved rather barren hills, though *Athyrium alpestre* was abundant, and a single plant of *Leucorchis albida* was seen.

On Tuesday 13th July the last member of the party arrived and the day was spent

by Loch Lochy and in Coire Lochain of Meall na Teanga (930m (3050 ft)). The latter proved a very interesting area.

After two days of hill botanising, Wednesday 14th July was devoted to lower ground beside Loch Oich and in Glen Buck. The greatest variety of the week was found here, as loch-shore, woodland, moor, gorge, and disturbed ground were all explored, yielding 262 records.

Three persons ascended Ben Tee on Thursday 15th July, and saw *Arctous alpinus* and *Arctostaphylos uva-ursi* on the ridge. A fourth joined them in Coire Glas, while the rest explored Kilfinnan with its gorge and waterfall.

The last day, Friday 16th July, was spent motoring to Kinlochhourn, with many stops on the way. There is little but moorland here as Loch Quoich is a reservoir with barren edges, trees are few and there are virtually no houses to provide weeds of cultivation. The pools in the R. Garry proved interesting and at Kinlochhourn the western seaboard provided a very sudden change.

The total number of species encountered during the week was 385, though this number is subject to increase as critical species are determined.

A. A. P. SLACK

GLEN AFFRIC, GLEN CANNICH AND STRATHFARRER, INVERNESS. 17TH-24TH JULY

Five persons gathered at the start of the week at the Glen Affric Hotel, but were joined later in the week by four others, and also by members of the Inverness Botany Group, who came as guests.

The first day was spent in Glen Cannich. We worked in the 5 km square 27/33 SW mainly around Loch Craskie and the banks of the River Cannich. *Lobelia dortmanna* was seen in this loch, and also in the next square, 27/23 SE, at Loch Carrie. *Gentianella campestris* was found on the shores of Loch Carrie. Some of the party climbed by Allt Charaidh to An Soutar, and between these two saw extensive areas of *Betula nana*, growing up to 1620 ft, and thereafter *Arctous alpinus*. We crossed into square 27/23 NE at the summit, where such species as *Salix herbacea*, *Loiseleuria procumbens*, *Arctostaphylos uva-ursi* and *Carex bigelowii* were present.

On the 19th, we returned to Glen Cannich, this time going to Loch Mullardoch, where in square 27/23 SW, *Leontodon taraxacoides* was found. The party split, some remaining on the low ground within the above square, and others climbing Allt Fraoch-Choire towards Coire an T-Sneachda. All of the recording was within square 27/22 NW. The area was not rich, but we did record *Thalictrum alpinum*, *Juncus trifidus*, *Gnaphalium supinum*, *Silene acaulis* and *Luzula spicata*.

The 20th found us in Glen Strathfarrar, working in the lower parts of the Glen. Squares 27/33 NE and 27/33 NW gave us many lowland woodland and riverside species, and we moved upstream to square 27/23 NE, where we climbed An Carnais, finding *Melica nutans* and *Rubus saxatilis*. The flat river plain within this square also gave us *Carex lasiocarpa*, alongside *C. rostrata* and *Menyanthes trifoliata*.

Weather on the 21st forced us to keep to low ground in Glen Affric. We worked along the south side of Loch Beinn a' Mheadoin, through squares 27/22 NE, 27/22 SW and 27/12 SE. The latter square was profitable indeed, producing *Carex limosa*, *C. paupercula*, *Nymphaea alba* and *Vaccinium microcarpum*. The series of small lochans and bogs in this area may well reward further attention.

Better weather conditions next day enabled us to tackle a climb of Sgurr na Lapaich, between Glen Strathfarrar and Loch Mullardoch. The square was 27/13 NE. We climbed the ridge of An Leth-chreag, towards the summit recording *Alchemilla alpina*, *Saxifraga aizoides*, *S. oppositifolia*, *S. stellaris*, *Carex saxatilis*, *Armeria maritima* and many other alpine and woodland species. This is a very fine hill, worth further study. Miss Webster topped the day by finding the rare *Gnaphalium norvegicum*.

The final day, the 23rd, took us to square 27/12 SE once more, to climb the other Sgurr na Lapaich. The weather was atrocious, but a group pressed on by Allt na Faing,

towards the crags, which supported such interesting plants as *Saussurea alpina*, *Trientalis europaea*, *Oxyria digyna* and *Sibbaldia procumbens*, all of which had already been seen elsewhere during the week. Lower down, at Loch Lapaich, Miss Webster had been finding *Subularia aquatica* and *Sparganium minimum*.

On the 24th, after most members had dispersed, a few remained to look around the village of Cannich, which had been sadly neglected all week. Bad weather caused serious attempts at botanising to be quickly abandoned.

The week was a very enjoyable one, with a fine friendly spirit among the participants. We were a group in which each contributed his or her share. None of us was a great expert, and we each learned a lot, especially from the enthusiastic and knowledgeable Miss Webster, who spent three days with us. A feature of the week was the presence of Miss J. T. Wisely, who painted most beautiful representations of the species which we brought down to her. As well as recording for the 5km squares, the opportunity was taken to view the area from the conservation angle, and a report along these lines was prepared for the Nature Conservancy. A copy of this has been presented to the Committee, along with a useful list of sites worthy of future exploration.

A. CURRIE

BEN LEDI, PERTH. 25TH SEPTEMBER

The object of the meeting, which was held jointly with the Andersonian Naturalists of Glasgow, and which was attended by twelve persons, was to investigate the bryophyte flora of the mountain. Species found on the way up to the east Corrie included *Seligeria recurvata*, **S. pusilla*, **Philonotis capillaris*, *Dicranum blyttii*, *Orthothecium intricatum* and *Cololejeunea calcarea*. On the floor of the corrie were *Rubus chamaemorus*, *Chamaepericlymenum suecicum* and *Acrocladium sarmentosum*. On rocks at the head of the corrie were **Pohlia polymorpha* and *Grimmia funalis*. The richest area, one that would repay further study, was to the north of the corrie where were found *Polystichum lonchitis*, *Draba incana*, *Oedipodium griffithianum*, *Amphidium lapponicum*, *Metzgeria pubescens*, **Bryum dixonii*, *Eremonotus myriocarpus* and *Hygrobiella laxifolia*. Species marked with an asterisk are new to v.c. 87.

A. C. CRUNDWELL

IRELAND

URLINGFORD, CO. KILKENNY. 12TH JUNE

The object of the meeting, attended by five members, was to explore the flora of turlough-type lakes known as 'The Loughans' about two miles south-east of Johnstown. The lakelets, fringed with *Filipendula ulmaria* and *Potentilla anserina*, contained much *Ranunculus trichophyllus*, *R. aquatilis* and *Glyceria fluitans*. Other damp areas, possibly under water in winter, yielded *Thalictrum flavum*, *Parnassia palustris*, *Carex hostiana*, *C. lepidocarpa*, *Molinia coerulea* and *Ophioglossum vulgatum* while the calcareous drift banks held *Antennaria dioica*, *Linum catharticum*, *Briza media* and *Orchis morio*. Tullanvoolty Bog, mentioned in older botanical literature, was next visited. Here, two miles north-west of Johnstown, the 'Bog' proved to be a fen somewhat adversely affected by recent drainage. However, species recorded here included *Cirsium dissectum*, *Schoenus nigricans*, *Carex hostiana*, *C. lepidocarpa*, *Selaginella selaginoides* and *Equisetum variegatum*. The meeting ended with the exciting re-discovery of *Ophrys insectifera* recorded from this site in 1837.

C. BREEN

MULLINGAR, CO. WESTMEATH. 23RD-27TH JULY

Twenty-five people attended the meeting centred on Mullingar, County Westmeath. The object of the meeting was to introduce members to the rich flora of the Midland lakes and mires.

Saturday was spent in the Lough Owel area. The fen at Ballynagall, which is known as the 'Scraw Bog', was the first objective and the morning was spent there. Most of the rarities known from there were seen, *Pyrola rotundifolia*, *Carex appropinquata* and *Eriophorum gracile* being of particular interest. *Drosera intermedia*, reported by the Dublin Naturalists' Field Club in 1967, was refound there and is a new county record, as is the rare moss *Camptothecium nitens*.

After lunch the difficult scraw at the north-west corner of Lough Owel was penetrated and *Pyrola rotundifolia*, *Carex appropinquata*, *Thelypteris palustris* and *Lathyrus palustris* refound by the more intrepid adventurers.

Cut-away bog and fen at Welshestown South, two miles south of Lough Owel, produced *Ophrys insectifera*, which had not been recorded for Westmeath. *Selaginella*, *Osmunda*, *Epipactis palustris* and *Carex diandra* were also seen.

Sunday was spent in the region north and north-east of Mullingar. A first call at the southern end of Lough Derravaragh found the lake-level so low that the rhizomes of *Nuphar lutea* were fully exposed to the air; in spite of this, however, *Oenanthe aquatica*, in deep water, barely surfaced. An unusual abundance of *Catabrosa aquatica*, a recently arrived colony of *Epilobium angustifolium* and a few plants of *Ranunculus sceleratus* were seen here.

In a kettle hole just east of Fore a curious type of acid fen has developed with hummocks of *Sphagnum palustre* and *S. rubellum* and the more mesotrophic species. Here was *Carex curta* (discovered here earlier in the year, and now past its prime), not hitherto known from Westmeath; also a remarkable abundance of *Eriophorum vaginatum* and a little *Vaccinium oxycoccus*.

At Fore itself a promising limestone bluff turned out to be so cherty that the plants on top included *Vaccinium myrtillus* and *Carex binervis*, while by the roadside a colony of *Chrysanthemum segetum* also defied the surrounding limestone. The extensive fenny margins of Ben Loughs were next visited: here there is a great abundance of *Cladium* and *Carex diandra*, with *Potamogeton coloratus*, *Carex lepidocarpa*, *Schoenus nigricans* and other calcicoles but also a quantity of *Epilobium angustifolium*. A small colony of *Galium uliginosum* was found on a drier part of the northern shore.

A list was made of the plants growing about a small lakelet to the north-east of White Lough in County Meath but did not include anything unusual. The lakelet itself was surrounded by a band of shell-marl and showed a poor development of aquatics and marginal vegetation; the peaty nature of the soil for some distance above the present water level and the presence of several sub-fossil alder stumps under water was evidence of considerable variation in water level above and below its present level.

On Monday the chief objective was Lough Ree. The shore was visited at two places, south-west of Glassan and opposite Inchmore. *Teucrium scordium* in full flower on the stony shore made a good show at both stations and at the second there was an enormous 'reed-bed' of almost pure *Carex lasiocarpa*. Other interesting plants seen included *Rosa agrestis*, *Thalictrum flavum* and *Equisetum* × *litorale*. *Pinguicula vulgaris* and *Blackstonia perfoliata* were seen scarcely six inches apart on the stony shore. A little further north by Creggan Lough an irregularly cut-away bog yielded a good mixture of calcicole and calcifuge species, with *Potamogeton coloratus* and *P. polygonifolius* mingled in the water. Here the bog-holes yielded three species of *Utricularia*, luxuriant *Myriophyllum verticillatum* and some *M. spicatum*, and also *Sparganium minimum* and a little *Hydrocharis*; while on the surface were *Drosera intermedia* and a profusion of *Osmunda* unusual for Leinster. One plant of *Epipactis palustris* was seen near the roadway. Two visits to the now derelict Royal Canal showed it to be choked with *Glyceria maxima* and *Ranunculus lingua*, with a fringe of *Oenanthe fistulosa* and *O. aquatica*, with floating *Hydrocharis* here and there in open water. A final call at a cut-away bog near the R. Inny on the Longford border showed that drainage had diminished the interest of the place since attention was drawn to it in the *Irish Naturalists' Journal*, 12: 250 (1958) but there is still a profusion of *Rumex*

hydrolapathum and a little *Hydrocharis*, *Ranunculus lingua* and *Stellaria palustris*. The damp pasture beside the bridge was filled with *Senecio* × *ostenfeldii*.

Tuesday morning, the last of the meeting, was spent in the Delvin area. A moraine south of Balrath Cross Roads proved to be too grassy for rare plants. A raised bog east of the Bord na Mona development at Lisclogher appeared to be subjected to controlled burning for grouse but had all the usual bog species. Crowinstown Lake to the east of Delvin has a fenny margin with *Schoenus*, *Carex elata*, *C. hostiana*, *C. diandra*, *Ranunculus lingua* and *Epipactis palustris*, but is becoming acid on the west side with *Sphagnum* spp., *Molinia* and *Erica tetralix*.

D. SYNNOTT & D. A. WEBB

EXHIBITION MEETING, 1971

The Annual Exhibition Meeting was held in the Department of Botany, British Museum (Natural History), London, on Saturday, 27th November, 1971, from 1200 to 1730 hours.

SOME CONFUSED PLANTS

Plants with an overall superficial similarity do not necessarily belong to the same species or even genus and may be easily confused. In our experience this confusion often arises or is amplified because specimens are carelessly keyed and compared with descriptions, or carelessly collected, inadequately labelled and not compared with authentically named material. The following six species-pairs, represented by herbarium specimens, were shown together with short notes drawing attention to particularly useful characters. In each case the two descriptive phrases given refer respectively to the two species they follow.

Cardamine flexuosa and *C. hirsuta*: stamens 6; stamens 4 (but the 2 short stamens in the former may be overlooked).

Medicago lupulina and *Trifolium dubium*: leaflets apiculate; leaflets obcordate and never apiculate.

Potentilla sterilis and *Fragaria vesca*: leaflet teeth acute and 3 terminal teeth forming a truncate apex; leaflet teeth obtuse and terminal ones forming a cuneate apex.

Lamium moluccellifolium and *L. amplexicaule*: bracts petiolate and never amplexicaul; bracts sessile and amplexicaul.

Galinsoga parviflora and *G. ciliata*: pappus regular, stems ± glabrous; pappus irregular, stems densely hairy.

Leontodon autumnalis and *Hypochoeris radicata*: hairs on involucre soft, terminal lobe of leaf acute; hairs on involucre stiff, terminal lobe of leaf blunt.

Seven other pairs of species were exhibited at the 1969 Exhibition Meeting (*Watsonia*, 8: 333 (1971)).

E. B. BANGERTER & L. F. FERGUSON

SYNTHESISED *GERANIUM PURPUREUM* × *ROBERTIANUM*

This exhibit comprised specimens and an explanatory note to illustrate hybridisation experiments involving *Geranium purpureum* Vill. and *G. robertianum* L. A further note will be published when the experiments are completed.

P. M. BENOIT

THE B.S.B.I./W.R.O. WEED SURVEY NO. 1

The survey is designed to measure the changes in frequency of 19 common weeds in arable land, and 21 less common ones in any habitat, over a period of time. This

first survey, which is continuing until the end of 1973, will be repeated after a number of years.

So far, records have been received for 128 tetrads and the frequency ratings of the 19 common species in arable land were exhibited as histograms. Of these, *Sinapis arvensis*, *Chenopodium album* and *Atriplex patula* are apparently still widespread and common, although thought to be declining because of their particular sensitivity to herbicides. They were rated as very frequent to abundant in 14–29% of the tetrads so far assessed.

Cardaria draba, thought to be increasing, has so far only been recorded in arable land in one tetrad and rare at that, although noted as a ruderal in several others. Similarly *Anchusa arvensis* has only been recorded from 12% of the tetrads.

R. J. CHANCELLOR

RANUNCULUS BULBOSUS IN EUROPE

The *R. bulbosus* group has previously been divided into several species and subspecific categories. The group has been re-examined and in the proposed classification only two subspecies within the single species *R. bulbosus* L. are recognised: subsp. *bulbosus* and subsp. *adscendens* (Brot.) Neves.

Subsp. *bulbosus* occurs over northern and central Europe; the main habitat in which it occurs is well-drained grassland. Subsp. *adscendens* occurs in southern Europe in areas with a Mediterranean climate, but it only occurs in damp habitats, such as marshes and ditches. It differs from subsp. *bulbosus* in having entire leaves, broad, tuberous roots and root-stocks which are only slightly swollen and corm-like. There is a continuous array of intermediates between the two subspecies, occupying climatically transitional regions.

Examples of both subspecies and of intermediate plants were exhibited. The distribution of the various types of plants which occur in southern Europe was shown on maps.

S. M. COLES

VARIATION IN SPECIES OF VULPIA

The exhibit consisted of herbarium specimens, photographs of chromosome preparations, and a map of Europe indicating the origin of plants of known chromosome number.

Most of the European species of *Vulpia* fall into two main groups: chasmogamous diploids confined to the Mediterranean Region; and partially or wholly cleistogamous species which are diploid or polyploid and occur over a wider part of Europe. *V. geniculata* is the commonest member of the first group. In the second group *V. myuros* and *V. membranacea* are known as diploid, tetraploid and hexaploid races, and there is some indication that the diploids are natives of the Mediterranean zone and the polyploids of more northern areas. In the latter species, diploids are more chasmogamous than polyploids.

Three British species of *Vulpia* are known to hybridise with *Festuca rubra*. A plant of the intergeneric hybrid involving *V. membranacea* from Harlech proved to be pentaploid, with tetraploid (*Vulpia*) and hexaploid (*Festuca*) parents.

R. COTTON & C. A. STACE

THE PHYTOGEOGRAPHY OF MULL

The five-year field programme of the British Museum Mull Survey Project was completed in 1970. Since then a manuscript account of the Flowering Plants and Ferns

has been prepared and work now centres on an investigation of the phytogeographical relationships of the flora. To this end an analysis has been made of the floras of a number of areas in terms of the *Distributional Elements* of J. R. Matthews.

This analysis showed by means of maps and histograms that Mull fits into the general sequence of phytogeographical change in both north-south and west-east directions, with a very strong representation of oceanic and northern elements. Mull has a poor representation of the Arctic-Subarctic, Arctic-Alpine and Alpine elements when compared with the 100 km squares to the east (27 and 37). This is of course due to both the extreme oceanic conditions on Mull and the lack there of the base-rich habitats favoured by many species of these elements. It is hoped that a computerised procedure using the above data will provide a relatively precise picture of the Mull flora in relation to those of comparable areas.

DEPARTMENT OF BOTANY, BRITISH MUSEUM (NATURAL HISTORY)

FOSSIL PLANTS FROM THE SILURIAN AND DEVONIAN OF SOUTH WALES AND THE WELSH BORDERLAND

The early history of land plants was traced from the Upper Silurian into the Lower Devonian of South Wales and the Welsh Borderland. In the Silurian, very few plants are present. Dichotomously branching, naked axes from lower and upper Ludlovian horizons have not yet yielded tracheids, so that the earliest proven vascular plants are *Cooksonia pertonii* and *C. hemisphaerica*, described by Lang from the Downtonian. Plants with similar organisation, again members of the Rhyniophytina were shown from the younger Downtonian rocks of Breconshire (*Steganotheca*) and Pembrokeshire (*Cooksonia* sp.).

The Breconian flora is much more extensive and varied. Members of the Zosterophyllophytina include *Gosslingia breconensis*, *Sawdonia ornata* and four species of *Zosterophyllum*, while the Rhyniophytina is represented by *Cooksonia* sp. Also included in the assemblage are *Dawsonites arcuatus* (Trimerophytina), *Krithodeophyton croftii* (Barinophytales) and various *Drepanophycus* species, the first lycopods recorded from the region.

D. EDWARDS

SOME UNCOMMON BRITISH SPECIES OCCURRING IN THE EYJAFJÖRDUR AREA OF NORTHERN ICELAND

On display were a selection of herbarium sheets of, in the main, uncommon British species collected by the exhibitors in northern Iceland during the summer of 1971. These were supplemented by maps and coloured photographs of the area, together with a selection of Icelandic botanical literature and details of the Katla Field Station.

From the floristic viewpoint the Eyjafjörður area is both rich and diverse when compared with other regions of Iceland. The vegetation reaches higher altitudes than in most other regions, and several arctic species that occur there are absent from other parts of the country. At lower altitudes and towards the outermost parts of the local peninsulas many interesting arctic oceanic species are located.

It is considered that the existence of this rich and diverse flora is, in part at least, due to the fact that the district was not covered by a continuous ice-cap, and that elements of the flora survived the major glaciations in such situations as nunataks and ice-free lowland strips on the peninsulas.

J. E. ELSLEY & P. W. LAMBLEY

VARIATION IN *PUCCINELLIA MARITIMA*

Puccinellia maritima is a widespread and often dominant plant in British salt marshes, yet comparatively little is known of its biology, ecology or taxonomy. Work begun recently at the Coastal Ecology Research Station, Norwich, suggests that the species has reacted to the complex mosaic of habitats within the intertidal environment by both plastic responses and the production of genetically fixed ecotypes. Whilst collateral cultivation has eliminated a great deal of variation found in the field, much of this, particularly in characters related to growth-habit and leaf-type, has a genetic basis.

Chromosome counts in the literature include $2n = 14, 49, 56, 63$ and 77 . Counts so far obtained at C.E.R.S. are mostly at the octoploid level ($2n = 56$), occasionally with chromosomes apparently missing (counts of $54, 55$ etc).

A. J. GRAY

HERTFORDSHIRE ALIENS

A collection of about 35 different live specimens was exhibited. The plants were representative of both the bird-seed and wool alien species which had survived in flower until the meeting. They included *Senecio inaequidens*, *Lamarckia aurea*, *Psoralea americana*, *Echinochloa colonum*, *Arachis hypogaea* and *Scorpiurus muricatus*.

Also shown were a selection of the seeds and fruits of some 50 alien plants, together with actual samples of wool waste (grey shoddy), in which large numbers of fruits were visible—this shoddy was the source of about 50% of the specimens on display.

C. G. HANSON

MEADOW SAFFRON AND SAFFRON

In spite of its name the British meadow saffron, *Colchicum autumnale*, is not a source of the spice saffron. The saffron, *Crocus sativus*, is a Mediterranean plant of ancient origin. Some 4320 styles are required for each ounce of saffron, which is therefore very expensive.

F. N. HEPPER

METHODS OF INSECT CAPTURE AND DIGESTION IN BRITISH SPECIES
OF *PINGUICULA*

Species of *Pinguicula*, although superficially the least remarkable of all insectivorous plants, show many striking adaptations for capturing and digesting their prey. Electron microscope studies of a living leaf show what happens when a living insect is trapped on its surface: how the mucilage from the stalked glands anchors it down firmly and the stalked glands start to secrete. A pool of digestive fluid, having marked detergent properties, then accumulates and wets the whole insect surface.

High resolution cytochemical and other methods have located the distribution of certain enzymes (esterase, acid phosphatase, ribonuclease, protease and amylase) in unstimulated and stimulated leaf glands and these enzymes have been shown to have different patterns of distribution.

The time taken for the uptake of the digestive products on the leaf surface has been followed with radioactive tracers and the translocation of the products of digestion, moving through and out of the leaf, has been observed over a 12 hour period.

Y. & J. HESLOP-HARRISON

THE NAMING OF NARCISSI

The only satisfactory and accurate way to treat naturalised Narcissi is as the clones most are. The cultivars appear to persist unaltered; in some cases they have done so for well over a century, and in one for 350 years (see *Roy. Hort. Soc. Daffodil and Tulip Yearbook* 1971, pp. 181–183). The numerous naturalised Narcissi of Guernsey, where vast quantities have been grown, are being treated this way in the forthcoming account of its wild flowers. A sample score or so of naturalised and named Guernsey Narcissi were shown. It has been expertly said that the full tally is likely to be nearer 100 than 50.

D. McCLINTOCK

DOUBLE-FLOWERED CALLUNAS

Mr J. W. Dyce's discovery of a double-flowered *Calluna* in Norfolk this year seems to be about the twelfth such definitely recorded plant in the wild anywhere, apart from about three before the present century. Details of the latter and of their numerous synonyms are lost in a maze of uncertainty (see *Jl R. hort. Soc.*, 91: 438–442 (1966)). Our present clone 'Flore Pleno' is probably one of them.

In addition to pressing material, Mr Dyce sent his heather for propagation. This will allow study of its inherent characteristics and whether it will sport or revert. *Ruth Sparkes*, a yellow-foliaged cultivar, is a sport from the green-foliaged *Alba Plena*, which has produced an apparently identical double-flowered seedling and which is itself a sport from the single-flowered *Alba Elegans*. Most, but not all, plants of *Ruth Sparkes* have branches reverting to *Alba Plena*. In addition, *Ruth Sparkes* has sported to produce the pink-flowered *Joan Sparkes*. Such apparently unstable groups would seem to offer interesting possibilities for genetic investigation.

D. McCLINTOCK

GUERNSEY 1971

The last of the three annual field meetings in Guernsey made fewer important discoveries than its predecessors, which suggests it may now not be too premature to attempt to complete an account of the island's flowers. A few useful observations were made at other times, but the great bulk of worth-while records came from the visit of the B.S.B.I. and the Wild Flower Society in July (see p. 184), and the most exciting from the visit of the British Pteridological Society in April (see p. 204). In all, something like 120–150 records of some importance were made during the year, plus many hundreds of others which were new to one or other of the 79 island squares.

During the year 11 taxa new to Guernsey were discovered in the island, seven species were rediscovered which had not been seen for between 25 and 75 years, ten other species were found which had been recently lost or hardly seen at all, and 16 species rare in Guernsey were found in quite new areas.

D. McCLINTOCK

CONYZA IN BRITAIN

Three taxa of the genus *Conyza* originating from the New World are widespread weeds of waste ground, etc., in many parts of the world. *Conyza canadensis* (L.) Cronq. has been recorded in Britain since the early seventeenth century. *Conyza bonariensis* (L.) Cronq., first recorded at the beginning of this century, is an infrequent alien. *Conyza floribunda* Kunth is now established in Guernsey.

The exhibit consisted of herbarium specimens showing typical and atypical variants

together with an analytical key and a table of contrasting characters as an aid to the identification of these often confused and misidentified species.

In the case of *C. floribunda*, attention was drawn to the fact that the majority of specimens examined at the herbaria of the British Museum and Kew do not entirely conform with the type description but were variants of that species which correspond to forma *subleiotheca* Cuatrecasas of *Conyza bonariensis*.

J. B. MARSHALL & D. McCLINTOCK

BIRD-SEED ALIENS

Many of the alien plants which appear on rubbish tips and waste ground originate from cage or domestic bird-seed. The purpose of this exhibit was to demonstrate the bird-food species, the variety of plants which are introduced into this country with bird seed and the range of countries from which they are imported.

The exhibit included a list of some 30 species of plants which are imported as bird-food together with specimens and seed samples as examples. The following material was exhibited in addition: maps of the world marked to show bird-seed producing regions; samples of crude imported seed; published articles on the bird-seed industry; and specimens of plants introduced with bird-seed.

J. L. MASON & D. McCLINTOCK

TREES ON STAMPS

Only a few species of trees such as coconut palm, banana and rubber have been depicted on stamps in the past. In recent years designers of stamps have become more adventurous, depicting not only the tree but also its flowers and fruits. Today the main countries producing stamps showing trees are tropical and the most popular topic is the timber industry.

Y. L. MOSCATI

SOME SPREADING ALIENS

The problem of mapping unfamiliar alien species that are establishing themselves in our country is one of increasing importance. Three species in point, all from western North America, whose spread is being mapped are *Rubus spectabilis*, *Tolmiea menziesii* and *Tellima grandiflora*. The exhibit attempted to give a summary of what is already known about their distribution and extended an invitation to other botanists to help in the work of mapping them. The maps were based on data in the Biological Records Centre, Monks Wood.

J. O. MOUNTFORD

MISTLETOE SURVEY

The exhibit included a map which showed the tetrads from which Mistletoe has been reported during the last two seasons. Obvious gaps still exist in southern and south-eastern England.

Some smaller maps show the distribution of Mistletoe on its most important hosts in the Hereford area; apple is by far the most widely attacked host in this essentially apple-growing area. It was suggested that the western limit of distribution is not related to the absence of orchards; altitude appears to be a most important limiting factor. The maximum altitude at which it was seen is 870 ft.

The majority of hosts are exotic trees, and it seems likely that the species was much

rarer before man began clearing the forests, typically occurring in open woods on limestone cliffs in the Wye Valley where Mistletoe still occurs today on *Sorbus aria*.

Mistletoe has so far been recorded on thirty hosts within twenty miles of Hereford, the commonest being apple, hawthorn, poplar, lime, false-acacia and field maple.

F. H. PERRING

KENT FIELD CLUB TETRAD MAPPING SCHEME

The object of this scheme is to map the distribution of the vascular plants that occur in Kent on a tetrad basis during the years 1971 to 1975 inclusive. A map of the county marked in tetrads showed that some records had already been received for about half the 1042 tetrads in Kent. From this first year's experience it has been found that there was no magical number by which one could say a tetrad was well worked. At about 200 some of the coastal squares would include all the plants likely to be found there, whilst some of the more inland tetrads had a score of over 400 and even then new plants were still regularly being added.

The exhibit also showed specimens of some of the species recorded for the first time from Kent, such as *Cerastium pumilum*, *Hieracium calcaricola*, *Taraxacum comixtum*, *T. retzii* and *Scirpus holoschoenus*, plus progress distribution maps of *Viburnum lantana*, *V. opulus*, *Agropyron pungens* and *A. repens*.

E. G. PHILP

SOUTH AUSTRALIAN PLANTS RELATED TO BRITISH SPECIES

Dr A. G. Spooner, a B.S.B.I. member who emigrated to South Australia, has kindly sent a large number of herbarium specimens. A selection of those related to British species was exhibited. Some colour photographs showed examples of semi-desert, mallee, coastal dune and riverside vegetation.

H. M. PROCTOR

HYPERICUM × DESETANGSII

Examples of the parents (*H. maculatum* and *H. perforatum*) and both nothomorphs of this hybrid—nm. *desetangsii* (*H. maculatum* subsp. *obtusiusculum* (Tourlet) Hayek × *perforatum*) and nm. *carinthiacum* (Fröhlich) N. Robson (*H. maculatum* subsp. *maculatum* × *perforatum*) were shown. Nm. *desetangsii* (usually tetraploid) is not uncommon in Britain and, owing to its interfertility with both parents, exists as a complete series of intermediates between them; only F₁ or F₂ plants are easily recognisable. Nm. *carinthiacum*, which has not yet been recorded in Britain, is only recognisable in its triploid form; the pentaploid form is similar to *H. perforatum*.

N. K. B. ROBSON

VARIATION IN *CAKILE MARITIMA*

The characters used to differentiate infraspecific groups within this species are leaf and fruit morphology.

Both show considerable variation in the field and in cultivation, leaf-shape being particularly variable. Some reliable patterns of leaf morphology have been obtained by collateral cultivation of plants from different localities in Europe, using leaves from an equivalent position on each plant. Despite the considerable variation present within each population it is possible to deduce that deeply dissected leaves are correlated with regions having little rain in the Spring (the eastern Mediterranean, Spain and the Baltic).

The relationship between *C. maritima* and *C. edentula* in the North Atlantic is to be studied further, but there appear to be no good grounds for separating them as species (other than a chromosome count of $2n = 36$ recorded for *C. edentula* by A. Löve, *C. maritima* having $2n = 18$).

R. SCOTT

A NEW FERN HYBRID FROM THE CHANNEL ISLANDS

During a British Pteridological Society excursion to Guernsey in April, 1971, a new hybrid within the genus *Asplenium* was discovered (*A. billotii* $\times$ *A. adiantum-nigrum*). It has since been described as *Asplenium* $\times$ *sarniense* Sleep (*Br. Fern Gaz.*, 10: 209–211 (1971)).

Several plants of this hybrid were discovered in two different localities on the island where both putative parents were growing in abundance. In view of their generally intermediate morphology and uniformly abortive spores there seems little doubt that these plants represent a cross between *Asplenium billotii* and *A. adiantum-nigrum*.

The new fern is approximately intermediate between the parents, but is easily overlooked as a state of *A. adiantum-nigrum*, which it closely resembles in its triangular frond and conspicuous basal pinnae. The influence of *A. billotii* is seen in the pinnules, which are distinctly, although shortly, stalked, even towards the distal end of the pinna, and are oval in shape, with bluntly rounded tips bearing short, mucronate teeth.

Meiosis has been examined in two plants. As expected, both are tetraploid, with the disturbed meiosis indicative of hybridity. The chromosome pairing is of the order of n bivalents and $2n$ univalents, which is completely in accordance with the postulated parentage.

A. SLEEP

THE STATUS OF SOME INTERMEDIATES BETWEEN *CENTAURIUM LITTORALE* AND *CENTAURIUM ERYTHRAEA* FROM THE LANCASHIRE COAST

Mixed populations of *Centaurium littorale* (D. Turner) Gilmour and *Centaurium erythraea* Rafn have been recorded from a number of places on the Lancashire coast. Intermediate plants have previously been reported from Freshfield, Ansdell and Hightown.

Morphological analysis of similar populations found at Freshfield, Ainsdale, Hightown and Lytham St Annes in 1970 and 1971 indicates that some plants are referable to *Centaurium littorale*, others to *Centaurium erythraea* and the remainder appear to be intermediate.

Meiotic chromosome counts of British and European populations of *Centaurium erythraea* and of European populations of *Centaurium littorale* agree with those done by Zeltner (Neuchâtel). Both species have $2n = 40$ and both have regular meiosis and a high percentage of fertile pollen grains.

Counts of the intermediate plants from Freshfield, Ainsdale, Hightown and Lytham St Annes gave $2n = 50, 51, 52, 54, 56, 57, 58, 59$ and 60 , with clear but often unequal division at anaphase I, such as $27-27$ and $26-25$. All have a slight reduction in the percentage of fertile pollen grains.

These chromosome counts, together with the intermediate morphology, indicate that hybridisation has taken place between *Centaurium littorale* and *Centaurium erythraea*.

R. UBSDELL

PANELS OF PHOTOGRAPHS OF *CALTHA PALUSTRIS* AND
TUSSILAGO FARFARA

The panels are an excerpt from an attempted photographic record of the wild plants of a hill sheep-farm in the upper reaches of Tima Water, Selkirkshire (v.c. 79), the altitude being 900–1500 ft. This and neighbouring farms are about to be planted by commercial forestry, which will inevitably upset the present pattern. It is hoped that such a record may be of interest later, after the new pattern has been established.

A. WALKER

A STATISTICAL ANALYSIS OF THE DISTRIBUTION OF THE BRITISH
MICROSPECIES OF THE GENUS *HIERACIUM*

The exhibit presented a vice-comital analysis of the microspecies of *Hieracium*, using distributional data from the *Critical Supplement to the Atlas of the British Flora*, and choropleth mapping techniques. The data were obtained using an overlay of the Watsonian vice-counties on the *Atlas* grid squares. Two hundred and forty-six species were recorded for the 112 vice-counties of Britain and the 40 vice-counties of Ireland.

The sections of the genus *Hieracium* were represented as choropleth maps showing the numbers of species for each section per vice-county. In addition, the presence-absence species $\times$ vice-county matrix was subjected to association analysis and principal components analysis. These techniques produced a major division into montane and lowland vice-county groups, which indicated main centres of distribution in the Scottish Highlands and south-eastern England, with subsidiary centres in montane Ireland and Wales and the Pennines.

The analysis substantially supported Zahn's hypothesis of two separate migration pathways with subsequent microspeciation—one from Scandinavia into the Scottish Highlands, prior to the other into lowland southern England.

D. L. WIGSTON & D. ASTLEY

The following also exhibited:

E. J. CLEMENT & T. B. RYVES, B.S.B.I. alien hunt, September 1971 (see p. 188).

COMMITTEE FOR THE STUDY OF THE SCOTTISH FLORA. Inverness-shire survey.

B. EVERARD. Botanical paintings.

J. FAULKNER & A. C. JERMY. The status and distribution of *Carex recta* in Britain.

A. N. GIBBY. Botanical postage stamps.

S. E. GREENWOOD. Some slides taken at the Manchester Conference.

A. C. JERMY & P. BROWNSEA. New and interesting fern records from Crete.

A. MELDERIS. An unusual habitat for *Molinia*.

In the Lecture Hall the following members gave short talks illustrated by colour-slides:

H. J. B. BIRKS. Plants of the Yukon.

C. G. HANSON. Aliens in Hertfordshire.

J. L. MASON. Bird-seed aliens.

A. G. SIDE. Flowers of Kent.

F. M. TAYLER. Mediterranean flowers in Britain.

G. TUCK. Field meetings 1971—Breckland and Alien Hunt.



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The genus *Taraxacum*, commonly known as Dandelions, has been largely neglected in the British Isles, although it is of botanical, ecological and economic importance. Most accounts of the genus in this country consider only four species, which are too general in scope to be of much service.

In the present account the author shows that, due to the apomictic (non-sexual) means of reproduction usual in the genus, a much larger number of clear-cut species can be recognised in Britain, 132 in all, and that these demonstrate characteristic ecological and distributional behaviour.

A substantial introduction, with notes on the taxonomic history, biology, genetics, taxonomy, distribution, identification, cultivation and collection of the British species is followed by a key to the species. In the main account, each species is treated individually with nomenclature, a full description, breeding behaviour, ecology, British distribution (including a vice-county list), European distribution and general notes and comments repeated in each case.

Each species is illustrated with line drawings and there is a full index.

Although our knowledge of the British species of the genus is still incomplete, it is hoped that this work will form a standard reference for a number of years and thus should be valuable to Universities, Colleges, Field Stations, Museums and to all botanists interested in the higher plants of the British Isles.

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with a section on Bryophytes by T. Laflin and contributed chapters by F. W. Shotton, H. Thorpe and G. T. Warwick

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Warwickshire includes a great variety of terrain – dry upland, sandy alluvial valley soils (both cultivated in Neolithic times), scrub and woodland. These areas have seen colonization and change from forest through arable to enclosed pastures and back to arable; the industrial revolution, too, has left its mark. There can be no more suitable area than the county of Warwickshire for so comprehensive a study.

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could be achieved only by the use of a computer.

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Keys should be in one of the generally accepted forms; *Flora of the British Isles* by Clapham, Tutin and Warburg (2nd ed., Cambridge, 1962) and *Flora Europaea* (Cambridge, 1964-8) provide suitable patterns.

Names of genera and species should be underlined, but any other typographical indications should be inserted lightly in pencil. Names of vascular plants should normally follow the *List of British Vascular Plants* by J. E. Dandy (British Museum (NH) and BSBI, London, 1958) and changes published in *Watsonia*, 7: 157-178 (1969) or *Flora Europaea* (Cambridge, 1964-8) and may then be cited without authorities. Otherwise authors' names must be cited, at least on the first occasion where they appear in the text and followed by the 'Dandy' or *Flora Europaea* name in parenthesis. Authors must follow strictly the *International Code of Botanical Nomenclature* (Utrecht, 1966). Synonyms should be cited in chronological order; misapplied or illegitimate names should be placed in square brackets. Examples will be found in recent parts of *Watsonia*.

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Papers and short notes should be sent to Dr G. Halliday, Dept. of Biological Sciences, The University, Bailrigg, Lancaster. Books for review should be sent to Dr N. K. B. Robson, Dept. of Botany, British Museum (Natural History), Cromwell Road, London, S.W.7. Plant records should be sent to the appropriate vice-county recorders.

Watsonia

July 1972 Volume nine Part two

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Ranunculus bulbosus L. in Europe

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ABSTRACT

The variation shown by *Ranunculus bulbosus* L. within Europe has been examined, and its classification revised. The *R. bulbosus* complex had formerly been split into several specific and subspecific categories. In the classification proposed here, only the one species *R. bulbosus* L. and two subspecies are recognised: subsp. *bulbosus* and subsp. *adscendens* (Brot.) Neves.

Subsp. *bulbosus* is widespread over central Europe occurring chiefly in grasslands which are well drained. Subsp. *adscendens* is only found in the Mediterranean region, where it occurs in habitats such as marshes. Intermediate plants are found in regions with climatic conditions transitional between those under which the two subspecies grow.

INTRODUCTION

Ranunculus bulbosus L. belongs to the subgenus *Ranunculus* section *Ranunculus*. Species in this section are characterised by a nectary scale which is more or less free laterally, compressed achenes with a distinct beak, and a receptacle which in fruit is not more than three times its length when in flower.

Within the section *Ranunculus*, *R. bulbosus* is characterised by the following combination of characters: Plant perennial, usually pubescent. Root-stock swollen and corm-like, or, if little swollen, roots thick and tuberous. Stems never stoloniferous. Basal leaves tripartite, entire or divided into 3 or more segments with the central segment long-stalked so that it projects beyond the lateral segments. Petiole bases leaving few, if any, persistent fibres.

Inflorescence one- to few-flowered. Pedicel sulcate. Receptacle pubescent. Buds ovoid, not subglobose. Sepals reflexed. Petals usually 10-15 mm long, broadly obovate. Nectary-scale obtriangular, more or less as broad as the claw of the petal. Achenes 2-4 mm, dark brown, keeled, with a well-defined paler border whose margin is marked by a distinct ridge; beak rarely exceeding 1 mm, hooked or straight; surface very finely punctate, or very rarely with small tubercles bearing hairs.

R. bulbosus is widely distributed over Europe, except in the north, where it is limited to the southern lowlands of Scandinavia and south-western Finland (Harper 1957). In the south it extends into North Africa, where it occurs in Morocco, Algeria and Tunisia. In the eastern Mediterranean it reaches as far south as Kriti and Cyprus. Eastwards it extends at least as far as north-western Iran. It has been introduced into North America and New Zealand.

R. bulbosus has, in previous classifications, usually been split into several specific and subspecific categories (*cf.* the treatment in *Flora Europaea* (Tutin 1964)), but from the variation pattern found within Europe, only two subspecies

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within the single species *R. bulbosus* are recognised in this present work. The two subspecies of *R. bulbosus*, subsp. *bulbosus* and subsp. *adscendens* (Brot.) Neves, may be distinguished by the following characters:

	Subsp. <i>BULBOSUS</i>	Subsp. <i>ADSCENDENS</i>
Root-stock:	A well-formed corm.	Only slightly swollen, rarely corm-like.
Roots:	Thin (rarely exceeding 3 mm in diameter)	Thick (over 4 mm in diameter), tuberous.
Basal Leaves: (produced before 1st flowering stem of the year)	Divided into 3 or more segments, middle segment usually long-stalked.	Entire, or, if divided, middle segment $\pm$ sessile.
Petiole-hairs:	Fine (rarely exceeding 0.03 mm in diameter)	Coarse (exceeding 0.03 mm in diameter)

In the northern and central parts of its European range, *R. bulbosus* is represented by subsp. *bulbosus*. This subspecies characteristically occurs in well-drained habitats, mainly in lowland grasslands where the soil has a high base-status. Although subsp. *bulbosus* often occurs in habitats where summer drought is a factor limiting the growth of the vegetation, and where its corm may remain dormant for several of the summer months, it appears to be absent from truly xerophytic communities. Subsp. *adscendens* only occurs in the Mediterranean region, where it occurs in habitats which are waterlogged for at least part of the year, such as in marshes, ditches, etc.

There is a continuous array of intermediate plants which are found in the transitional regions between the two climatically different geographical areas occupied by the two subspecies. Because of these intermediates the taxa recognised have been placed in a single species. The subspecific category would seem most appropriate for these taxa, because they are morphologically very distinct and occupy different habitats in different regions within the range of the species. Such a treatment does however leave plants which can only be designated as intermediates, but this is usually inevitable when subspecies are recognised.

The distribution of subsp. *bulbosus* is continuous across Europe. It often shows great variation in any one locality, but variation of a geographical nature is not apparent.

The distribution of subsp. *adscendens* is rather disjunct, due to the configuration of the Mediterranean lands, but the range of variation of most characters is similar throughout. The only constant difference found between plants of different regions is that plants from the Iberian peninsula have achenes with hooked beaks, whereas plants from elsewhere usually have more or less straight beaks. Such apparently trivial variation is not thought to merit taxonomic recognition.

MATERIAL AND METHODS

This study was largely based on herbarium material from the following herbaria: British Museum (BM), Cambridge (CGE), Coimbra (COI), Edinburgh (E), Florence (FI), Leicester (LTR), Porto (PO), Stockholm (S), Uppsala (UPS) and Vienna (W).

Plants of known wild origin were grown from as wide a range of localities as possible. They included plants of subsp. *bulbosus* from 30 localities in Britain and from 10 localities on the Continent; plants intermediate between the two subspecies from 5 localities; and plants of subsp. *adscendens* from 4 localities. Plants of this latter subspecies were also grown from seed of botanic garden origin.

Characters were investigated from as many parts of the plant as possible. The following characters were found to be of most value: form of rootstock and roots, shape of leaves, type of indumentum and form of beak of achenes. Many other characters have been used previously, but mostly it was impossible to see how such character distinctions were at all justified, as they do not show any noticeable correlation with plants of either taxon or to plants of different geographical regions.

DISCUSSION OF CHARACTERS

A detailed evaluation of characters and of the extent of variation found within them is given below. The chief characters separating the two subspecies have been plotted on the maps in Figs. 1 and 2. The characters plotted are: form of root-stock and roots, leaf-shape, width and type of petiole-hairs. Also marked on these maps is the limit of the Mediterranean vegetational zone, as characterised by the presence of *Olea*, *Cistus*, *Genista*, *Arbutus* and *Nerium* (taken from Thompson 1970).

THE ROOT-STOCK AND ROOTS

Plants of *R. bulbosus* are perennial. The root-stock is short and is vertically orientated, but 'freak' plants with a horizontal axis are found. The root-stock is always somewhat enlarged laterally and is thus corm-like. In subsp. *bulbosus* the root-stock is greatly swollen, whereas in subsp. *adscendens* relatively little expansion occurs. However in subsp. *adscendens* the roots are much thicker and are tuberous in appearance. A continuous range between these two root-stock types is to be found among plants which are intermediate between the two subspecies (examples of such root-stocks are shown in Fig. 3).

The maximum diameter of roots in cultivated plants of subsp. *adscendens* was found to be 4–6 mm, whereas in subsp. *bulbosus* it never exceeded 3 mm. The increase in the size of the roots in subsp. *adscendens* is chiefly by an increase in the number of cells in the cortex. The size of the 'corm' in either subspecies is very variable and can be greatly modified by environmental conditions, whereas root-diameter is far more constant.

The shape of the corm and the number of flowering stems produced by a corm have previously been used as diagnostic characters for taxa, chiefly within subsp. *bulbosus* as here understood; such use is not justified. Although the greatest dimension of a corm is usually its breadth, its shape is easily modified. Examples of such modifications are especially common in plants growing on sand-dunes, where they suffer continual burial by sand; these conditions can produce spindle- or carrot-shaped corms or even a beaded effect where numerous small 'corms' have been produced on the main stem.

The apical bud of an over-wintered root-stock produces a flowering stem. Lateral buds may produce other flowering stems. This is partly controlled by the environment, but corms of the same size growing together in the same con-

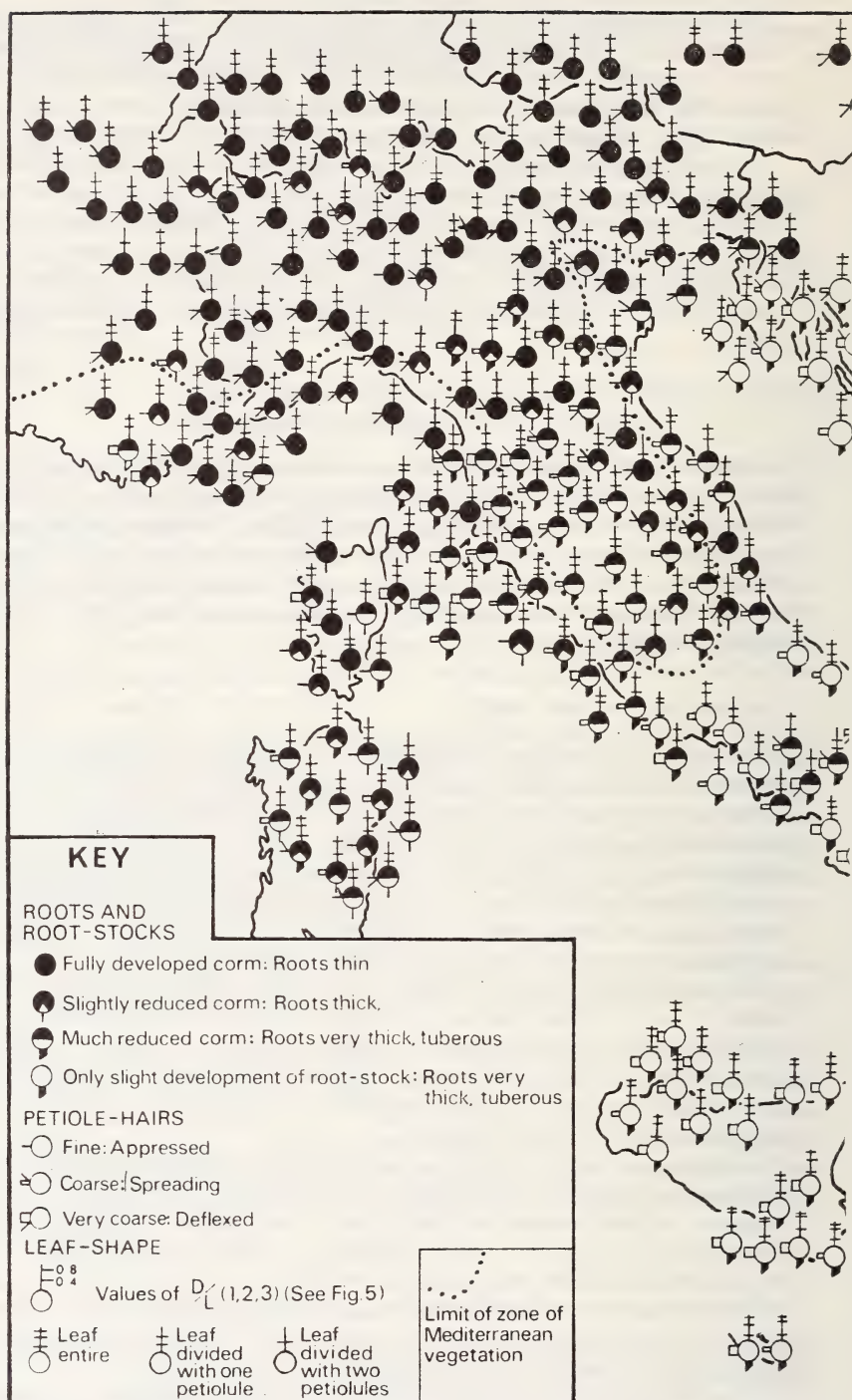


FIGURE 1. Distribution of morphological characters



in *R. bulbosus* in Italy and the Balkan Peninsula.



FIGURE 2. Distribution of morphological characters in *R. bulbosus* in the Iberian Peninsula. [see Fig. 1 for key.]

ditions can vary very greatly, producing one or many stems. Lateral buds lower on the corm produce daughter corms, although the parental root-stock may persist until the flowering season of the following year. When plants are growing in poor ground or are in competition with other vegetation the parental plant is usually replaced by a single daughter plant. In more favourable conditions several daughter plants may be produced; limited vegetative propagation is therefore possible.

The size of the root-stock depends not only on the size of the plant, but also on its stage of development; it is not fully developed until after the first flowering, so that at the onset of flowering neither the root-stock nor the roots may appear enlarged. In measuring these characters from herbarium sheets no absolute measurements were therefore possible, only assessments into arbitrary categories, although these were based on the expected appearance (given in parentheses) had the plant been mature.

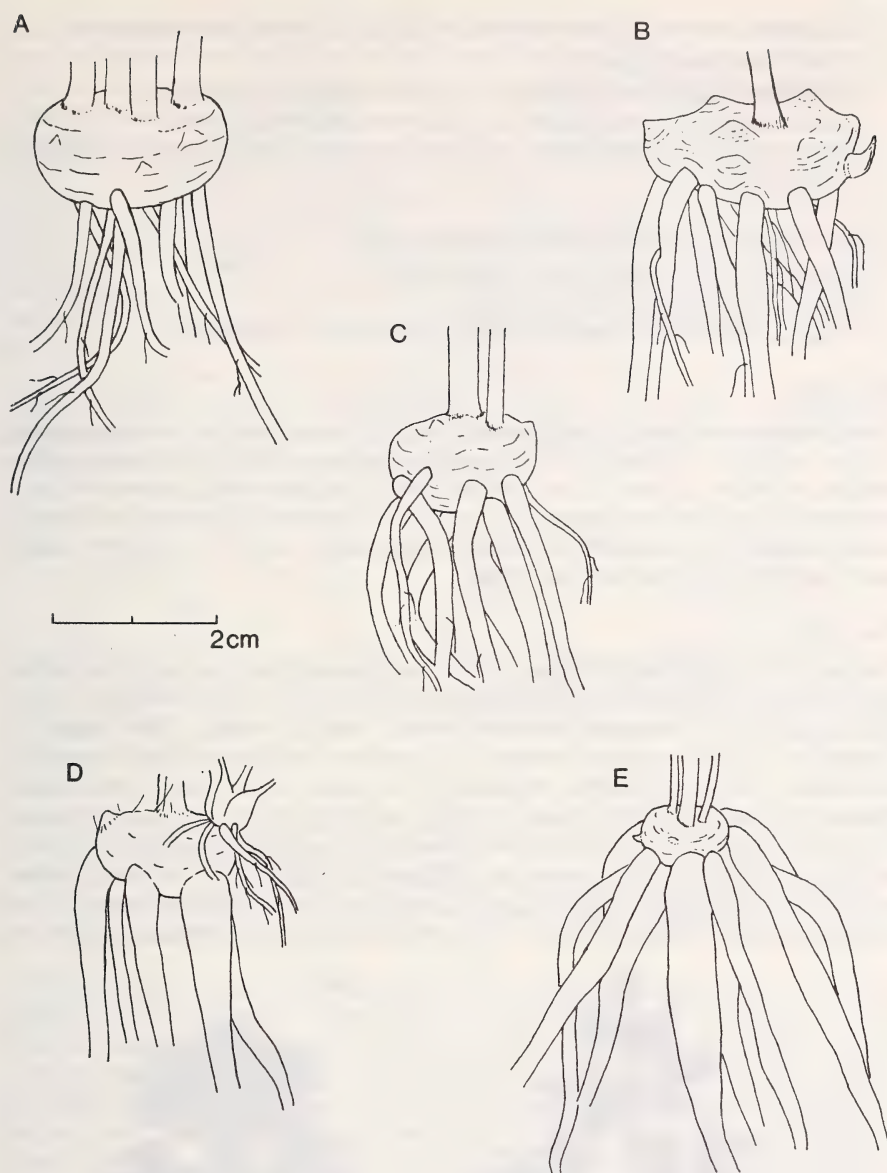


FIGURE 3. Root-stocks:

- A. subsp. *bulbosus*, Llandudno, N. Wales.
- B, C & D. Intermediate plants
 - B. Genova, N. Italy
 - C. Estartit, Gerona, N. Spain
 - D. Ronda, S. Spain.
- E. subsp. *adscendens*, Rethimnon, Kriti.

The type of root-stock was recorded using the following four categories:

1. Fully developed corm.
2. Slightly reduced corm (about 75% development of full corm).
3. Much reduced corm (about 50% development of full corm).
4. Only slight development of root-stock (not more than 25% development of full corm).

Root-type was recorded using three categories:

1. Roots thin (less than 3 mm in diameter).
2. Roots thick (3–4 mm in diameter).
3. Roots very thick, tuberous (more than 4 mm in diameter).

THE STEM

Subsp. *adscendens* was generally found, both in the wild and in cultivation, to be a taller and more robust plant than subsp. *bulbosus*. Subsp. *adscendens* often reaches a height of over 60 cm whereas subsp. *bulbosus* rarely exceeds 40 cm; however this distinction cannot be used as a diagnostic character as there is much overlap in the height of the two subspecies, and it is also very easily modified by environmental conditions.

THE LEAF

The leaf of *R. bulbosus* is trilobed or further dissected into 3 or more segments, in which case the terminal petiolule and the main axis of the leaf elongate so that the segments are arranged pinnately rather than palmately. The degree of dissection of a leaf varies according to its position on the plant, and when it is produced. The basal leaves produced by a plant which has over-wintered become progressively more finely divided, and those appearing just before the first flowering stem are the most finely dissected. Leaves produced from the buds in the axils of the basal leaves are very different in shape. They are broadly lobed and usually entire even when the basal leaves produced at the beginning of the season are finely divided (Fig. 4). Flowering only occurs sporadically after the

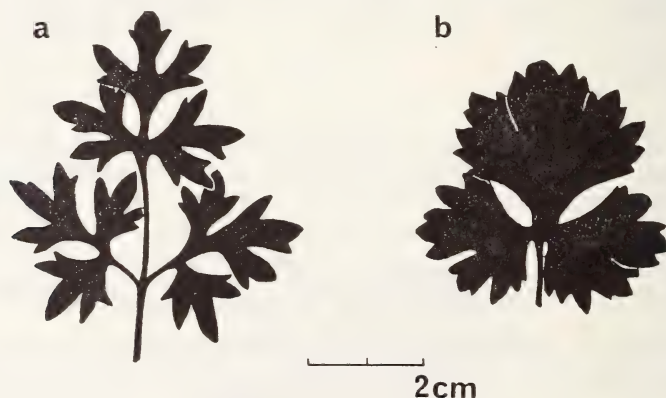


FIGURE 4. Seasonal variation in leaf-shape.
Subsp. *bulbosus* from Keele, Staffordshire, England
a. leaf produced before first flowering stem
b. leaf produced later in the season.

first main peak in spring, and consequently plants with these less-divided leaves occur infrequently in herbarium collections. This perhaps explains why no such seasonal variants have been given taxonomic recognition in the past as they have in other species of *Ranunculus*.

Measurements of leaf-shapes, so that they would be comparable, were only made on the leaves produced just before the first flowering stem. Further discussion of leaf-shapes refers to these leaves only. The character which showed the most significant variation is the degree of dissection. The measurements (D_1 , D_2 and D_3) made to record this are shown in Fig. 5. The ratios of these measurements to length of lamina are plotted in Figs. 1 and 2, the length of lamina being taken as the length of the whole lamina along the main axis of the leaf.

Among the other variables of leaf-shape are the width of the lobes and the number of teeth. These do not show any close correlation with the degree of dissection of the leaf; both are very variable in any one population and do not appear to show any geographical variation.



FIGURE 5. Measurements made on the leaves.

L—length of lamina

D (1,2,3)—distance from apex of leaf to the three primary divisions on the main axis of the leaf (these are ignored when at that position there is a petiole).

Within subsp. *bulbosus* the leaves are divided into segments; only in dwarfed plants are the leaves ever simple. A wide range of leaf-shapes commonly occurs within a single population (Fig. 6). Plants with very finely dissected leaves appear to be mainly confined to lowland populations, although even here they are not the predominant kind. Little geographical variation in leaf-shape is apparent within subsp. *bulbosus* except that very finely divided leaves are rare in southern Europe. Subsp. *adscendens* has simple leaves (Fig. 6) but, if the leaf is divided into three segments, the latter are more or less sessile. Plants intermediate between the two subspecies are nearly always marked by having a divided leaf in which the central segment is stalked. Intermediate plants from the Sierra Nevada region in southern Spain are unusual, often having very finely divided leaves.

THE HAIRS

R. bulbosus is generally rather a hairy plant, except during the winter. Only very few plants of both subspecies were seen with glabrous leaves at the time of flowering; those of subsp. *bulbosus* were chiefly from montane habitats.

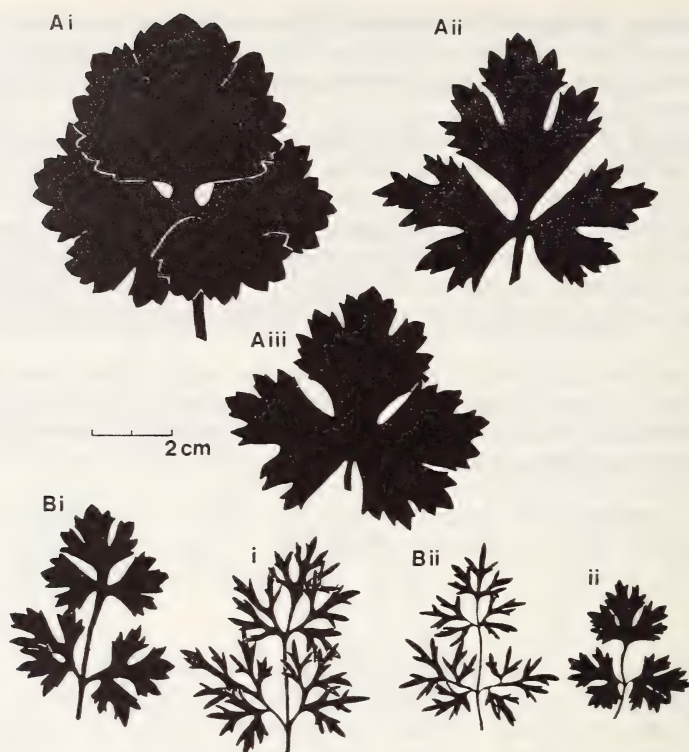


FIGURE 6. Examples of leaf-shapes:

- A. subsp. *adscendens* i. Faro, Portugal
 ii. Reguengos de Monsaraz, Portugal
 iii. Malaxa, Kriti.
- B. subsp. *bulbosus* i. Copmere, Staffordshire, England
 ii. Llandudno, N. Wales.

Hair-width is the only hair attribute showing any difference between the two subspecies, the width being much greater in subsp. *adscendens* than in subsp. *bulbosus*. Hair-width was measured on the longest hairs on a petiole (excluding the sheathing region). The measurements were divided into the following arbitrary categories:

1. Fine (less than 0.03 mm).
2. Coarse (0.03–0.05 mm).
3. Very coarse (more than 0.05 mm).

The results are shown in Figs. 1 and 2. The petiole-hairs of subsp. *bulbosus* fall within category 1. Those of subsp. *adscendens* are more variable (within categories 2 and 3). Also plotted in Figs. 1 and 2 are the positions of the hairs relative to the petiole. This was recorded using 3 categories: appressed, spreading and deflexed. Similar variation is found in both subspecies. The more detailed field data on subsp. *bulbosus* suggest that local variation in this character is to some extent ecotypic in nature; deflexed hairs are commoner in upland and coastal

habitats, whereas appressed hairs are typical of lowland pastures. The pubescence is very variable, but tends to be greater in plants with deflexed hairs.

THE FLOWER

The pedicel in *R. bulbosus* is sulcate. In subsp. *bulbosus* it is strongly sulcate for the whole length, unless it is more than half the total height of the plant. In subsp. *adscendens*, except where the pedicels are very short, the furrows fade out before the base of the pedicel. This character could only be examined on fresh material.

In the past the shape of the receptacle has been used as a diagnostic character. Although it is more or less the same within a single plant, it is very variable within populations. The commonest shapes are ellipsoid to conical, but subglobose receptacles are not uncommon. The shape and size of the sepals, petals and stamens are relatively constant throughout the species.

The size and shape of the achenes in plants from any one locality are very variable (Fig. 7). No geographical trends were found in the variation of these characters, except in the form of the beak. In subsp. *bulbosus* the beaks of the achenes are always hooked. They are also hooked in subsp. *adscendens* from the Iberian peninsula, and these achenes are indistinguishable from those of subsp. *bulbosus*. The beaks of subsp. *adscendens* elsewhere in Europe are more or less straight except for a few plants in Sicilia and southern Sardegna which have curved beaks. The achenes of these plants are also peculiar in that their beaks are longer (up to 1.2 mm) than are found elsewhere in the species, and that the faces of the achenes sometimes bear hairs with tuberculate bases. These plants are discussed below (p. 225).

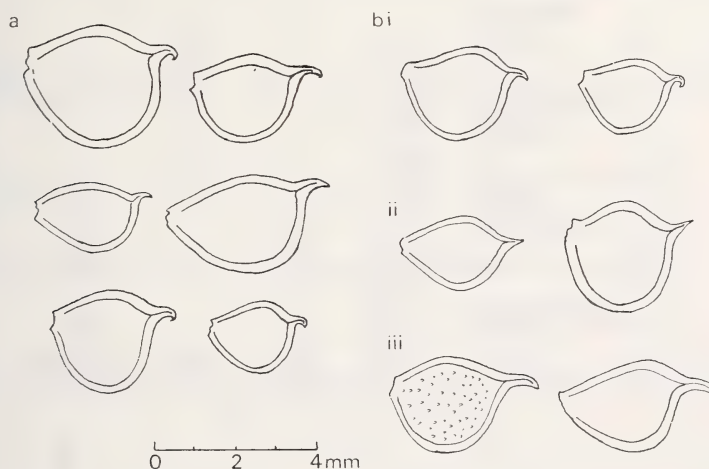


FIGURE 7. Examples of achenes:

- a. subsp. *bulbosus*, Braunston, Northamptonshire, England, showing the variation in size and shape of the achenes of plants from a single population.
- b. subsp. *adscendens*,
 - i. Portugal
 - ii. Kríti
 - iii. Palermo, Sicilia.

TABLE 1. EXPERIMENTAL CROSSES BETWEEN CULTIVATED PLANTS OF WILD ORIGIN
Results expressed as percentage seed-set per flower.

♂ / ♀		Burton Dassett * Warwickshire	Roan Head * Lancs.	Cawston * Warwickshire	Oundle * Northants.	Ilam * Staffordshire	Budapest * Hungary	Estaritz ** N.E. Spain	Ronda ** S. Spain	Madrid ***	Colimbra *** Botanic Gardens	Oeiras *** Portugal	Rethimnon *** Kriti
*Burton Dassett, Warwickshire, England		88; 27; 71 53; 88; 92	36; 70; 72	66; 45	84	30; 89; 15; 74; 50	68; 59; 67; 0	93; 23; 25; 35; 39	17; 20; 16; 28; 0	11; 16	7; 0	6; 34; 86; 0; 30; 68; 4; 24; 41	7; 79; 58; 81; 69; 47 19; 41; 25
*Roan Head, Lancashire, England		72; 33	12				81; 68	33	0; 0	46; 26	37; 41	13; 42	36; 13
*Cawston, Warwickshire, England		80	59		48; 52; 36		86; 53	80; 28	0		27	4	
*Oundle, Northamptonshire, England		33; 25; 84; 73; 44	83; 15; 86			28; 52	69	28	75; 16; 0; 34; 13; 0	61	56; 0; 30	48; 15	
*Ilam, Staffordshire, England		76; 61	57; 60	67; 76; 80	80; 64	83; 55; 92; 91; 91	96; 79; 0; 73	68; 15; 28; 88; 76	17; 12; 22; 31; 35; 26	70; 55	13; 0; 5; 14; 0	26; 0; 22; 7; 0; 9; 17	15; 5; 10; 0; 9; 35; 0

*Urçay, Cote d'Or, France	62; 64; 52			67; 46	23; 80; 71	81	5; 0	70	27; 22; 79	24; 34; 11; 7; 12	
*Bouafles, Eure, France				91; 37; 37		44; 11	65; 73; 0		26; 32; 47; 8		
**Genoa, Italy	52; 36; 37	50		55; 58; 19		91	6	56; 0; 0	70; 78; 5	5	
**Estartit, Gerona, Spain	38; 68; 79		0; 53; 50; 71; 72	66; 69	37; 52	40; 43	64	10; 50	54; 56; 67; 69	75; 54; 0 0; 0; 58	0; 61; 82
**Ronda, Malaga, Spain	0; 0; 41; 0	56; 19	0	0; 0; 0			0; 38		36; 0	47; 52	
***Botanic Gardens, Madrid	63; 65	48; 91; 5	76; 29; 29; 57	32; 30	63; 64	41; 60	17	8; 36	33; 0; 71; 22; 27; 43	54; 41; 36; 56	79; 80; 0; 43; 48
***Botanic Gardens, Coimbra	35; 68; 24; 40; 38	65; 40; 33; 44	0; 35; 63; 40	32; 33; 63; 65; 60; 60	50; 38; 77; 48; 56; 29	71; 68	85; 29; 51; 29	0; 50; 46; 43; 48; 0	76; 39; 31; 38; 38	0; 67; 32; 43; 31; 40; 67	61; 89; 60; 35; 46; 86
***Oeiras, Portugal	88; 0; 72; 60; 76; 15	66; 79; 78; 90	89; 0; 84	85; 0; 0	90; 41; 74; 0; 23	0	80; 0; 33; 40; 63	75; 0	24; 81	31; 90; 77; 97	54; 24; 91; 68; 29; 88; 83; 62
***Rethimnon, Kriti	21			0; 5	28			18	19	0; 0	9; 27

* Subsp. *bulbosus*

** Intermediate between subsp. *bulbosus* and subsp. *adscendens*

*** Subsp. *adscendens*

CHROMOSOMES AND BREEDING EXPERIMENTS

Almost without exception the number of chromosomes recorded for members of the *R. bulbosus* complex is $2n = 16$ (e.g. Coonen 1939, Gregson 1965, Neves 1944). Gregson found the karyotype, except for occasional abnormalities, to be constant throughout *R. bulbosus*. She says it consists of 2 pairs of chromosomes with a median centromere (2 LL), 2 pairs nearly median (2 L1), 2 pairs submedian (2Lm), 6 pairs with a much shorter arm ($2Lp_1 + 2Lp_2 + 2Lp_3$) and 4 pairs with subterminal centromeres—one of these pairs with a satellite on the short arm ($2L + 2L!$). The karyotype given by Neves (1944) has a satellite on the long arm of the first pair of chromosomes which have subterminal centromeres, but he still found consistency in the karyotype of all the plants of *R. bulbosus* which he examined. The karyotype given by Kurita (1957) differs from that given by Gregson in the position of the satellites. An accessory chromosome was found by Gregson (1965) in material from Greece. However, not only does the karyotype appear to be the same throughout *R. bulbosus*, but it is almost identical with that of *R. sardous* Crantz, a closely related species, and of *R. ficaria* L., a species from another very different section of the genus (Gregson 1965, Larter 1932).

Some selfing and a low degree of agamospermy have been previously reported for *R. bulbosus*. These were tested for by selfing and by emasculating flowers. The plants used were grown in a greenhouse and the flowers were individually covered by cellophane bags. These tests were carried out on the following numbers of plants, several flowers per plant being tested.

	Flowers emasculated	Flowers selfed
Subsp. <i>bulbosus</i> (British)	12 plants from 7 localities	29 plants from 7 localities
Subsp. <i>bulbosus</i> (from the Continent)	3 plants from 7 localities	4 plants from 3 localities
Subsp. <i>adscendens</i>	10 plants from 3 localities	15 plants from 3 localities
Intermediate plants	—	7 plants from 3 localities

In all these tests only five seeds were set, and in each case of seed-set the tests were repeated with only negative results. It is probable that these seeds were the result of contamination and that *R. bulbosus* is totally self-incompatible and sexual.

The interfertility of plants from different regions and of different morphological types was tested by means of a series of experimental crosses. The percentages of seeds set per cross are given in Table 1. The percentage from any one cross was very variable, but usually a high seed-set was obtained at least once when a cross was repeated several times (failure to set seed could generally be attributed to the use of rather infertile pollen, or to the arrested development of the flowers, probably due to attacks of root-fly maggots). The results indicate that there are no serious barriers to crossing between different members of the species. In Fig. 8 the results are shown in the form of histograms; the data for plants of the same subspecies have been combined. The best results are shown by crosses involving subsp. *bulbosus* $\times$ subsp. *bulbosus*. Crosses within subsp. *adscendens* gave lower values. Plants of this subspecies were generally less fertile than those of subsp. *bulbosus*. This point is discussed below. What is of interest, and for

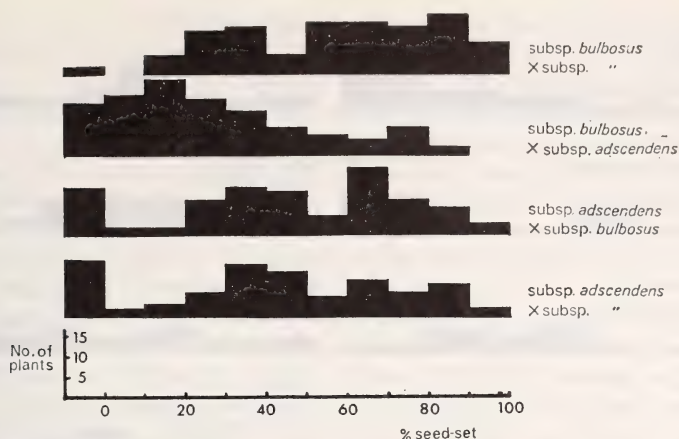


FIGURE 8. Histograms of percentages of seed-set in the experimental crosses.

which there is no apparent explanation, is that crosses of *subsp. adscendens* × *subsp. bulbosus* gave results as good as *subsp. adscendens* × *subsp. adscendens* and better than *subsp. bulbosus* × *subsp. adscendens*. Crosses between plants of the same subspecies, but from widely separated localities showed little, if any, decrease in seed-set when compared with crosses between plants from the same region.

No appreciable differences were found in the percentage germination of achenes obtained from inter-subspecific crosses compared with intra-subspecific crosses, neither were significant differences detected between the germination of achenes from intra-subspecific crosses from the same area or from widely separated areas. As in many perennial species of *Ranunculus*, the germination of *R. bulbosus* achenes is rather erratic and germination of achenes from a single head is often spread over several months.

The fertility of the F_1 plants obtained from the crosses was investigated by examining their pollen fertility. A mixture of pollen grains from both inner and outer anthers of a flower was stained in cotton blue. All pollen grains with contents and of normal appearance were counted as 'good' grains. This, however, only gives an indication of true viability. Böcher (1938) showed that, under conditions in which medium-sized grains of *R. bulbosus* showed good germination, the smallest and largest grains did not germinate. Counts were only made on the first flower of a stem, as the percentage of 'good' grains decreases in subsequent flowers. Even in the first flower produced by a plant this percentage can fluctuate greatly from year to year. The measurements made, therefore, only give a rough guide to the fertility of the plant.

The percentages of 'good' pollen grains for the parental and F_1 plants (maximum of 5 plants/cross) are plotted as histograms in Fig. 9. Parental plants of *subsp. adscendens* showed a generally lower percentage of 'good' grains when compared with those of *subsp. bulbosus*. This may be due to the fact that *subsp. adscendens* is from southern Europe and experiences adverse climatic conditions when grown in the British Isles. The percentages of 'good' grains in the F_1 plants from the crosses between the two subspecies were slightly lower than those of the parental *subsp. adscendens*, but many plants showed a reasonably high pollen

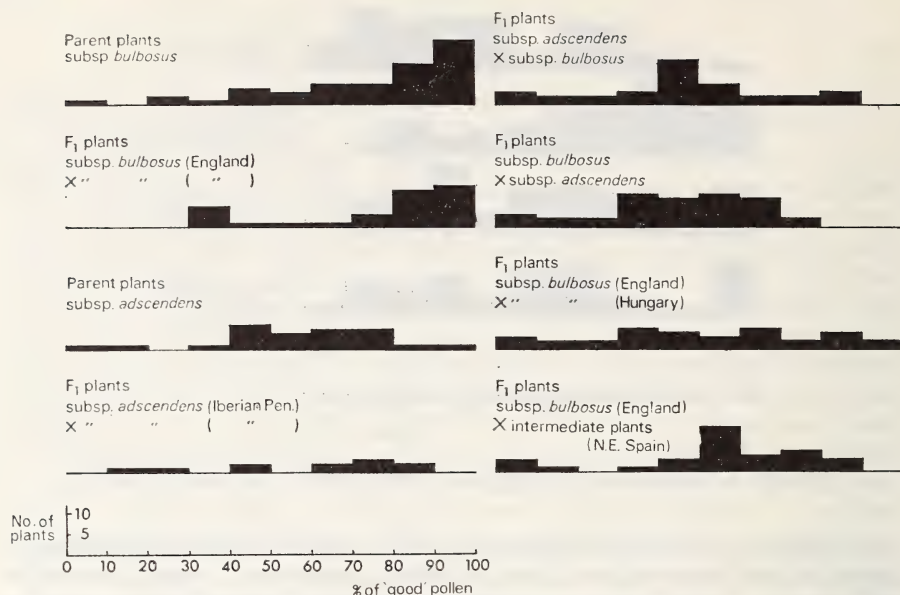


FIGURE 9. Histograms of percentages of 'good' pollen.

fertility. A general reduction in fertility was also found in F₁ plants from crosses of British subsp. *bulbosus* with morphologically similar plants from remote localities. F₂ plants showed no decrease in pollen fertility when compared with their F₁ parents.

Meiosis in the pollen-mother-cells of parental and F₁ plants was also examined. Univalents were quite common, but generally only in the plants which had a low percentage of 'good' grains.

The low percentages of 'good' grains which were found in many of the parental plants are a common feature of many *Ranunculus* species, *R. bulbosus* showing a complete range in the reduction of pollen fertility from almost '100% fertile' plants to those exhibiting complete gynodimorphism. Gynodimorphism is not as common in *R. bulbosus* as it is in *R. acris* L. (Coles 1971), and examination of pollen of British material of these two species showed *R. bulbosus* to be generally more fertile.

HYBRIDS WITH OTHER SPECIES

No substantiated records of hybrids between *R. bulbosus* and other species have been found, but from the results obtained in the experimental crosses described below such hybrids might well be expected to occur in the wild. Only a limited number of species was available for these tests.

R. nemorosus DC. and *R. polyanthemus* L. are morphologically close to *R. bulbosus* and have the same chromosome number ($2n = 16$). Reciprocal crosses of *R. bulbosus* with both these species resulted in good seed being set. Seed-set of up to 72% was achieved when using plants of *R. bulbosus* and *R. nemorosus* from the same district, but in other cases the cross had to be repeated several times before any seed was set. F₁ plants were raised from some of the *R. bulbosus* (both subspecies) × *R. nemorosus* crosses, and these were fairly fertile; 40% of 'good' pollen was found in several plants.

R. repens is morphologically close to the species already discussed, but has a chromosome number of $2n = 32$. In crosses between *R. bulbosus* and *R. repens* no seed was ever set. Crosses between *R. repens* and *R. nemorosus* also resulted in no seed being set, but when *R. nemorosus* was used as the female parent some carpel enlargement (without any visible development of the seed) occurred. A tetraploid plant of *R. bulbosus* ($2n = 32$) was produced artificially (by colchicine treatment) and when pollinated by *R. repens* some carpel enlargement also occurred. Such enlargement did not occur when these species were selfed or when they were crossed with species of *Ranunculus*, showing no close morphological relationships.

The annual *R. sardous* Crantz is morphologically very close to *R. bulbosus* and has the same chromosome number, but no seed was ever set when it was crossed with *R. bulbosus*. However, in some crosses where *R. bulbosus* was the female parent, but not in the reciprocal cross, a few carpels showed some enlargement. A much higher percentage of enlarged carpels occurred when *R. sardous* was pollinated by the closely related annual species *R. marginatus* D'Urv. ($2n = 32$).

NOMENCLATURE

The taxonomy of *R. bulbosus* is extremely confused because of the vogue for naming minor variants and the lack of co-ordination between botanists working in different regions. *Index Kewensis* lists over forty specific names referable to this complex, and infraspecific names are equally numerous. Except for the recognition of the two subspecies, *bulbosus* and *adscendens*, the many variants which have been given taxonomic status are rejected. This is because there is complete intergradation from one form to another with no barriers to gene-exchange and there is no constancy in the form of their offspring, as could be found in inbreeding or agamosperous plants.

The synonyms given below include only the more important ones, and are those which have been most frequently applied to variants of the complex.

R. BULBOSUS L., Sp. Pl., 554 (1753)

Subsp. *BULBOSUS*

R. brachiatus Schleich., Cat. Pl. Helv., 3rd ed., 24 (1815)

R. bulbifer Jord., Ann. Soc. Linn. Lyon, N.S., 7: 448 (1861)

R. sparsipilus Jord., Ann. Soc. Linn. Lyon, N.S., 7: 448 (1861)

R. albonaeus Jord., Ann. Soc. Linn. Lyon, N.S., 7: 449 (1861)

R. valdepubens Jord., Ann. Soc. Linn. Lyon, N.S., 7: 450 (1861)

R. castellanus Boiss. & Reuter ex Freyn in Willk. & Lange, Prodr. Fl. Hisp., 3: 932 (1880)

R. bulbosus subsp. *bulbifer* (Jord.) Neves, Contrib. Portug. Ranunc., 84 (1944)

R. bulbosus subsp. *castellanus* (Boiss. & Reuter ex Freyn) P. W. Ball & Heywood, Reprium nov. Spec. Regni veg., 66: 151 (1962)

Many of the variants of subsp. *bulbosus* have been given taxonomic status, one of the worst offenders being Jordan. The phenotypes to which he gave specific names can occur in a single locality, but to some extent they represent ecotypes. For instance, his *R. valdepubens*, a very hairy plant, is found in upland and coastal areas rather than in lowland meadows; in this latter habitat his *R. bulbifer* is more prevalent. He describes *R. bulbifer* as the most widespread species in eastern France, and indeed his description fits one of the commonest phenotypes

found throughout Europe. This name, however, has since been applied in a much narrower sense (e.g. Neves 1944, Tutin 1964), generally to rather small plants with more or less entire leaves. Such plants, of wide geographical occurrence, are mainly of subsp. *bulbosus*, but also include some intermediates between subsp. *bulbosus* and subsp. *adscendens*; in the former case the more or less entire leaves result from environmental dwarfing. *R. castellanus* was formerly used for plants occurring in the pastures of the montane regions of northern and central Spain, but also reaching sea-level in north-western Spain. These habitats are occupied by outliers of subsp. *bulbosus* or by plants which sometimes show some intergrading with subsp. *adscendens*. The distinguishing features ascribed to *R. castellanus* are short divaricate stems and basal leaves which are small, sparsely pilose or glabrescent and which have petioles with very broad sheaths. Such characters are present in plants growing in similar habitats throughout Europe.

Subsp. *ADSCENDENS* (Brot.) Neves, Contrib. Portug. Ranunc., 170 (1944)

R. adscendens Brot., Fl. Lusit., 2: 370 (1804)

R. palustris L. ex Smith in Rees, Cyclop., 29: sp. 52 (1814)

R. pratensis C. Presl in J. & C. Presl, Del. Prag., 9 (1822)

R. neapolitanus Ten., Ind. Sem. Horti Bot. Neap., 11 (1825)

R. heucherifolius C. Presl, Fl. Sic., 15 (1826)

R. tommasinii Reichenb., Herb. Norm. Fl. Germ. Exsicc., Cent. 25: nr. 2479 (1845)

R. eriophyllus C. Koch, Linnaea, 19: 46 (1847)

R. broteri Freyn in Willk. & Lange, Prod. Fl. Hisp., 3: 930 (1880)

R. adscendens was described by Brotero in 1804 and again in 1827. The two descriptions, based on Iberian plants, do not completely correspond, especially with regard to the indumentum. The plants Brotero described in 1827 have often been treated as a separate species, for example Freyn named it *R. broteri*. Brotero's two descriptions merely represent plants of different appearance within the great variation shown by Iberian subsp. *adscendens*. In the material examined in this present study, no geographical trends were apparent, and no taxonomic recognition of any of the variation is considered justified.

The description of *R. palustris* L. ex Smith (in Rees) is based on a specimen in the Linnaean herbarium. However Davis (1960) found that the specimen consisted of a mixture of two elements, neither identifiable with certainty, and he therefore suggested that the name should be dropped. Davis also considered *R. eriophyllus* and *R. tommasinii* in his discussion on the synonymy of *R. neapolitanus*.

R. neapolitanus Ten. was based on plants of subsp. *adscendens* from Italy, and it has been widely used for plants in the eastern Mediterranean, but only rarely has it been applied to plants from the Iberian peninsula. In his original description Tenore stated that *R. neapolitanus* has a terete pedicel and achenes with longish hooked beaks. This latter feature is also shown in Table 148 of his *Flora Napolitana*, although the rest of the plant agrees well enough with subsp. *adscendens*. He later pointed out these mistakes (Tenore 1842), and material collected and determined by him in the Herbarium at Florence (In uliginosis montani, FI) is indeed of subsp. *adscendens*.

Presl's description of *R. pratensis* leaves a slight degree of doubt as to the correct application of this name. Unfortunately no type specimen has been

traced. The plant generally held to be *R. pratensis* is the variant of *R. bulbosus* which occurs in the Palermo district of Sicilia, but is also to be seen in southern Sardegna. The only difference between these plants and those of typical subsp. *adscendens*, which also occurs in these regions, appears to be in the form of the achenes. In plants of '*R. pratensis*' the beak of the achene is long, 0.8–1.2 mm, and curved, whereas in plants of subsp. *adscendens* the length of the beak seldom exceeds 0.6 mm and is more or less straight. Also, in '*R. pratensis*' the faces of the achenes may bear tubercles which terminate in single-celled hairs (*c* 40% of plants examined). The density of such tubercles is very variable, but plants with as many as 50 tubercles on one face of the achene are not uncommon. Tubercled variants in species with usually smooth fruits are found in other closely related species, e.g. *R. nemorosus* DC. and *R. macrophyllus* Desf. (Davis 1960). The '*R. pratensis*' plants therefore appear to be merely a local variant of subsp. *adscendens* not meriting taxonomic recognition. However a more detailed study, preferably including field-work, is required before their true status is understood. The variation might possibly be due to hybridisation with another species; a possible candidate is *R. macrophyllus*. This species is not well understood, but morphologically it is close to *R. bulbosus* and is at times confused with it, as the distinguishing features are difficult to see in herbarium material. Its achenes are very similar to those of '*R. pratensis*' and, in the region where '*R. pratensis*' occurs, *R. macrophyllus* reaches the eastern limits of its distribution.

The following synonyms of *R. bulbosus* refer to plants intermediate between subsp. *bulbosus* and subsp. *adscendens*.

R. aleae Willk., *Linnaea*, **30**: 84 (1859)

R. occidentalis Freyn in Willk. & Lange, *Prod. Fl. Hisp.*, **3**: 929 (1880), non Nutt. (1838)

R. gallecicus Freyn in Willk., *Ill. Fl. Hisp.*, **1**: 100 (1883)

R. bulbosus subsp. *aleae* (Willk.) Rouy & Fouc., *Fl. Fr.*, **1**: 106 (1893)

R. bulbosus subsp. *gallecicus* (Freyn) P. W. Ball & Heywood, *Reprium nov. Spec. Regni veg.*, **66**: 151 (1962)

Willkomm (1883 *op. cit.*, Willkomm & Lange 1880 *op. cit.*) described *R. aleae* as very variable, and the forms which he recognised cover a wide span of the array of the intermediates which occur between subsp. *bulbosus* and subsp. *adscendens*. He separated *R. gallecicus* from others in the group mainly on leaf-shape; but it is difficult to see why he considered it distinct from his *R. aleae*.

DISCUSSION AND CONCLUSIONS

Only two subspecies, subsp. *bulbosus* and subsp. *adscendens*, within the single species *R. bulbosus*, are recognised within Europe and no further taxonomic divisions are considered justified. The subspecies are generally so distinct morphologically that there would be little hesitation in treating them as separate species were it not for the presence in certain areas of intermediate plants. The subspecies occupy totally different ecological habitats within different geographical regions. The fact that the species is most conveniently split into two subspecies, with intermediate types of plants occupying a relatively smaller area than the 'pure' subspecies, may be purely a result of the limited occurrence of intermediate habitats.

Little evidence of the evolution of the species is available, the chromosome number and the karyotype being uniform. Although crosses between widely separated plants, of the same or differing subspecies, were found to result in a general reduction of fertility, it is insufficient to present a significant barrier to gene-flow between all members of the species. Gene-flow and the resulting merging of the subspecies appears to be checked by the limited occurrence of the habitats required by the intermediate plants.

Further investigation is required of the variation of *R. bulbosus* to be found outside Europe. Plants with well-formed corms occur in the mountains of Morocco. These are very isolated from subsp. *bulbosus* and although similar they are not morphologically identical with it.

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REFERENCES

- BROTERO, F. DE AVELLAR (1827). *Phytographia Lusitaniae Selector*, ed. 3, 2. Lisbon.
 BÖCHER, T. W. (1938). Cytological studies in the Genus *Ranunculus*. *Dansk bot. Ark.*, **9**: 1–33.
 COLES, S. M. (1971). The *Ranunculus acris* L. complex in Europe. *Watsonia*, **8**: 237–261.
 COONEN, L. P. (1939). The chromosomes of *Ranunculus*. *Am. J. Bot.*, **26**: 49–58.
 DAVIS, P. H. (1960). Materials for a Flora of Turkey: IV. Ranunculaceae: II. *Notes R. bot. Gdn Edinb.*, **23**: 103–161.
 GREGSON, N. M. (1965). *Chromosome morphology and cytogenetics in the genus Ranunculus* L. Ph.D. thesis, University of Liverpool.
 HARPER, J. L. (1957). *Ranunculus acris* L., *R. repens* L., *R. bulbosus* L., in Biological Flora of the British Isles. *J. Ecol.*, **45**: 289–342.
 KURITA, M. (1957). Chromosome studies in Ranunculaceae VII. Karyotypes of *Eranthis* and some other genera. *Mem. Ehime Univ.*, sect. 2., **2**: 325–334.
 LARTER, L. N. H. (1932). Chromosome variations and behaviour in *Ranunculus* L. *J. Genet.*, **26**: 255–283.
 NEVES, J. DE BARROS (1944). *Contribuição para o Estudo cário-sistemático das espécies portuguesas do Género Ranunculus* L. Dissertação para Doutoramento em Ciências biológicas na Universidade de Coimbra.
 TENORE, M. (1842). *Ad Florae Neapolitanae Syllogem*, Appendix 5. Naples.
 THOMPSON, P. A. (1970). Germination of species of Caryophyllaceae in relation to their geographical distribution in Europe. *Ann. Bot.*, **34**: 427–49.
 TUTIN, T. G. (1964). *Ranunculus*, in TUTIN, T. G., *et alia*, ed. *Flora Europaea*, **1**: 223–238. Cambridge.

APPENDIX

EXAMPLES OF HERBARIUM MATERIAL OF THE TWO RECOGNISED SUBSPECIES AND OF INTERMEDIATE PLANTS

R. bulbosus L. subsp. *bulbosus* (Fig. 10)

Østfold: Hvaler: . . . 1 km S. of Korsham (on the road to Bølingshamn), 10. VI. 1962, K. Lye (S)

British Isles: v.c. 97 Westernness, grass verge near the Stage House Hotel, Glenfinnan, 2. IX. 1965, M. McCallum Webster (E)



FIGURE 10.

A. subsp. *bulbosus*
(Nieder-Österreich: Wiesen
nächst dem roten Stadl bei Liesing,
12.V.1927, J. Vetter (W).)

B. subsp. *adscendens* (Brot.) Neves
(Vila Vicosa: Tapada Real: Águas
Férreas. 4.V.1947, A. Fernandes
et Sousa n. 1459 (S).)

Upsalia in pratis collinis freqn., VI. 1869, F. Ahlberg (CGE)
St Georges s. Loire, M. et L., 26. IV. 1867, G. Genevier (CGE)

R. bulbosus subsp. *adscendens* (Brot.) Neves (Fig. 10)

Faro, V. 1889, A. Moller (COI)

Prov. Estremadura. Sa de Arrabida in silvaticis umbrosis l. Matade Vidal,
solo calcareo 400 m.s.m., 22. IV. 1939, W. Rothmaler & A. P. Silva (S)

Austria.* Istria. In graminosis prope 'Pola'. 2-170m.s.m., IV & V 1897, K.
Untchj (BM, E, W)

Crete: Rochers calcaires de Malaxa, 13. VI. 1883, E. Reverchon (E, UPS)

* now Yugoslavia

Intermediates between subsp. *bulbosus* and subsp. *adscendens*

Toscana—Firenze in Gamberaia, 10. IV. 1948, *A. Contardo* (W)

Italy. Dist. Massa: Alp Apuane N.W. of Terrinca, 1000m, pasture, 26. V. 1961, *Davis* 34,315 (E)

Regnum Granatense, Sierra Nevada, in udis graminos ad flumen Monathil partibus alpini, 23–3000m., 21–28. VII. 1879, *Huter, Porta, Rigo* (E)

Prov. de Teruel. Camarena, lieux incultes et herbeux sur le calcaire 1,500m., VI. 1892, *E. Reverchon* (S)

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Two hybrids in *Equisetum* new to the British flora

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ABSTRACT

Two hybrids in *Equisetum* subgenus *Equisetum* are reported as new to the British flora. These are *E. palustre* L. $\times$ *E. telmateia* Ehrh. (= *E. \times font-queri* Rothm.) and *E. arvense* L. $\times$ *E. palustre* L. (= *E. \times rothmaleri* hybr. nov.).

Descriptions and diagnoses of these hybrids are given, and the significance of their occurrence in Britain is discussed.

INTRODUCTION

Within the British flora two hybrids in *Equisetum* subgenus *Equisetum* (the deciduous horsetails) have previously been known. One of these, *Equisetum palustre* L. $\times$ *E. fluviatile* L., has been recorded only from a single station in the Outer Hebrides (Page 1963). The other, *E. arvense* L. $\times$ *E. fluviatile* L. (*E. \times litorale* Kühlew.), has long been familiar to botanists and is widespread. This paper reports the presence in Britain of two further interspecific hybrids in the subgenus. These are *Equisetum arvense* L. $\times$ *E. palustre* L. (*E. \times rothmaleri* hybr. nov.) and *E. palustre* L. $\times$ *E. telmateia* Ehrh. (*E. \times font-queri* Rothm.).

E. \times font-queri has been previously recorded from two stations in the Mediterranean area, but earlier reports of hybrids between *E. arvense* and *E. palustre* (as *E. \times torgesianum* Rothm.) (Rothmaler 1944) are, I think, incorrect. Good examples of both these hybrids have been found recently by the author on the Isle of Skye (v.c. 104, North Ebudes). Although both represent significant additions to the British flora, the find of *E. \times font-queri* is in several ways of special interest. Its shoots are large and exactly intermediate in morphology between its two rather dissimilar parents (Fig. 1A, D, E); it has colonised nearly two square miles (c 5 km²) of native moorland, possibly displacing one of its parent species from most of this area; and it cones vigorously and produces spores which may not be entirely abortive.

Descriptions and diagnoses of the new hybrids are detailed below, with notes on their ecology and biology. For ease of comparison the descriptions follow the format of Warburg (1962).

EQUISETUM \times ROTHMALERI

DESCRIPTION AND DIAGNOSIS

***Equisetum \times rothmaleri* C. N. Page, hybr. nov. (*E. arvense* L. $\times$ *E. palustre* L.).**
Fig. 1B

Caules 25-50 cm alti, 2-3 mm diam., virides, alte 5-8 sulcati; vaginae (dentibus exclusis) 6-7 mm, virides; dentes tot quot sulci, subulati, nigrescentes, marginibus



FIGURE 1. Silhouettes of typical aerial shoots of *Equisetum* $\times$ *rothmaleri* and *E.* $\times$ *font-queri* and their putative parents taken from material collected on Skye in early July. A, *E. palustre*; B, *E.* $\times$ *rothmaleri* (*E. arvense* $\times$ *palustre*); C, *E. arvense*; D, *E. telmateia*; E, *E. font-queri* (*E. palustre* $\times$ *telmateia*), two vegetative shoots and one fertile shoot.

angustis scariosis, 1-costati; cavitas centralis $\frac{1}{4}$ – $\frac{1}{2}$ caulis diam. Ramuli patentes vel suberecti, $\pm$ regularites verticillati, simplices, plerumque tetragoni; internodium infimum vaginam caulis proximam aequans vel duplo superans; vaginae pallidae, dentibus triangularibus-acuminatis patulis minute nigro. Strobilus 4–9 mm longus; sporae abortivae.

Stems 25–50 cm, erect, 2–3 mm diameter, green; grooves 5–8, deep; sheaths (excluding teeth) 6–7 mm, green; teeth as many as the grooves, subulate, blackish with narrow scarious margins, 1-ribbed; central hollow $\frac{1}{4}$ – $\frac{1}{2}$ diameter of stem. Branches spreading to suberect, in $\pm$ regular whorls, simple, usually 4-angled; the lowest internode 1–2 times length of adjacent stem-sheath; sheaths pale, teeth triangular-acuminate, somewhat spreading, with minute black tips. Cone 4–9 mm long; spores abortive.

HOLOTYPE: Kilmaluag, near Rubha Hunish, Trotternish Peninsula, Isle of Skye, Scotland, GR 18/427.742, July 1971, C. N. Page no. C 7902 (E; isotypi BM, K)

Shoots of this hybrid are clearly intermediate in general morphology between those of the putative parents *E. palustre* and *E. arvense*. The three are compared in Table 1. The hybrid resembles *E. arvense* in having the teeth of the sheaths on the main shoot with only narrow scarious margins, the longest branches typically near the middle of the shoot, the first internode of the branch about as long as or longer than the adjacent stem-sheath, the branches with prominent acute ridges separated by deep furrows (usually not more than four), and spreading teeth to the branch-sheaths. It resembles *E. palustre* in typically having a rather long branchless terminal portion to the stem, branches which are mostly ascending, a gradually tapering outline to the upper part of the shoot, black-tipped teeth on the branch-sheaths, and small vallecular canals and central cavity and a single common endodermis in the stem. The combination of these characters distinguishes *E. × rothmaleri* from either parent. The appearance of the entire colony is thus one of somewhat yellow-green shoots of *E. palustre* with a broader outline and more conspicuously angled branches.

The monomorphic habit of *E. palustre* is inherited in the hybrid, whose cone-bearing shoots thus differ from the sterile shoots only in being slightly shorter (25–35 cm) and in terminating in a small ovoid cone (4–9 mm long, 2–3 mm broad) which is black in colour when mature in July. Only about 5% of the shoots found bore cones, and these shoots were widely scattered amongst the vegetative ones. The cones were all small and the spores entirely mis-shapen, colourless, lacking all but the most rudimentary elaters and obviously abortive.

E. × rothmaleri can be distinguished from *E. × litorale* (*E. arvense* $\times$ *E. fluviatile*) by its smaller size, more ascending branches, darker ochreolae, and by the transverse section of the stem, which shows a much smaller central cavity and a single common endodermis. *E. × rothmaleri* is distinct from *E. × font-queri* (*E. palustre* $\times$ *E. telmateia*) in its smaller size, green stem-internodes, stem and branches with simple ridges and single ribs to the teeth. It is less easy to distinguish from *E. fluviatile* $\times$ *E. palustre* but it can be separated by its smaller size, more abundant and more regular branching, more deeply furrowed branches with more prominent ridges and a longer first internode, a single common endodermis in the stem, and the lack of any orange-brown tinge to the internodes or sheaths of the main stem (a characteristic of only *E. fluviatile* and its hybrids).

TABLE 1. COMPARISON OF *EQUISETUM* HYBRIDS AND THEIR PUTATIVE PARENTS

(all data based on material from Skye)

	<i>E. telmateia</i>	<i>E. palustre</i> × <i>E. telmateia</i> (<i>E.</i> × <i>font-queri</i>)	<i>E. palustre</i>	<i>E. arvense</i> × <i>E. palustre</i> (<i>E.</i> × <i>rothmalerti</i>)	<i>E. arvense</i>
height (cm)	40-80	30-65	25-30	35-50	20-55
stem-width* (mm)	5.0-8.0	2.5-4.0	1.5-2.5	2.0-3.0	2.0-3.0
stem-internode colour	ivory white	mostly ivory white	green	green	green
proportion of upper unbranched part of shoot	$\frac{1}{10}$	$\frac{1}{8}$	$> \frac{1}{4}$	$\frac{1}{6}-\frac{1}{4}$	$< \frac{1}{10}$
length of sheath of main stem (excluding leaves)* (mm)	13-18	12-15	6-8	6-7	5-8
number of teeth of main stem-sheath (= internodal ridges)*	14-18	8-12	5-8	6-10	7-15
usual number of branch ridges	4-5	4-6	5-6	mostly 4	3-4
shape of branch ridges	prominent, biangulate	moderate, shallowly biangulate	low, rounded, simple	prominent, simple	prominent, simple
position of longest branches on main stem	upper $\frac{1}{2}$	near middle	lower $\frac{2}{3}$	near middle	middle-upper $\frac{1}{3}$
ratio of length of first branch internode to adjacent stem-sheath	$\frac{1}{2}-1$	$\frac{1}{3}-\frac{1}{4}$	$\frac{1}{4}-\frac{1}{2}$	$< 1-2$	2-3
endodermal pattern of main stem	single common	single common	single common	single common	single common
ratio of width of central hollow of stem to stem diameter*	$> \frac{1}{2}$	$c \frac{1}{4}$	$< \frac{1}{4}$	$\frac{1}{4}-\frac{1}{2}$	$c \frac{1}{2}$
ratio of width of vallecular canals to stem diameter*	$< \frac{1}{8}$	$c \frac{1}{6}$	$\frac{1}{5}-\frac{1}{4}$	$c \frac{1}{6}$	$c \frac{1}{8}$
fertile shoot-type	dimorphic	monomorphic	monomorphic	monomorphic	dimorphic

* Measured $\frac{1}{3}$ of the way up the stem.

LOCAL DISTRIBUTION AND ECOLOGY

A single colony of this plant was found in July 1971 at Kilmaluag near Rubha Hunish on the Trotternish Peninsula, Isle of Skye (v.c. 104) (GR 18/427.742). It is locally abundant in roadside ditches which drain flat marshy ground. It occurs for about 50 yards (c 46m) along either side of a small road and it spreads for a short distance into the adjacent marshy fields. In the ditches it is locally dominant but becomes less abundant in the fields where it occurs with *Equisetum palustre*, *E. fluviatile*, *Filipendula ulmaria*, *Ranunculus flammula*, *Potentilla palustris*, *Caltha palustris* and other marsh species.

EQUISETUM × *FONT-QUERI*

DESCRIPTION AND DIAGNOSIS

Equisetum × *font-queri* Rothm. (*E. palustre* L. × *E. telmateia* Ehrh.) Fig. 1E

Stems 30–65 cm, erect, 2.5–4.0 mm diameter, mostly ivory-white, smooth; grooves 8–12, shallow; sheaths (excluding teeth) 12–15 mm, ± appressed, greenish, sometimes blackish above; teeth as many as the grooves, blackish with scarious margins, subulate, 2-ribbed; central hollow about $\frac{1}{4}$ diameter of stem. Branches spreading, usually in regular whorls, numerous, simple, 4–6-angled; the lowest internode $\frac{1}{3}$ – $\frac{3}{4}$ the length of adjacent stem-sheath; sheaths pale, teeth triangular-acuminate, brownish, appressed. Cone 8–42 mm long; spores at least partially abortive.

SPECIMENS: c $\frac{1}{2}$ mile north of Loch Leathan, 1 mile WSW of the Storr, Trotternish Peninsula, Isle of Skye, Scotland, GR 18/511.534, July 1971, C. N. Page no. C7880 (BM, E, K)

Shoots of this hybrid are strikingly intermediate in size and morphology between those of *E. palustre* and *E. telmateia* (Table 1). They resemble *E. telmateia* in their large size, thick stems, stem internodes which are mostly ivory-white, biangulate branch ridges, stem- and branch-sheaths with 2-ribbed teeth, and relatively long somewhat flexuous teeth on the main stem-sheaths. They can be clearly linked with *E. palustre*, however, by their comparatively slender overall outline, long terminal branchless portion, spreading to subascending branches which are more robust than those of *E. telmateia*, stems with relatively small vallicular canals and central cavity, and stomata on the stem internodes (absent in *E. telmateia*). Indeed, the overall appearance of stands of the hybrid is one of overgrown shoots of *E. palustre* with the conspicuous ivory-white internodes and long teeth on the sheaths of the main stem as in *E. telmateia*. Although the monomorphic habit of *E. palustre* is inherited in the hybrid, a few cone-bearing shoots of *E. × font-queri* were found in which whorled branches were absent from the vegetative nodes. However, these shoots were tall (25–50 cm) with long vegetative internodes and resembled the occasional unbranched shoots also to be found from time to time in local *E. palustre* colonies; they are very different therefore from the thick, short, spring cone-shoots characteristic of *E. telmateia*. Most cone-bearing shoots of *E. × font-queri*, then, closely resemble the vegetative ones with profuse whorls of green branches. Nearly half of all the shoots seen in July 1971 bore cones. These mature in July and are ovoid in shape, slimmer than those of *E. telmateia* (8–42 × 3–9 mm) and pale green in colour with chestnut-

brown tips. They are thus intermediate between the relatively small, markedly cylindrical and usually blackish cones of *E. palustre* and the large, broad, ovoid-ellipsoid cones of *E. telmateia*, which are whitish or pale green with small brown tips. In the field, cones of the hybrid appear well-filled and seem to open and dehisce normally. Examination of the fresh spores showed that a proportion (varying from 5% to 50% in different sporangia and different cones) were relatively well-formed, green in colour, and possessed well-developed elaters. The remainder of the spores were small, mis-shapen, lacked good elaters, and were obviously abortive as in other hybrids.

Equisetum $\times$ *font-queri* can be readily distinguished from the other known *E. palustre* hybrids (*E.* $\times$ *rothmaleri* and *E. fluviatile* $\times$ *E. palustre*) as well as from *E.* $\times$ *litorale* (*E. arvense* $\times$ *E. fluviatile*) by its more robust shoots with ivory-white internodes, typically more abundant branches, and 2-ribbed teeth to the stem- and branch-sheaths.

LOCAL DISTRIBUTION AND ECOLOGY

It was found in July 1971 locally abundant and sometimes dominant over a distance of about two miles (*c.* 3.5 km) by the road along the east side of the Storr on the Trotternish peninsula, Isle of Skye (v.c. 104) (GR 18/511.532–516.614). It was present on both sides of the road and up to half a mile (*c.* 0.8 km) from it, the altitude varying from 150–525 ft (45–160 m). It extended from just north of Loch Leathan in the south to about half a mile north of Rigg Burn. Between these two points the hybrid forms a nearly continuous stand, becoming particularly abundant in most damp depressions, irrigated slopes, flushes, seepage lines, screebanks, drainage channels, ditches and streambanks; it is also vigorously colonising roadside verges and rubble along most of the two-mile stretch of road. The plant was not found in the immediate vicinity of the Storr itself (J. C. Gardiner *pers. comm.*).

DISCUSSION

MORPHOLOGY AND PARENTAGE OF THE HYBRIDS

It has been shown in Table 1 that the two hybrids are almost exactly intermediate between two pairs of British species in a large number of distinct morphological characters; the parentage of each can therefore be deduced with reasonable certainty. The only morphological trait not found to be intermediate in the hybrids is the inheritance (from *E. palustre* in each case) of monomorphic aerial shoots. It is worth noting that in *E.* $\times$ *litorale* the monomorphic condition of one parent (*E. fluviatile*) is similarly dominant over the dimorphic condition of the other (*E. arvense*).

All three putative parent species of the two hybrids are present on Skye, and at least one of these (*E. palustre*—the parent common to each of the hybrids) is locally extremely abundant. It colonises a wide range of wet boggy and marshy habitats, flushes, ditches, and even roadside banks and verges, and in most places cones vigorously. Both the other two parent species occur near the hybrids. The withered remains of the ephemeral spring fertile shoots of *E. telmateia* were found and it is probable that *E. arvense* is also fertile in this area.

The hybrids occupy habitats intermediate between those of the putative

parents; in the case of *E. × font-queri* the hybrid also occupies virtually the whole range of habitats of both.

EXTRA-BRITISH DISTRIBUTION

Putative hybrids between *E. arvense* and *E. palustre* have been reported by Rothmaler (1944) under the name *E. × torgesianum* from about five localities in north-central Europe, although these stations are poorly documented. I am not aware of any further published records and I have found no material of this hybrid in herbaria. I have examined the material from the north-central European localities (six sheets from five stations) at Jena (JE) attributed by Rothmaler to hybrids between *E. arvense* and *E. palustre*. Specimens from four of these localities, including the holotype of *E. × torgesianum*, appear to be robust plants of *E. palustre* with a superficial resemblance to *E. arvense*. I can, however, find no good characters to link any of the specimens firmly with *E. arvense* (or any other species). I am not convinced, therefore, that they are hybrids and in my opinion they all belong to *E. palustre*. The specimen from the fifth locality is equally clearly *E. arvense*. My material from Skye is easily distinguished from all of these plants. The name *E. × torgesianum* cannot, therefore, be used for the Skye hybrid, which has accordingly been described above (p. 229) as *E. × rothmaleri*. The Skye locality is thus the only one known for this hybrid.*

Putative hybrids between *E. palustre* and *E. telmateia* have been recorded previously from two Mediterranean stations. The type locality of *Equisetum × font-queri* is given by Rothmaler (1944) as 'Hispania, Gerona, Martorella de la Selva . . . Solum in loco classico observatum, sed frequens', where the plant occurred in damp alder woodland. I have examined Rothmaler's material (8 sheets bearing 45 shoots) at JE collected at various times from the Gerona locality, including the holotype of *E. × font-queri* collected on 29th April 1934 by Font Quer. In size and morphology all Rothmaler's specimens are distinctly intermediate between *E. palustre* and *E. telmateia*, and are, without doubt, the hybrid between them. My Skye material of *E. palustre × E. telmateia* corresponds extremely closely with these Spanish specimens, and there is little doubt that they are the same hybrid.

The second and, as far as I am aware, only other known station for this hybrid was detected by Hauke (1966) in herbarium material at Stockholm (S-PA) from 'Entre le pont du Var et la mer (Alpes maritimes)' collected by Emile Burnat, 20th May 1872. The locality is near Nice, southern France. I have examined this material and agree with Hauke's determination. These specimens are somewhat smaller than my Skye plants (averaging about 30–45 cm) but otherwise they compare very closely with them, and small specimens of the Skye plants can be distinguished from them only with difficulty. The habitat is given as alluvial riverside sand several feet above the river water; about half the shoots seen bear cones. Further sheets from this same locality are at Kew (K), and most of these are also fertile. Judging by the size of these collections (4 sheets containing 17 specimens at S-PA, 4 sheets with 22 specimens at K) the hybrid must also have once been reasonably abundant in the Nice locality, and further search for this plant both at Gerona and Nice is greatly to be desired.

A retrospective search for other herbarium material also revealed a specimen which is clearly this taxon in London (BM) collected from Rigg Burn, Skye, by

* This updates and re-inforces information already published (Page 1972, p. 366).

Patricia A. Sims, on 19th August, 1960. This record pre-dates my own find of this plant on Skye in the same locality and provides evidence that *E. × font-queri* has been in this area for over 10 years. These specimens were also bearing cones.

EXCEPTIONAL FEATURES OF *E. × FONT-QUERI* ON SKYE

The very large size of the area occupied by *E. × font-queri* on Skye cannot fail to impress even a casual observer. Further, over the whole of this area, with the exception of the immediate vicinity of the road, *E. × font-queri* appears to have invaded previously closed habitats. Many of the habitats it occupies are elsewhere colonised vigorously by *Equisetum palustre*, but in the area of the hybrid this species is almost absent, giving the impression that *E. × font-queri* has largely ousted and replaced this parent.

The abundance of fertile shoots and the large size of the cones of *E. × font-queri* are also exceptional features for a hybrid horsetail. The presence of a proportion of spores in these cones which appear to be not entirely abortive is possibly unique, although it is not known whether any of these spores are viable.

These features all contrast markedly with the colony of *E. × rothmaleri* described here as well as with the only known colony of *E. fluviatile × E. palustre*, which is in the Outer Hebrides. The colonies of each of these two hybrids are small and appear to be hardly, if at all, more vigorous than their parent species. Indeed, the only hybrids in *Equisetum* subgenus *Equisetum* seen by the author which approach the vigour of *E. × font-queri* are certain colonies of *E. × litorale* in other parts of the British Isles. Cases where *E. × litorale* has invaded closed communities must also be rare. The weakness of the colonies of *E. × rothmaleri* and *E. fluviatile × E. palustre* when compared with the relative vigour of those of *E. × litorale* and *E. × font-queri* is especially significant in the light of the inter-relationships of the parent-species that have been suggested on micro-morphological grounds (Page 1972). These data indicate that *E. palustre* and *E. telmateia* are closely related, similarly *E. arvense* and *E. fluviatile*. It appears, therefore, that the most vigorous and successful hybrids in the subgenus *Equisetum* are those between the most closely related (yet ecologically diverse) pairs of species, whilst hybrids between more distantly related species (which may be ecologically more similar) are scarcely, if at all, more vigorous than their parents.

DISTRIBUTION AND ORIGIN OF THE HYBRIDS

During this survey several stations for *E. × litorale* were also detected on Skye, making a total of four interspecific hybrids in *Equisetum* subgenus *Equisetum* in the Hebrides. This high local concentration of hybrids in this subgenus contrasts with the certain occurrence elsewhere in the British Isles of only *E. × litorale*.

Despite the extensive total ranges of the *E. telmateia* complex (temperate western Eurasia and western North America) and of *E. arvense* and *E. palustre* (chiefly North Temperate regions of both the Old and New Worlds), the recorded interspecific hybrids among this trio are all from western Europe. Furthermore, the number of known stations for these hybrids is surprisingly small when compared with the relatively large number for the hybrid between *E. arvense* and *E. fluviatile*—90 stations for *E. × litorale* are known in Fennoscandia (Borg 1967) and nearly 100 in the British Isles.

The isolation of the Skye colony of *E. × font-queri* from its two Mediterranean stations suggests that, as with *E. × rothmaleri* and *E. fluviatile × E. palustre*,

this hybrid has arisen independently in the Hebridean area, and implies that the local environment must be particularly favourable for hybridisation. Conditions that are conducive to hybridisation in *Equisetum* are as yet poorly understood and clearly deserve further study. Reports of *Equisetum prothalli* in the wild are extremely few, and are only from habitats which are damp, recently-exposed and free, at least initially, from much competition (Matzke 1941, Feigley 1949, Hauke 1967, Page 1967). The occurrence of all three Hebridean *E. palustre* hybrids near to or in roadside ditches suggests an association between the digging or clearing of the ditch by man and the formation of the hybrid. Any damp mud surface exposed at an appropriate season would probably form an ideal substrate for rapid prothallial growth. Manton (1950 p. 223), commenting upon the number of interspecific hybrids in *Equisetum* known at that time from Ireland, states that the mild, oceanic Irish climate seems likely to favour their production. This view is strengthened by the subsequent discovery of *Equisetum fluviatile* $\times$ *E. palustre* in the Outer Hebrides and the presence of these two new hybrids on Skye—both in areas where the rainfall is high and spread liberally throughout the year.

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REFERENCES

- BORG, P. (1967). Studies on *Equisetum* hybrids in Fennoscandia. *Ann. Bot. Fenn.*, **4**: 35–50.
FEIGLEY, M. (1949). An occurrence of gametophytes of *Equisetum* in Cheboygan County, Michigan. *Am. Fern. J.*, **39**: 106–109.
HAUKE, R. L. (1966). A systematic study of *Equisetum arvense*. *Nova Hedwigia*, **13**: 81–109.
HAUKE, R. L. (1967). Sexuality in a wild population of *Equisetum arvense* gametophytes. *Am. Fern. J.*, **57**: 59–66.
MANTON, I. (1950). *Problems of Cytology and Evolution in the Pteridophyta*. Cambridge.
MATZKE, E. B. (1941). Gametophytes of *Equisetum arvense* L. *Torreyia*, **41**: 181–187.
PAGE, C. N. (1963). A hybrid horsetail from the Hebrides. *Br. Fern. Gaz.*, **9**: 117–119.
PAGE, C. N. (1967). Sporelings of *Equisetum arvense* in the wild. *Br. Fern. Gaz.*, **9**: 335–338.
PAGE, C. N. (1972). An assessment of inter-specific relationships in *Equisetum* subgenus *Equisetum*. *New Phytol.*, **71**: 355–369.
ROTHMALER, W. (1944). Pteridophyten-Studien I. *Reprum nov. Spec. Regni veg.*, **54**: 55–82.
WARBURG, E. F. (1962). *Equisetum*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 6–11. Cambridge.

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A cytological study of the British Labiatae (excluding *Mentha*)

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ABSTRACT

Chromosome numbers based on indigenous material are reported for 41 of the 47 species of Labiatae native in Britain. The hybrid origin of *Stachys* $\times$ *ambigua* Sm. is confirmed, its chromosome complement at diakinesis consisting of 83 univalents. A spectrum of polyploidy is given, the incidence being 69.8%. This figure is likely to be reduced to 67% when the few remaining species are examined.

INTRODUCTION

In Britain the Labiatae consist of 47 native species, about 13 naturally occurring hybrids (or hybrid complexes) and some 16 well-established introduced species. Of these, 4 native and 3 introduced species, together with 9 hybrid complexes, belong to the genus *Mentha* and will not be considered in the present paper. An account of the chromosome numbers in the British Menthae has already been published (Morton 1956). The large proportion of introduced taxa (about one third) in the British Labiatae is largely due to many species being important herbs which have long been cultivated in cottage and monastery gardens for their fragrance, and their medicinal and culinary uses. Chromosome numbers are reported in this account for all but 6 of the native species, from material of known British origin. Details of the materials used, chromosome numbers, ploidy level, and the location of voucher specimens are given in Table 1. Genera and species are arranged alphabetically and the nomenclature is that of Warburg (1962).

MATERIALS AND METHODS

Living material was collected in the field and brought into cultivation either by transplanting or by growing from seed. In most cases chromosomes were studied in root-tip preparations using previously-described section and squash techniques (Morton 1956, 1962). Root-tips were taken from well-grown plants to prevent anomalies arising from seedling root-tips or from misidentification of immature material.

DISCUSSION

Most of the chromosome numbers confirm those already reported for the same species in other parts of their range. However, numbers for 26 of the species (and one hybrid) are here reported for the first time from material of British

TABLE 1. CHROMOSOME NUMBERS IN BRITISH LABIATAE

J.K. Morton reference no. Vouchers** (or reference to publication)		Origin	2n	n	Base-no.	Ploidy	Illustration
<i>Acinos arvensis</i> (Lam.) Dandy	s.n. DHM, JKM	Worm's Head, Gower v.c. 41	18	—	9	2	—
"	4682 JKM	Raisby Quarries, Durham v.c. 66	—	—	—	—	Fig. 1a
<i>Ajuga chamaepitys</i> (L.) Schreb.	Rutland (1941)	British, unlocalised	28	—	7	4	—
<i>A. pyramidalis</i> L.	s.n. JKM	South Harris v.c. 110	32	—	8	4	Fig. 1b
<i>A. reptans</i> L.	Maude (1940)	British, unlocalised	32	—	8	4	—
"	s.n. JKM	Hadley Woods, Sheffield v.c. 63	32	—	8	4	—
<i>Ballota nigra</i> L. subsp. <i>foetida</i> Hayek	Rutland (1941)	British, unlocalised	22	11	11	2	—
<i>Betonica officinalis</i> L.	4704 DHM, JKM	Westgate in Weardale v.c. 66	16	—	8	2	—
"	s.n. JKM	Kynance Cove ¹ v.c. 1	16	—	8	2	Fig. 1c
<i>Calamintha ascendens</i> Jord.	4817 JKM	Tytherington v.c. 34	48	—	12	4	Fig. 1d
"	4869 JKM	Mann's Sands, Brixham v.c. 3	48	—	12	4	—
"	5008 DHM, JKM	Saunton Sands, Barnstaple v.c. 4	48	—	12	4	—
<i>Calamintha nepeta</i> (L.) Savi	4787 JKM	Eynsham v.c. 23	48	—	12	4	—
"	4860 JKM	Corfe Castle v.c. 9	c72	—	12	6	—
<i>C. sylvatica</i> Bromf.	5087 DHM, JKM	Apes Down, Isle of Wight v.c. 10	24	—	12	2	Fig. 1e
<i>Clinopodium vulgare</i> L.	4715 JKM	Cirencester v.c. 33	20	—	10	2	Fig. 1f
"	s.n. JKM	Raisby Quarries, Durham v.c. 66	20	—	10	2	—
<i>Galeobdolon luteum</i> Huds. (= <i>Lamium astrum galeobdolon</i> (L.) Ehr. & Polat.)	4723 JKM	Wooten Under Edge v.c. 34	36	—	9	4	—
"	s.n. JKM	Hadley Woods, Sheffield v.c. 63	36	—	9	4	Fig. 2a
"	Wegmüller (1971)	many localities	36	—	9	4	—
"	"	Lincolnshire	18	—	9	2	—
<i>Galeopsis speciosa</i> Mill.	5025 " DHM, JKM	Gretna v.c. 72	16	—	8	2	Fig. 2c
<i>G. tetralix</i> L. (inc. <i>G. bifida</i> Boenn.)	4774 JKM	Inverness v.c. 96	32	—	8	4	—
"	5153 JKM	Kirkwall, Orkney v.c. 111	—	16	8	4	—
<i>Glechoma hederacea</i> L.	4950 JKM	Avebury v.c. 7	36	—	9	4	—
"	Rutland (1941)	British, unlocalised	36	—	9	4	—
<i>Lamium album</i> L.	4727 JKM	Bishop Auckland v.c. 66	18	—	9	2	Fig. 1g
<i>L. amplexicaule</i> L.	4865 DHM, JKM	Berry Head, Brixham v.c. 3	18	—	9	2	—
<i>L. hybridum</i> Vill.	5023 JKM	Edmondsley v.c. 66	36	—	9	4	—

<i>L. moluccellifolium</i> Fr.	5143	JKM, WAT	Dunnet Dunes v.c. 109	36	9	4	Fig. 2e
<i>L. purpureum</i> L.	4799	—	Ireshope Burn, Weardale v.c. 66	18	9	2	—
* <i>Leonurus cardiaca</i> L.		Rutland (1941)	British, unlocalised	18	9	2	—
<i>Lycopus europaeus</i> L.	4709	JKM	Kew v.c. 17	22	11	2	—
<i>Marrubium vulgare</i> L.	4966	JKM	Saunton Sands, Barnstaple v.c. 4	34	17	2	—
" "		Rutland (1941)	British, unlocalised	34	17	2	—
<i>Melittis melissophyllum</i> L.	s.n.	—	King Harry Ferry, Truro v.c. 2	30	15	2	Fig. 1h
<i>Nepeta cataria</i> L.	5001	JKM	Ewelme v.c. 23	34	17	2	—
" "	4786	JKM	Green Lane, Woodstock v.c. 23	34	17	2	Fig. 2d
" "	5109		British, unlocalised	30	15	2	—
<i>Origanum vulgare</i> L.		Rutland (1941)	Tytherington v.c. 34	28	7	4	Fig. 1i
* <i>Prunella laciniata</i> (L.) L.	4816	JKM	Westgate in Weardale v.c. 66	28	7	4	—
<i>P. vulgaris</i> L.	4707	JKM	Thetford v.c. 28	54	9	6	Fig. 1j
<i>Salvia horminoides</i> Pourr.	4806	JKM	Corfe Castle v.c. 9	54	9	6	—
" "	4816	JKM	Wilton v.c. 8	54	9	6	—
" "	4887	DHM, JKM	Plymouth Ho v.c. 3	54	9	6	—
" "	5079	JKM	Kew v.c. 17	32	8	4	Fig. 1k
<i>Scutellaria galericulata</i> L.	4708	JKM	Bollihope, Frosterly v.c. 66	c32	8	4	—
<i>S. minor</i> Huds.	4825	JKM	Wooten under Edge v.c. 34	30	15	2	Fig. 1l
<i>Stachys alpina</i> L.	4724	DHM, JKM	King Harry Ferry, Truro v.c. 2	83	—	—	—
<i>S. × ambigua</i> Sm.	5090	JKM	Wick v.c. 109	83	—	—	—
" "	5139	JKM, WAT	Melmerby, Penrith v.c. 70	83	—	—	Fig. 2b
" "	5227	JKM	Croyde v.c. 4	10	5	2	—
<i>S. arvensis</i> (L.) L.	4974	DHM, JKM	Wixall ² v.c. 40	102	17	6	—
<i>S. palustris</i> L.	p1147	JKM	Ross Carbery, ³ Cork v.c. H3	64	8	8	—
<i>S. sylvatica</i> L.	4302	JKM	Braunton Burrows v.c. 4	32	8	4	—
<i>Teucrium scordium</i> L.	s.n.	—	Black Head, Clare v.c. H15	c32	?	?	—
<i>T. scorodonia</i> L.	4268	JKM	British, unlocalised	34	17	2	—
" "		Rutland (1941)	Many localities	50-56	7	8	—
<i>Thymus drucei</i> Ronn.		Pigott (1954)	Norfolk and Surrey	28	7	4	—
<i>T. pulegioides</i> L.		Pigott (1954)	Norfolk and Suffolk	24	6	4	—
<i>T. serpyllum</i> L.		Pigott (1954)					

¹ dwarf maritime ecotype—see p. 244.

* not native in Britain

² a white-flowered form

³ flowers of an unusual greenish colour

... DHM ... Herbarium of the Department of Botany, University of Durham, U.K.

WAT ... Herbarium of the Department of Biology, University of Waterloo, Canada

JKM ... Author's herbarium

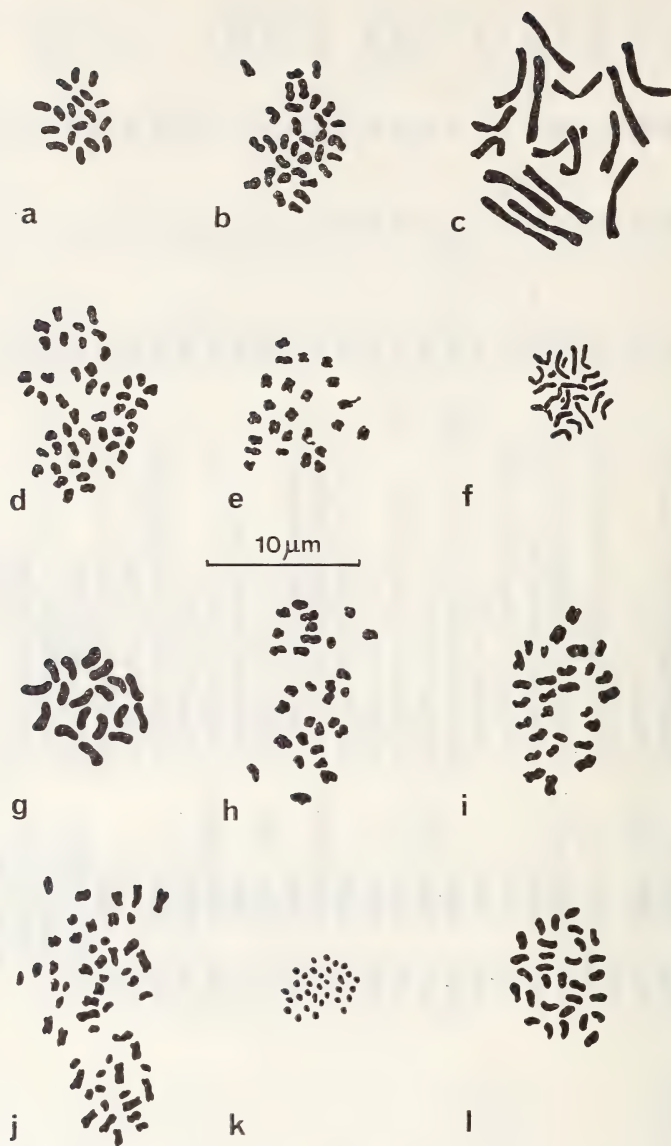


FIGURE 1. Chromosomes in British Labiatae:

- | | |
|--------------------------------|------------------------------------|
| a. <i>Acinos arvensis</i> | g. <i>Lamium album</i> |
| b. <i>Ajuga pyramidalis</i> | h. <i>Melittis melissophyllum</i> |
| c. <i>Betonica officinalis</i> | i. <i>Prunella laciniata</i> |
| d. <i>Calamintha ascendens</i> | j. <i>Salvia horminoides</i> |
| e. <i>C. sylvatica</i> | k. <i>Scutellaria galericulata</i> |
| f. <i>Clinopodium vulgare</i> | l. <i>Stachys alpina</i> |

Metaphase plates of root-tip mitosis in squash preparations, except for a, f, g, k and l, which are from sections. In all except c and f the material was prefixed in a saturated aqueous paradichlorobenzene solution

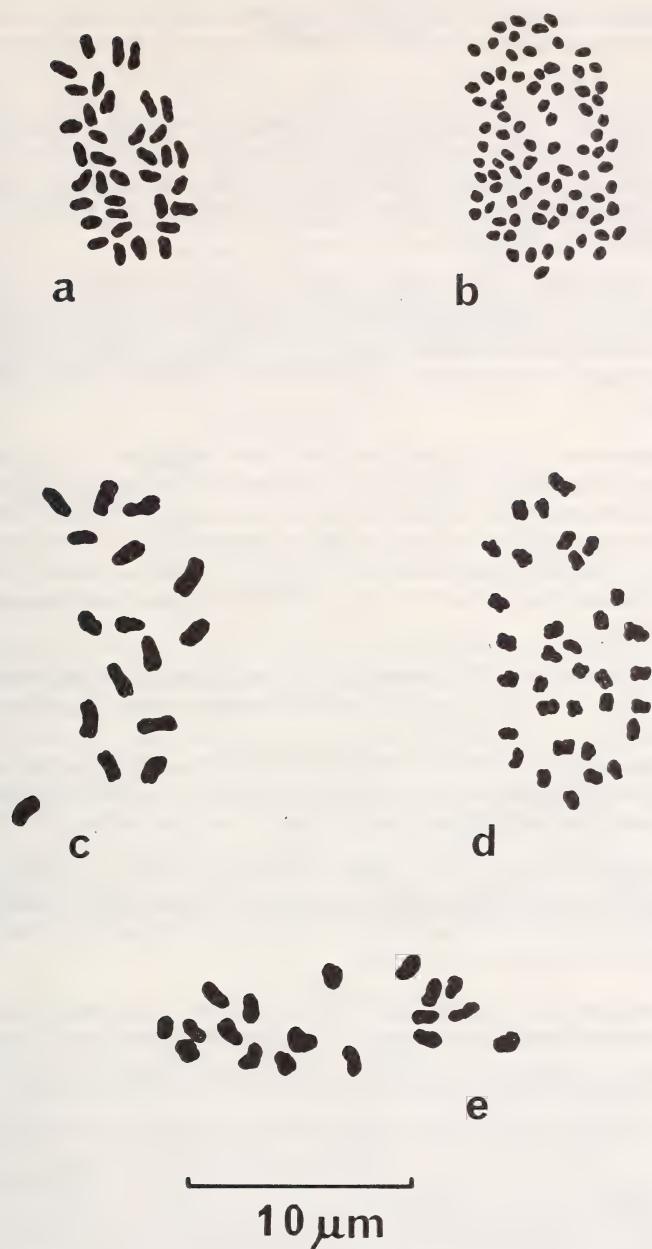


FIGURE 2. Chromosomes in British Labiatae:

a. *Galeobdolon luteum*

b. *Stachys × ambigua*

c. *Galeopsis speciosa*

d. *Nepeta cataria*

e. *Lamium moluccellifolium*

a-d. Metaphase plates of root-tip mitosis in squash preparations. Material prefixed with paradichlorobenzene.

e. Anaphase II of pollen-mother-cell meiosis in squash preparation.

origin, including 3 species and one hybrid* not previously examined cytologically. Few of these observations call for any comment but the following are worthy of note.

Betonica officinalis L. The material from Kynance Cove was a dwarf maritime ecotype which in nature grows only 3 or 4 inches high. Under cultivation in the north of England it retained its dwarf habit over the 6 years that it was grown, and made a very attractive rock-garden plant. Similar plants grow on the sea-cliffs at Marsden, Co. Durham.

Calamintha. The species of this genus form a polyploid series of apparently closely related species. Experimental work is desirable to determine their relationships. In particular the hexaploid material of *C. nepeta* from Corfe Castle requires further study to see whether it may be of hybrid origin with accompanying amphidiploidy.

Glechoma hederacea L. It is desirable that more material of this species be examined from elsewhere in Britain. In continental Europe diploid and tetraploid races occur, together with triploids in some areas. Similarly both races occur in North America as a result of introduction (Gill & Morton 1973). A fuller study of British populations may reveal a situation similar to that in *Galeobdolon luteum* (Wegmüller 1971) in which both diploid and tetraploid races occur in this country.

Prunella. The population of *P. laciniata* at Tytherington has undergone extensive introgression with *P. vulgaris* and it is doubtful whether pure *P. laciniata* remains in that locality.

Previous workers (fide Federov 1969) have frequently reported a diploid number of 32 in this genus, both for *P. laciniata* and *P. vulgaris*. My own observations indicate that both these species have $2n = 28$ in Britain.

Salvia horminoides Pourr. The number reported here ($2n = 54$) for British material may be a new number for this species, but there is considerable confusion in the literature with *S. verbenaca* L. for which this and other numbers ($2n = 42$ and 64) have also been reported.

Stachys $\times$ *ambigua* Sm. This has for a long time been presumed to be a hybrid between *S. palustris* and *S. sylvatica*. The diploid number ($2n = 83$) reported here for the first time confirms this, for the parents have $2n = 102$ and 64 respectively. Furthermore, the count for the Wick material was obtained from a pollen-mother-cell squash which showed 83 univalents at diakinesis. *S.* $\times$ *ambigua* is a rather variable plant and it is possible that it consists of a hybrid complex rather than a simple F_1 hybrid, which these chromosome counts suggest. Further material is being examined to resolve this problem (see also Wilcock 1972). *S. palustris* itself is a very variable and widely distributed plant. In North America some of its forms have been erroneously referred to as *S.* $\times$ *ambigua* (Epling 1934). Recent work on North American plants of *S. palustris* shows that most have $2n = 64$, though a plant with $2n = 96$ has been found (Gill & Morton 1973).

**Calamintha nepeta* (L.) Savi, *Scutellaria minor* L., *Stachys* $\times$ *ambigua* Sm. and *Teucrium scordium* L.

POLYPLOIDY

The spectrum of polyploidy for the native British Labiatae can be readily established from the above data, coupled with those already published for the genus *Mentha* (Morton 1956). There are only 4 native species of *Mentha* in Britain—*M. aquatica* ($2n = 96$), *M. arvensis* ($2n = 72$), *M. rotundifolia* ($2n = 24$) and *M. pulegium* ($2n = 20$)*. I am now of the opinion that the base-number in the section *Mentha* is probably 12 rather than 6. The forms of *M. spicata* and *M. longifolia* with $2n = 36$ are sterile triploids with incomplete chromosome pairing—not fertile hexaploids. Several genera have high base-numbers which are almost certainly of secondary origin due to allopolyploidy—viz. *Marrubium* (17), *Melittis* (15), *Nepeta* (17), *Origanum* (15), *Stachys* (15 and 17) and *Teucrium* (17). The spectrum of polyploidy thus becomes:—

	Primary diploids	13
Polyploids	$\left\{ \begin{array}{l} 4x \\ 6x \\ 8x \\ \text{Secondary base-numbers} \end{array} \right.$	$\left\{ \begin{array}{l} 17 \\ 3 \\ 3 \\ 7 \end{array} \right.$
		30
	% polyploidy	69.8

This is slightly lower than the figure (71.4%) calculated several years ago from less complete information (Morton 1961) in which the base-number in the genus *Mentha* section *Mentha* was presumed to be 6.

On the basis of their known chromosome numbers in material from other countries, the 6 Labiatae which have not yet been examined cytologically using British material (*Salvia pratensis*, *S. verbenaca*, *Stachys germanica*, *Galeopsis angustifolium*, *G. segetum* and *Teucrium botrys*) will not greatly alter this picture, but will probably reduce the percentage of polyploidy to about 67%. This high percentage of polyploidy in the British Labiatae contrasts with that found in our native Caryophyllaceae where the percentage is 41.2 (Blackburn & Morton 1957).

REFERENCES

- BLACKBURN, K. B. & MORTON, J. K. (1957). The incidence of polyploidy in the Caryophyllaceae of Britain and Portugal. *New Phytol.*, **56**: 344–351.
- EPLING, C. (1934). Preliminary revision of American *Stachys*. *Reprim nov. Spec. Regni veg.*, **80**: 1–75.
- FEDEROV, A. A. (1969). *Khromosomnye chisla tsvetkovykh rasteny*. Leningrad.
- GILL, L. S. & MORTON, J. K. (1973). A cytological survey of the Canadian Labiatae, with a conspectus of the Canadian species. In press.
- MAUDE, P. F. (1940). Chromosome numbers in some British plants. *New Phytol.*, **39**: 17–32.
- MORTON, J. K. (1956). The chromosome numbers of the British Menthae. *Watsonia*, **3**: 244–251.
- MORTON, J. K. (1961). The incidence of polyploidy in a tropical flora. *Recent Advances in Botany*, **9**: 900–903.
- MORTON, J. K. (1962). Cytotaxonomic studies on the West African Labiatae. *J. Linn. Soc., Bot.*, **58**: 231–283.
- PIGOTT, C. D. (1954). Species delimitation and racial divergence in British *Thymus*. *New Phytol.*, **53**: 470–495.
- RUTLAND, J. P. (1941). The Merton Catalogue, Supplement 1. *New Phytol.*, **40**: 210–214.

* The count for *M. pulegium* is from material collected at Slapton Sands in Devon.

- WARBURG, E. F. (1962). Labiatae, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 730-763. Cambridge.
- WEGMÜLLER, S. (1971). A cytotaxonomic study of *Lamiastrum galeobdolon* (L.) Ehrend. & Polatschek in Britain. *Watsonia*, 8: 277-288.
- WILCOCK, C. C. (1972). Is *Stachys* × *ambigua* Sm. always distinguishable? *Watsonia*, 9: 62.

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Notes on British Rubi (1)

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ABSTRACT

Three brambles described in Watson's *Handbook* (1958) as *R. insularis*, *R. broensis* and *R. septentrionalis* are considered. The Scottish bramble which Watson called *R. insularis* is shown to be identical with *R. septentrionalis* and the Surrey bramble which Watson identified with *R. broensis* is renamed *R. milfordensis*. *R. broensis* is excluded from the British list.

INTRODUCTION

There is a common bramble in Scotland which Rogers (1900) identified with *R. villicaulis* Koehl. and Watson (1958) as a rule, though not always, with *R. insularis* Aresch., but which cannot be satisfactorily equated with either. The late B. A. Miles told me in 1965 that in his view the Scottish bramble matched specimens which C. J. Lindeberg distributed in 1882 as no. 11 of a set entitled *Herbarium Ruborum Scandinaviae* (Fasc. 1). There is an example in **MANCH** which A. Newton and myself have both examined and we are inclined to agree with Miles, though the specimen we saw is in fruit and apparently shade-grown. There is some doubt about its correct name. Lindeberg called it *R. umbraticus* P. J. Muell. on the strength of a determination by Mueller himself: 'Nomen Mülleri retineo, quod hanc ipsam formam suam *R. umbraticum* agnovit auctor.' But Watson (1946) thought Mueller was wrong (there is a note to this effect on one of his specimens in my herbarium) and renamed it *R. broensis*.

In addition to no. 11 there are two specimens in **MANCH** of no. 12 of Lindeberg's *Herb. Rub. Scand.* (Fasc. 1) which match the Scottish bramble even more closely. Printed labels with each sheet bear the name *R. confinis* n. sp. and a full Latin description. Watson gave this bramble a new name too, when he discovered that the name *R. confinis* was already in use for a different species. He had a Scottish specimen in his herbarium (now in **CGE**) gathered by S. M. Macvicar from Moidart, Inverness, in 1894, which he considered to be identical with Lindeberg's no. 12. Accordingly he (Watson 1946) renamed Lindeberg's no. 12 *R. septentrionalis* and then wrote that name on Macvicar's Moidart specimen. In my judgement and also in that of A. Newton he was fully justified. Another specimen in Watson's herbarium and now in mine was collected from Loch Boisdale, Outer Hebrides, by Professor J. W. Heslop-Harrison in 1939 and was also correctly named *R. septentrionalis* by Watson. A. Newton tells me there is a third in **SLBI** from Croe Bridge, Kintoul, W. Ross, collected by E. F. Warburg in 1948 and determined by Watson as *R. septentrionalis*.

Whether or not Lindeberg's no. 11 and no. 12 are forms of the same species, it is plain that no. 12 and the Scottish plants Watson named *R. septentrionalis* are identical, and Watson is to be commended for being the first to recognise that. The strange thing is that he did not realise that the Scottish plants he had been

calling *R. insularis* and which he continued to call by that name were also identical with Lindeberg's no. 12, that in fact there are not two brambles in Scotland of this household, but only one, and that the right name for them is *R. septentrionalis*. An examination of many living bushes and herbarium specimens has made this clear. It may be that the credit for this discovery should go to W. H. Mills. There is a specimen in CGE collected by him near Dunblane, W. Perth, in 1953, which was first named *R. insularis* by Mills and confirmed by Watson as a small form of that species. But the name *R. septentrionalis* in Mills' handwriting has been added to the sheet, though we do not know whether on his own or someone else's authority.

It is not known whether *R. insularis* Aresch. occurs in Britain or not. It is a Swedish bramble with its headquarters in north-west Skåne. I have not seen any specimens collected by Areschoug, but there are six in MANCH from the *locus classicus*, collected by F. Elmqvist in 1891, and another in my own herbarium, collected by K. Friderichsen in 1893, which answer the original description and are quite unlike any Scottish bramble I have so far seen. The colour of the flowers alone should be enough to distinguish *R. insularis* from *R. septentrionalis*. In *R. septentrionalis* the petals are white or rarely pale pink; in *R. insularis* petals, stamens and styles are said to be rose-red. Specimens in my herbarium which Watson collected at Boar's Hill near Oxford in 1934 and 1950 and named *R. insularis* are near the true plant as I understand it, but they are very different from the Scottish bramble to which Watson gave the same name.

The specimens which Lindeberg distributed as no. 11 in Herb. Rub. Scand. (Fasc. 1) may have been a shade form of his no. 12. They came from the same locality and were gathered in the same year, though a month later. Lindeberg wrote on the label of no. 12: 'Cum priori, apud nos saepe commutato, in paroecia Bro Bahusiae multis locis.' But, as we have seen, Watson (1946) thought them distinct and renamed no. 11 *R. broensis*. Unfortunately the south of England bramble which Watson identified with Lindeberg's no. 11 is in our judgement a markedly different species. It is plentiful about Milford, near Godalming, in Surrey and we propose to call it *R. milfordensis*.

DESCRIPTIONS

Rubus septentrionalis W. C. R. Wats., J. Ecol., 33: 338 (1946) (*R. confinis* Lindeb., non P. J. Mueller)

The following is Lindeberg's original description of *R. confinis*, printed on the labels of his specimens (Herb. Rub. Scand., Fasc. 1, no. 12), which are dated mid-July 1882:

'Turio inferne obtusangulus sursum acutangulus passimque sulcatus subpruinosis et patenter pilosis, aculeis numerosis (10-20 in interfolio) validis compressis inaequalibus rectis reclinatis et curvatis armatus. Folia quinatopedata l. raro digitata petiolo ad max. partem plano cum petiolulo terminali elongato aculeis falcatis valde armato, foliola parva coriacea omnia petiolulata, supra laete viridia nitida parce pilosa subtus pallide viridia pubescentia l. superiora cinereo- et canescente-tomentosa, terminale pro longitudine latum ovatum ellipticum l. obovatum abrupte acuminatum sursum biserratum basi rotundatum l. leviter cordatum. Rami floriferi parum extensi villosi aculeis mediocribus sparsis reclinatis et subfalcatis foliisque ternatis vestiti, foliola

subtus pallide viridia pubescentia et villosa, terminale obovatum apicem versus grosse biserratum. Inflorescentia pauper aculeis longioribus firmis pl. m. subulatis et curvatis uberius armata tomentoso-villosa glandulis villo obtectis inferne foliosa interrupta ramulis 1-3-pollicaribus racemigeris l. 1-3-floris, superne, aphylla racemosa pedunculis patentibus semi-pollicaribus aequalis l., ramulis inferiorib. parum longiorib. 2-3-floris, decrescens. Bractee satis evolutae pedunculum vulgo superantes. Flores mediocres petalis obovato-orbicularibus albis staminibusque stylos bis superantibus. Sepala mucronata in flore et fructu laxa patentia.'

The following English description is the result of personal observation:

Stem angled, furrowed, dull purple, clothed with spreading hair, pruinose or subpruinose. Prickles strong with triangular bases, more or less patent, clothed like the stem with spreading hair, varying in length, some being considerably longer than the width of the stem, often crowded but unevenly disposed.

Leaves quinate, pedate or digitate, thinly strigose above, softly hairy beneath, with even but compound serrations. Terminal leaflet broadly ovate or roundish obovate with an abrupt acuminate point and an indented or nearly entire base, 2-3 times as long as its petiolule. Petiole armed with falcate prickles. Stipules linear and fringed with sessile and minutely stalked glands.

Flowering branch clothed with spreading hair like the stem, though more densely, and becoming felted above; armed with strong, declining prickles which are sometimes bunched or in pairs; with ternate leaves below giving place to simple leaves above, which are like those of the stem in texture and colour.

Panicle cylindrical with strongly ascending, three-flowered peduncles below and spreading one- to two-flowered peduncles above. Bracts broad and conspicuous.

Sepals aculeolate at the base, patent. Petals obovate, white or faintly pink. Stamens white, much longer than the green styles. Carpels glabrous. Receptacle pilose.

LECTOTYPUS: Bro, Bahusia, Sweden, July 1882, C. J. Lindeberg and J. L. Johansson, distributed as *R. confinis* n. sp. by C. J. Lindeberg, Herb. Rub. Scand., Fasc. 1, no. 12 (One of the two sheets in **MANCH** with this number has been selected as the lectotype and renumbered 12A)

Exsiccata from the following vice-counties have been examined: 9, 43, 87, 88, 95-7, 103-8, 110. Some of the specimens determined were for private collectors, others are in **BM**, **CGE**, **E**, **MANCH**. Most of the records are for Scotland, but the plant has also been recorded for England and Wales and the two specimens I have seen from south of the border are listed below with those in my own herbarium:

Branksome Park, GR 40/0.9, Dorset, v.c. 9, 1-15/7/1895, W. M. Rogers, Set of British Rubi, no. 111, **MANCH**

Bank near Builth Road station, GR 32/0.5, Radnor, v.c. 43, 11/8/1898, A. Ley, **MANCH**

Loch Lubnaig, GR 27/5.1, W. Perth, v.c. 87, 2/8/1966, E. S. Edees

Callander, GR 27/6.0, W. Perth, v.c. 87, 2/8/1966, E.S.E.

Methven, GR 27/9.2, Mid Perth, v.c. 88, 22/7/1966, E.S.E.

Findhorn, GR 38/05.62, Elgin, v.c. 95, 24/7/1966, E.S.E.

Forres, GR 28/99.56, Elgin, v.c. 95, 24/7/1966, E.S.E.
 Lossiemouth, GR 38/2.6, Elgin, v.c. 95, 28/7/1966, E.S.E.
 Nairn, GR 28/9.4, Easternness, v.c. 96, 27/7/1966, E.S.E.
 Tain, GR 28/7.8, E. Ross, v.c. 106, 10/8/1897, W. A. Shoolbred
 Achadhantuir, GR 29/08.24, W. Sutherland, v.c. 108, 30/7/1958, E.S.E.
 Achmelvich, GR 29/07.24, W. Sutherland, v.c. 108, 30/7/1958, E.S.E.
 Loch Boisdale, GR 08/7.1, Outer Hebrides, v.c. 110, 23/8/1939, J. W. Heslop-Harrison

***Rubus milfordensis* E. S. Edees, sp. nov.**

R. broensis W. C. R. Wats., J. Ecol., **33**: 338 (1946), pro parte

Turio alte arcuatus, angulatus, viridis vel castaneus, glabrescens, aculeis plerumque ad angulos dispositis, e basi valida declinatis.

Folia quinata, digitata, superne leviter strigosa, subtus molliter pubescentia, serrulata. Foliola plana et late disposita. Foliolum terminale oblongo-obovatum, acuminatum, basi emarginatum, petiolulo proprio triplo longius. Foliola infima breviter pedicellata. Petiolus aculeis falcatis armatus. Stipulae lineares, glandulosae.

Ramus florifer pubescens aculeis validis reclinatis falcatisque armatus. Inflorescentia basi laxa, foliis ternatis et ramulis ascendentibus multiflorisque, ad apicem densior foliis simplicibus bracteisque instructa.

Flores magni patentisque, 3–4 cm diametro. Sepala albo-marginata, pubescentia, laxa reflexa. Petala lata, obovata, cuneata, usque ad 2 cm longa, rosea, interdum emarginata. Stamina alba stylos virides multo superantia. Carpella glabra.

Stem high-arching, angled, green or chestnut brown, glabrescent. Prickles for the most part confined to the angles, declining from a strong base.

Leaves quinate, digitate, thinly strigose above, pubescent beneath, finely toothed. Leaflets flat and well spaced. Terminal leaflet oblong-obovate with an acuminate point and emarginate base, three times as long as its petiolule. Basal leaflets shortly stalked. Petiole armed with falcate prickles. Stipules linear and fringed with glands.

Flowering branch pubescent with strong declining and falcate prickles. Panicle lax below with ascending, many-flowered peduncles subtended by ternate leaves, more compact above with simple leaves and bracts.

Flowers large, opening widely, 3–4 cm diameter. Sepals loosely reflexed, white-edged, pubescent. Petals broad, obovate, tapering to the base and up to 2 cm long, pink, often emarginate. Stamens long, white. Styles green. Carpels glabrous.

HOLOTYPE: Crowthorne, GR 41/8.6, Berks, v.c. 22, 8/7/1936, W. C. R. Watson as *R. broensis* (herb. E. S. Edees no. 13099)

In addition to the type the following exsiccata have been examined in my own herbarium and in CGE:

Newlands Corner, Guildford, GR 51/0.4, Surrey, v.c. 17, 5/7/1950, W. H. Mills, CGE

Private road to Cutt Mill on north side of pond south of Puttenham Common, GR 41/91.45, Surrey, v.c. 17, 2/8/1957, E. S. Edees

- Witley Common, Milford, GR 41/9.4, Surrey, v.c. 17, 28/7/1957, E.S.E.
 Albury Heath, Guildford, GR 51/0.4, Surrey, v.c. 17, 6/7/1963, B. A. Miles as
R. confertiflorus
 Royal Common, Milford, GR 41/9.4, Surrey, v.c. 17, 1942, W. H. Mills, CGE
 By A30 east of Hartford Bridge, GR 41/7.5, N. Hants., v.c. 12, 6/7/1953, W. H.
 Mills as *R. confertiflorus*, CGE
 Yateley Common, GR 41/84.59, N. Hants., v.c. 12, 27/7/1968, E.S.E.
 Roadside foot of Mare Hill, Witley, GR 41/9.4, Surrey, v.c. 17, 9/7/1952, W. H.
 Mills as *R. confertiflorus*, CGE
 Shackleford Common, GR 41/9.4, Surrey, v.c. 17, 1942, W. H. Mills as *R.*
rhombifolius var. *megastachys*, CGE
 Rodborough Hill near Witley, GR 41/926.409, Surrey, v.c. 17, 1962, B. A. Miles
 as *R. confertiflorus*, CGE
 Puttenham Common, GR 41/9.4, Surrey, v.c. 17, 1892, E. S. Marshall and E. F.
 Linton as *R. holerythros*, Set of British Rubi, no. 77, CGE

R. milfordensis has a very different appearance from *R. septentrionalis* in the field, though general differences of size, colour, texture and habit, which arrest the eye, are not easily expressed in words. In detail, the stem of *R. milfordensis* lacks the white, spreading hairs of *R. septentrionalis* and the prickles are less crowded and usually declining. The terminal leaflet is larger, often nearly oval and with a less abrupt point. The panicle produces more and larger flowers and the petals are pink. *R. milfordensis* is a local species, frequent within fifteen miles of Guildford, but not yet certainly known further afield.

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REFERENCES

- ROGERS, W. M. (1900). *Handbook of British Rubi*. London.
 WATSON, W. C. R. (1946). *Rubus* appendix to Check-List of British Vascular Plants. *J. Ecol.*, 33:
 337-344.
 WATSON, W. C. R. (1958). *Handbook of the Rubi of Great Britain and Ireland*. Cambridge.

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Distribution of *Vallisneria spiralis* L. in the River Lea Navigation Canal (Essex-Hertfordshire border)

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ABSTRACT

The occurrence of *Vallisneria spiralis* in the River Lea Navigation Canal has been surveyed. It was found that the plant was the dominant hydrophyte over lengths of the canal, and its distribution in relation to water-flow, water temperature and other factors is discussed.

This alien plant is generally distributed in warmer parts of the world, and in Europe is found as far north as the Midi in France. It has previously been recorded as naturalised in West Gloucestershire, Worcestershire, South-west Yorkshire and South Lancashire (Tutin 1962). An earlier record than ours for the River Lea Navigation Canal was made by M. R. Gilson at Wormley, Hertfordshire, (GR 52/373.054) on October 9th 1961. However this report was not followed up and we knew of the record only after our survey had been completed.

Vallisneria was found by us in the canal at Cheshunt, Hertfordshire, (GR 52/369.024) in 1970 (Dony 1971), and the full extent of its distribution was surveyed from August to October 1971 (Fig. 1). The survey was carried out from the tow-path, this lying on the west side of the canal north of Enfield Lock (GR 51/375.996) and on the east side of the canal below this level. Access to the other bank was restricted over most of its length. The results show that the plant occurs over a length of 5½ miles and is found in three vice-counties: North Essex (v.c. 19), Hertfordshire (v.c. 20) and Middlesex (v.c. 21).

It was found that *Vallisneria* has the centre of its distribution around Cheshunt, and is the dominant hydrophyte over lengths of the canal, forming dense clumps each of several hundred plants. Throughout this part of the canal water-flow is negligible, the bottom is composed of mud and gravel, and the water is shallow, *Vallisneria* not occurring in water more than three feet deep. This results in a central channel free of *Vallisneria*, and above and below each lock there is also a length of canal (usually 100-150 yards) uncolonised by *Vallisneria* due to the greater depth and increased water-flow in the vicinity of the locks. North of Aqueduct Lock (GR 52/372.044) only two small clumps of *Vallisneria* were found, both near Wormley, although the habitat appears to be suitable as far north as Nazeing (GR 52/373.067). North of this level the canal bottom becomes

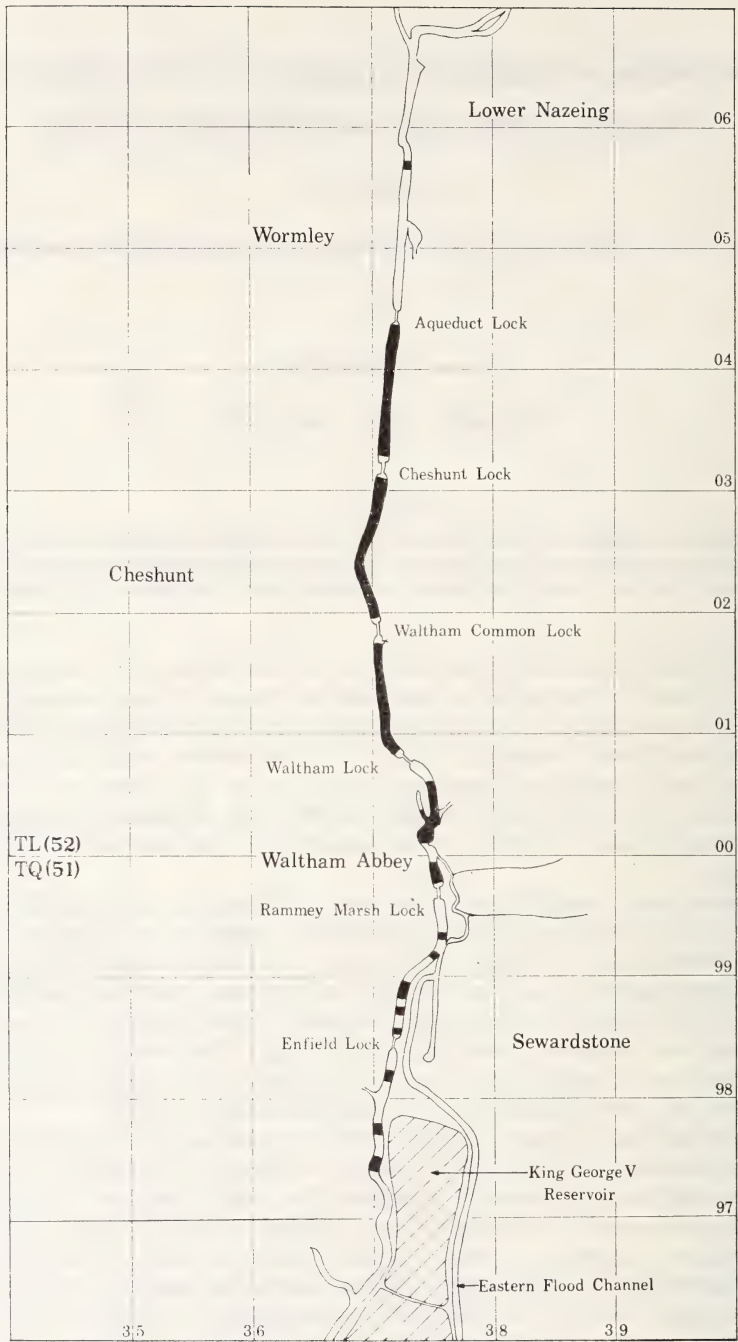


FIGURE 1. Distribution of Tape Grass, *Vallisneria spiralis*, in the River Lea Navigation Canal.

muddier, with a heavy covering of leaf litter, and this appears to be an unsuitable substratum for *Vallisneria*, which has only been found in areas with a gravelly bottom. South of Waltham Abbey (GR 52/376.005) the clumps of plants become more isolated, and south of Enfield Lock very few plants are found. Enfield Lock marks the northern limit of industrial use of the canal, and below this level the water is much deeper to facilitate access by barges. The few plants found are on shallow gravelly shelves, and are very stunted, presumably due to the industrial pollution. However even these plants flower freely. An extension of the range further south seems to be impossible, the deep polluted water providing an unsuitable habitat.

In this country *Vallisneria* is normally believed to be associated with areas of warm water. Thus Savidge *et alii* (1963) record that the Hollinwood Canal in South Lancashire had a short length warmed by condensed steam from the Mersey Mill, and here *Vallisneria* used to grow profusely, so that it had to be repeatedly dragged out. They also record it as abundant in the Reddish Canal in 1940 opposite Broadstone Mill, where the plant was found in water with a temperature as high as 29°C. Also in South Lancashire in 1956 the plant was recorded in hot water coming from an air compressor at Howe Bridge Colliery, Atherton. However the only heated effluent discharged into the Lea Navigation Canal between Hertford and Enfield is the Rye House Generating Station's cooling water at Dobbs Weir Pool, Hoddesdon, (GR 52/384.082) about 3½ miles north of the most northerly record for *Vallisneria* in the canal. The Rye House Station is a peak load station, so that the discharge from it is intermittent, and the effect on water temperature is negligible. Quarterly water temperatures (Table 1) are available for Rye House, Dobbs Weir and Broxbourne, respectively 3½, 2½ and ¾ of a mile north of the *Vallisneria* at Wormley. Between Wormley and Enfield, where flow is negligible, the water temperature is similar to that at Rye House. Thus in this area *Vallisneria* does not seem to require warm water.

For most other sites for *Vallisneria* details of water-flow are not available.

TABLE 1. QUARTERLY WATER TEMPERATURES IN
THE LEA NAVIGATION CANAL FOR 1970-1971

		Rye House	Dobbs Weir	Broxbourne
July-Sept. 1970	Min.	13.0°C	18.0°C	17.2°C
	Av.	16.9°C	21.5°C	20.6°C
	Max.	21.0°C	23.0°C	23.0°C
Oct.-Dec. 1970	Min.	0.0°C	7.0°C	4.0°C
	Av.	6.7°C	10.0°C	10.6°C
	Max.	10.0°C	13.5°C	17.0°C
Jan.-March 1971	Min.	5.0°C	5.0°C	7.0°C
	Av.	8.0°C	8.0°C	9.4°C
	Max.	10.5°C	12.0°C	13.0°C
April-June 1971	Min.	9.0°C	12.0°C	10.0°C
	Av.	13.9°C	18.1°C	15.0°C
	Max.	17.0°C	22.0°C	19.0°C

However Amphlett & Rea (1909) record the plant in Worcestershire in the stagnant water of Knapp's Brickyard, Northwick, in 1868. This is in agreement with the present observations, where water-flow is negligible or non-existent over the area of canal colonised by *Vallisneria*.

Periodically the Lea Navigation Canal is dredged, but this seems to have no long-term effect on the abundance of the plant, except perhaps in aiding its dispersal, large rafts of dredged-up plants drifting downstream.

The various habitat requirements outlined above limit the area of the Navigation Canal that can be colonised by *Vallisneria*, and also prevent the plant colonising the neighbouring streams, river and flood channels, all of which have connections with the Navigation Canal. *Vallisneria* has been present in the canal for at least eleven years, and is now well established, and this has made it impossible to discover the time or place of the original introduction.

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REFERENCES

- AMPHLETT, J. & REA, C. (1909). *The Botany of Worcestershire*. Birmingham.
DONY, J. G. (1971). Plant notes for 1970. *Trans. Herts. nat. Hist. Soc.*, 27: 119-120.
SAVIDGE, J. P., HEYWOOD, V. H. & GORDON, V., eds. (1963). *Travis's Flora of South Lancashire*, p. 292. Liverpool.
TUTIN, T. G. (1962). *Vallisneria*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 938-939. Cambridge.

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Festuca glauca Lam. and its var. *caesia* (Sm.) K. Richt.

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ABSTRACT

From a study of *Festuca glauca* Lam. in the Breckland, Suffolk, it is concluded that var. *caesia* (Sm.) K. Richt. is only a habitat modification resulting from unfavourable conditions.

INTRODUCTION

Following an initial study of the habitat of the grass described by Sir J. E. Smith (Sowerby & Smith 1808) as *Festuca caesia* (*F. glauca* var. *caesia* (Sm.) K. Richt.), further observations were made on the ecology of the British representatives of *Festuca glauca* Lam. and of its var. *caesia* in the only two known sites in the Breckland of West Suffolk, East Anglia. It had already been noted that var. *caesia* is scarce in some seasons and that plants of this variety become virtually indistinguishable from var. *glauca* when removed to the more fertile soil of a garden.

F. glauca and the var. *caesia* have been studied for more than 160 years. The history of the nomenclature leaves room for doubt as to their certain distinction and this is reinforced by personal study of the two plants over several seasons. This paper discusses the habitat, local climatic conditions and the behaviour of these two taxa under field and garden conditions.

Field observations have been made in the only two known localities of *F. glauca* in West Suffolk, at Foxhole Heath (GR 52/736.776) and Little Eriswell (GR 52/724.799). Hind (1889) only recorded '*F. glauca* Sm.?' at Mildenhall and at Cattawade on the tidal River Stour. The former probably referred to the Foxhole Heath site and his query was no doubt aimed at the Cattawade record, which could have been a mistake for *F. rubra* subsp. *rubra* var. *pruinosa*.

THE BRECKLAND HABITAT

The ten-year average annual rainfall for the years 1958-1968 at Elveden, West Suffolk (GR 52/824.799), is 23.32 inches whilst at Saxmundham (GR 62/368.638) in East Suffolk the average is 25.23 inches. In eight out of ten years of this period the rainfall at Elveden has been from 0.88 to 4.33 inches lower than that at Saxmundham. The soil texture in the Breckland varies from a fine to a coarse sand with a very low organic matter content and therefore it has little or no potential for moisture retention. Most of the area comprises a highly calcareous sand but there are heath areas, such as Foxhole, which are extremely acid.

On the Breckland sands there is a critical period for plant growth which usually falls somewhere between 20th May and 10th June when ten days without rain, more particularly if it follows or is accompanied by drying winds, will cause severe drought conditions. It is a period when barley is making its second root

growth and, if affected by this drought, the crop is permanently stunted in growth with consequent loss in yield. This is also a period which can have a marked effect on the growth of certain natural members of the Breckland flora.

The topography and the variations in the growth of vegetation on Foxhole Heath are typical of several of the poorer areas which remain uncultivated in West Suffolk. Much of the higher ground at Foxhole, between 15 m and 22.5 m altitude, is largely colonised by isolated dense tufts of *Festuca ovina*. No plants of *F. glauca* have been found there but plants of var. *glauca* are seen at this altitude in the closed sward of the wide roadside verge. Below the 15m contour on the Heath var. *glauca* is found in closed sward and var. *caesia* in open sward. There is little difference in the soil status. P and K are low on the upland soils and very low in the lowland; the pH of both is about 4.5.

Proceeding to the lower ground the plant cover is at first very open with scattered plants of *Festuca ovina* and *Aira praecox*; *Thymus pulegioides*, *Senecio jacobaea* and *Anthoxanthum odoratum* then appear and this eventually leads into an open sward of *Koeleria cristata*, *Hieracium pilosella* and isolated plants of *Calluna vulgaris*. This finally becomes a closed sward of grasses and other plants. These include *Festuca ovina*, *F. rubra* subsp. *rubra*, *Agrostis tenuis*, *Koeleria cristata*, *Rumex tenuifolius*, *Galium verum* and *Teesdalia nudicaulis*. It is in this type of closed sward that *F. glauca* var. *glauca* is found. It also occurs with several of the above grasses and *Helictotrichon pratense* on the nearby roadside verge. On the verge in Lords Walk at Little Eriswell no var. *caesia* is seen and var. *glauca* is only found in a closed sward of *Festuca rubra*, *F. ovina*, *Allium vineale*, *Medicago falcata* and *M. × varia*; it is absent from the adjacent open sward of *Bromus sterilis*.

Typical var. *glauca* is always found in dense vegetation. Its leaf-length is accentuated by competition, which also results in the leaves becoming more or less erect, rather than reflexed. It is noticeably palatable to rabbits. This close association with other plants is an indication of its moisture requirements. Within the more or less closed sward there are small open areas with a sparse cover of stunted *Festuca ovina* and lichens; it is only in this habitat that var. *caesia* is found while var. *glauca* is absent.

TAXONOMY

Festuca glauca var. *caesia* is said to be distinguished by its stunted growth, with few, very narrow leaves often only 5–8 cm long, and culms which over-top the leaves by 5–25 cm. The leaves may even be as short as 1.5 cm, but they are always distinctly curved, pointing downwards or sideways. They have a distinct 'bluish-grey' hue but Breckland plants are less pruinose than the plant for so long grown in European gardens for ornamental purposes. By contrast, the leaves of var. *glauca* are mostly straight and never curved to such an extent; at Foxhole and Eriswell they are more generally a greyish-green, but occasionally bluish-green according to the degree of drought. Var. *caesia* is said to have spikelets 6 mm long and lemmas 4 mm long, compared with var. *glauca* which has spikelets 2–8 mm long and lemmas 4.5–5 mm long. Var. *caesia* is seldom found with more than 1–2(–5) culms and it is scarce or absent in some seasons. Measurements of both varieties will be discussed later.

Smith (1808) originally gave var. *caesia* specific rank as *Festuca caesia*. Lowe (1868) treated both *F. caesia* and *F. glauca* as a single variety, var. *caesia* (Sm.)

Lowe, of *F. ovina*. He commented that it was 'glaucous and altogether larger' than *F. ovina*. This is clearly a reference to *F. glauca* Lam. Hackel (1882), who saw specimens from Smith's type locality, retained both taxa under *F. ovina sensu lato* as *F. ovina* subsp. *eu-ovina* var. *glauca* (Lam.) Hackel and *F. ovina* subsp. *eu-ovina* var. *glauca* subvar. *caesia* (Sm.) Hackel. *Festuca cinerea* Vill., which predates *F. glauca*, is now being used by several Continental botanists for what is supposedly the same plant. However, *F. cinerea* differs in having pubescent spikelets, whereas typical *F. glauca* is completely glabrous.

Sir J. E. Smith spent the last 30 years of his life at Norwich and botanised with James Crowe (1750–1807) of Lakenham. In *English Botany* (Sowerby & Smith 1808) the paragraph on *F. caesia* reads as follows: 'In almost the last botanical excursion that I enjoyed with my late friend Mr Crowe, when we examined the country round Bury St Edmunds, in June 1804, along with our experienced guide Sir Thomas Cullum, we were much struck with the very glaucous aspect of this grass on the dry barren heaths north of that town. We preserved both dry and living specimens; and though the latter have been cultivated ever since in the rich moist ground at Lakenham, and have consequently grown very luxuriantly, their glaucous hue, and all the essential characters above stated, by which they may be known from *F. ovina*, t. 585 and *duriuscula*, t. 470, remain unchanged'.

Smith concluded therefore that *F. caesia* is quite distinct from *F. ovina* and *F. duriuscula* (*F. longifolia*). Specimens 132–134 of *F. caesia* in his herbarium (LINN) are from 'heaths about Bury, June 15, 1804'. Both vegetative and floral characters of this specimen are identical with those of the var. *caesia* under review. Another specimen from the same area is in K. The Linnean Society also has a specimen labelled *Festuca glauca* 'from Mr Crowe's garden from heaths near Bury 1804'. It is apparent that these two plants were under close observation at this time. Smith recorded *F. caesia* 'near and north' of Bury St Edmunds, but a search of local archives of correspondence with Sir Thomas Cullum does not reveal any information as to the precise locality. It is improbable that Smith referred to heath to the north of Ingham, as Rochefoucauld (1784) commented that the country between Ingham and Thetford 'is covered with heather in every direction as far as the eye can see'. It is unlikely that *F. glauca* or Smith's *F. caesia* would have been growing in such a habitat and Rochefoucauld also commented on the complete absence of plants other than heather, 'except in the little valleys'. On the basis of soil-type the area immediately east of Bury St Edmunds is probably ruled out and there is some doubt of the plant growing in the more fertile soils of the Fornham parishes to the north of the town. It seems likely, therefore, that Smith's plants were collected from the west and north-west, towards Risby and Cavenham, or even from the present sites in the parish of Eriswell.

CULTIVATION EXPERIMENTS

Special attention to the growth-habit and habitat of var. *caesia* was first made by the writer in 1963. At no time has this dwarf variant been observed in a closed sward where var. *glauca* is found. It is always in an open low sward, mainly comprising stunted *F. ovina*, and on rabbit runs; if it were in the closed sward it would hardly be noticed. It does not appear to flower annually, a fact that bears no relation to differences in the total annual rainfall. Throughout the period May to August, 1968, no plants were observed and yet the April to July rainfall

TABLE 1. LEAF, CULM AND INFLORESCENCE MEASUREMENTS OF *FESTUCA GLAUCA* VAR. *GLAUCA* AND VAR. *CAESIA*

	var. <i>caesia</i> Herb. Trist ex Foxhole 1964	var. <i>glauca</i> Herb. Trist ex Foxhole 1964	var. <i>caesia</i> Garden transplant ex Foxhole 1964, recorded 1968	var. <i>glauca</i> ex Foxhole 1968	var. <i>glauca</i> ex Eriswell 1968	var. <i>glauca</i> Garden transplant ex Eriswell 1964, recorded 1968
Leaf-length cm	1.5-7.0	8-22	18-38	10-21	5-12	15-31
Leaf-width mm	0.2-0.4	0.3-0.8	0.5-0.7	0.4-0.7	0.3-0.5	0.5-1.0
Culm-length cm	8.0-25.0	21-24	28-30	8-14	7-18	44-54
Panicle-length cm	1.3-2.8	6.0-7.5	4.5-5.0	4.0-6.0	4.5-7.5	5.5-6.0
Spikelet-length mm	5.0-6.0	5.5-6.0	5.5-6.5	5.0-7.0	5.8-7.0	6.5-7.0
Lower glume-length mm	1.4-2.0	2.8-3.0	1.5-2.0	2.0-3.0	2.5-3.0	2.4-3.0
Upper glume-length mm	2.5-2.8	3.3-4.0	3.0-3.3	3.0-3.5	3.5-4.0	3.0-3.8
Lemma-length mm	3.5-4.5	4.5-5.0	3.8-4.0	4.0-4.8	5.0-5.4	4.0-5.0
Lemma-awn-length mm	0.3-1.2	0.5-1.8	0.8-1.6	0.4-1.7	0.5-2.5	0.5-1.3

amounted to 9.41 inches compared with 8.42 inches in 1964, when many plants were seen. The comparison, year by year, of the rainfall of individual summer months does not give the answer. The most likely explanation is that some of the seeds of var. *glauca* (which are distributed by birds and wind) fall on open or semi-open ground where the sandy soil and inadequate ground-cover give rise to soil moisture conditions which are inadequate for young seedling grasses, and this causes stunting or even death. In addition it is more than likely that late germination occasionally clashes with the critical drought period referred to above.

In order to pursue this theory, in 1964 very small plants of var. *caesia* from Foxhole Heath were introduced into a garden at Bury St Edmunds where organic matter, P, K and pH are higher. In the following year the length and number of leaves increased considerably and the plants have continued to thrive in a form which bears no resemblance to their original condition. The leaf-width and -length, together with the length and number of culms, are significantly greater than those of the original plants (Table 1).

The leaf-length of the 1964 herbarium specimen referred to in this Table is typical of var. *caesia*, ranging from 1.5–7.0 cm. The few leaves are distinctly curved and bluish-grey in colour. By contrast, when such plants are moved to the more fertile soil of a garden, many more leaves are produced forming a dense tuft and ranging in length from 18–38 cm. The leaves are no longer strongly curved and the colour changes from bluish-grey to a greyish-green. The influence of the more fertile soil is also shown by the 1968 measurements of material of var. *glauca* transplanted from Eriswell in 1964, leaf-length ranging from 15–31 cm. This is considerably greater than that of material collected at Eriswell in 1968 from a sandy roadside bank.

The leaves of both varieties are flat or tightly inrolled. Those of var. *caesia* in the wild are the narrower, varying in width from 0.2–0.4 mm but overlapping the range of var. *glauca*. As is evident from Table 1 the leaves of both varieties become wider in cultivation; to what extent this is the result of unrolling has not been investigated.

Culm-length is variable. The majority of var. *caesia* culms are short but always several times the height of the leaves, whilst in var. *glauca* the culm is frequently about equal to the leaves in the wild and more than twice as high under garden conditions. It is clear therefore that the vegetative growth of transplants of both var. *caesia* and var. *glauca* is considerably influenced by increased fertility.

The panicles of the 1964 wild-collected material of var. *caesia* varied from 1.3–2.8 cm in length. They were distinctly smaller than cultivated material (4.5–5.0 cm) and both cultivated and wild-collected material of var. *glauca* (4.0–7.5 cm). The spikelets varied in length from 5.0–7.0 mm and this is reasonably consistent in all the material. The lower glumes of wild and cultivated material of var. *caesia* ranged from 1.4–2.0 mm in length; they differed only slightly from those of var. *glauca* (2.0–3.0 mm). The measurements of the upper glumes, lemma and lemma-awn varied little in the two varieties.

CONCLUSIONS

As a result of this study I consider that *F. glauca* var. *caesia* is merely a depauperate form of *F. glauca* growing under adverse soil conditions. It does not therefore merit varietal status.

The following description of *F. glauca* is based on specimens from Suffolk and includes material referred in the past to var. *caesia*.

An erect, densely tufted, glaucous and glabrous perennial, 8–50 cm. Leaves erect or strongly curved, especially in semi-open habitats, flat or tightly inrolled, usually 0.4–1.0 mm wide, but 0.2–0.4 mm in stunted plants, abruptly pointed, smooth and less pruinose than most continental plants, frequently greyish-green, bluish-green in stunted plants. Sheaths smooth, open to the base, pale brown, becoming darker at the base. Ligule minute. Culms erect or spreading, relatively stout, with 2 nodes both near the base. Panicle 2–8 cm, narrowly oblong to ovate in outline, more or less crowded, greyish-green; rhachis slightly flexuous. Spikelets 5–7 mm; florets 5–7, separating at maturity. Glumes persistent, acuminate, the tips and upper margins hyaline; lower glume 2–3 mm; upper glume 3–4 mm. Lemma rounded on the back, 3.5–5.5 mm, mucronate or narrowed into a fine 0.3–2.5 mm awn. Palea about as long as the lemma. Anthers 2–3 mm.

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REFERENCES

- HACKEL, E. (1882). *Monographia Festucarum europaeorum*, pp. 94–5. Kassel & Berlin.
HIND, W. M. (1889). *The Flora of Suffolk*, p. 406. London.
LOWE, E. J. (1868). *A Natural History of British Grasses*, p. 155. London.
ROCHEFOUCAULD, F. DE LA (1784). *A Frenchman in England*, p. 210. Cambridge.
SOWERBY, J. & SMITH, J. E. (1808). *English Botany*, 27: Plate 1917. London.

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Weeds of a Leicester garden

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ABSTRACT

The main changes over 25 years in the weed-flora of a Leicester garden are described briefly and attention is drawn to the behaviour of certain species, very local in the wild, which become aggressive weeds in the garden. A list of the 95 species occurring as weeds is given.

Observations have been made on the weeds in a garden in Knighton, Leicester (GR 43/601.012) since 1947 and the changes that have occurred in these 25 years seem of sufficient interest to justify putting them on record.

The garden, of approximately half a hectare, surrounds a farmhouse, the oldest parts of which are probably 16th century. The land was farmed until about 1930, when most of it was sold for building; two fields of pasture remained to the north of the house, and a strip to the west was used as a nursery garden until recently.

The garden can conveniently be divided into three sections:

1. The original kitchen garden and front garden and associated paths and hedge bottoms
2. The 'kitchen midden' area on the north and east side of the house
3. The new garden made from a piece of permanent pasture in 1948-1950.

These three sections differ from one another in a number of ways, not least in their weeds. It should be borne in mind that weeding has been to a certain extent discriminatory. Aggressive weeds such as *Aegopodium podagraria* have been actively discouraged, although no species has been intentionally eliminated. On the other hand, rare or interesting species have been tolerated or even mildly encouraged. A short description of the three sections follows.

SECTION 1

This is about $\frac{2}{5}$ of the total area. It slopes gently towards the south and in the lower part has a rather light alluvial soil with water-worn pebbles; higher up the soil is derived from the boulder clay but has been worked for many years and, particularly in the kitchen garden, well manured with farmyard manure. The supply of manure ceased about ten years ago.

The striking feature of this area was the abundance of *Chenopodium polyspermum*, *C. rubrum* and, in one patch, *C. ficifolium*. These rapidly diminished after manuring ceased and *C. polyspermum* and *C. ficifolium* have not been seen for several years now; in 1971 two small plants of *C. rubrum* were all that could be found. *Atriplex hastata*, *A. patula* and *Polygonum convolvulus*, formerly common, particularly among rows of *Pisum sativum*, have also greatly diminished.

Agropyron repens and *Aegopodium podagraria* are restricted to different parts of section 1 and, in spite of determined efforts to get rid of them, both manually and by the use of herbicides, occupy approximately the same area now as in 1947. The abundance of the former has been greatly reduced by digging out and by treatment with dalapon but the latter is much as it was. It is perhaps remarkable that neither has succeeded in invading new territory.

Myosotis arvensis, *Papaver lecoqii*, *Geranium robertianum* and *Bromus sterilis* are each confined to its own small area where, though never abundant, they have maintained fairly steady populations for 25 years. *Sonchus arvensis* and *Campanula rapunculoides* likewise each occur in one small patch and are more or less unchanged in area and abundance. *Convolvulus arvensis*, formerly a widespread weed in the kitchen garden, has been greatly reduced by 2,4D and is no longer a serious weed. *Oxalis corniculata*, which was abundant in 1948 and for some years after, has now disappeared, though no exceptional measures were taken against it.

Corydalis lutea, *Linaria purpurea*, *Papaver atlanticum* and *Tanacetum parthenium* (*Chrysanthemum parthenium*) are obviously relics from earlier fashions in garden plants; they are not very aggressive and are reasonably ornamental, so they are left in odd corners.

Epilobium adenocaulon, now the commonest willowherb in all parts of the garden, first appeared about 1965 although known in Leicester for many years. *Senecio squalidus* apparently arrived in Leicester about 1944 and appeared in the garden about 1957; it has not spread widely but is confined to an old wall and cinder path. Two recent arrivals, not deliberately introduced, are *Arctium minus* and *Dipsacus fullonum*, one seedling of each of which was noticed simultaneously in 1968. Both were left undisturbed and flowered in 1969. *Dipsacus*, when in flower, was visited by numerous solitary bees by day and by moths at night. No visits by honey-bees or butterflies were noticed. The fruiting plant was visited regularly by goldfinches throughout the winter months, but abundant seedlings appeared in 1970, the one most distant from the parent plant being about 10m away. About half the seedlings flowered in 1971 and the remainder will in 1972, and presumably from now on some plants will be flowering every year. This is in marked contrast to *Linum bienne*, which was accidentally introduced about 20 years ago and which has maintained itself in a small patch ever since. This has so far proved strictly biennial, so a year in which all the plants flower is followed by one in which none flowers.

Arctium was more effectively dispersed than *Dipsacus*, the most distant seedling found being 40 m from the parent. Only one out of the numerous seedlings which germinated in 1970 flowered in 1971. Most, if not all, of the remainder seem to be going to flower in 1972. The seeds of these two species most probably arrived in mud on shoes, as the original seedlings appeared in a place where shoes are scraped. They are likely to have come from Shangton, south-east of Leicester.

The species of *Veronica* show some features of interest. *V. persica* and *V. agrestis* flower, fruit and germinate throughout the year, except in very severe winters. The latter is here the commoner, which is the reverse of the usual situation. *V. arvensis* has a more limited season of growth and usually, if not always, produces only one crop a year; it is confined to two small areas in the garden and seems unable to spread. *V. hederifolia*, as is well known, is strictly seasonal, though very abundant; the seeds germinate only after being chilled in winter.

SECTION 2

The soil here is light, ashy and well-drained, with bones, broken pottery and clay pipes, horseshoes and other rusting agricultural remains. This section occupies about $\frac{1}{3}$ of the total area, is level and is raised somewhat above the surrounding land, being held up in part by a low brick wall. The number of species of weeds is comparatively small, much of the area being covered by *Chelidonium*, *Circaea* and *Stachys sylvatica* with the addition of *Meconopsis cambrica*, which was formerly cultivated. *Solanum nigrum* and *Urtica urens*, though not abundant, are perhaps the two most characteristic weeds in this area. In the shade on the east side of the house is a large patch of *Ranunculus auricomus*, which is unlikely to have been deliberately introduced and may be a relic from the distant past.

Other possible relics from former woodland which survived until recently in the vicinity, though not actually in the garden, are *Allium ursinum*, *Melica uniflora* and *Mercurialis perennis*. A change in the use of the adjacent field has brought about the extinction of *Primula veris* within the last ten years.

SECTION 3

The original turf of this area consisted of a mixture of grasses, with such characteristic meadow species as *Hordeum secalinum*, *Alopecurus pratensis*, *Anthoxanthum odoratum*, *Cynosurus cristatus* and *Trisetum flavescens*, together with *Ranunculus acris*, *R. bulbosus*, *R. repens* and *Leucanthemum*. The lawn still has a similar composition, though *R. acris* has succumbed to mowing and, unlike the other three species, has failed to establish as a weed.

This section occupies about $\frac{2}{3}$ of the total area and the cultivated part consists of a fairly steep, south-facing slope with a level area at the top. The latter is used as vegetable garden and is separated from the former by a hedge of *Berberis* $\times$ *stenophylla*, which shelters the bank on the north. The soil has a high humus-content and good texture, but boulder clay is not far below the surface and water often stands in depressions in winter for several days on end. The first year after the removal of the turf from the bank *Ranunculus arvensis* appeared in some quantity; it diminished fairly rapidly in succeeding years and has not now been seen for some time. This plant is very rare in Leicestershire now, and the most likely source seems to have been from the germination of previously buried seeds. *Anagallis arvensis* perhaps had a similar source, but this just manages to maintain itself.

The adjoining field was levelled and sown with a grass mixture and this sowing was undoubtedly the source of *Bromus lepidus*, *Lolium perenne* and, perhaps, *Agrostis gigantea*. The worst weeds in this part of the garden are of my own introduction: *Agropyron donianum* from Inchmadamph, given me by Mr J. E. Raven, *Hierochloa odorata* from Lough Neagh, given me by Dr C. E. Hubbard, and *Lapsana intermedia* from Totternhoe, the gift of Mr E. Milne-Redhead. I had not expected extreme aggressiveness from species as local as these are, but I have entirely failed in my struggles to control them. *A. donianum* and *L. intermedia* reproduce freely by seed while *H. odorata* is, fortunately, completely sterile but advances inexorably by innumerable slender rhizomes. Its mass of long leaves swamps plants such as *Iris sibirica* and even things as large as *Potentilla fruticosa* survive with difficulty. *A. donianum* has established itself successfully in a hedge and in an unmown strip of lawn.

Crataegus, *Fraxinus*, *Sambucus* and, to a lesser extent, *Ilex* occur regularly,

and the first two frequently, as seedlings and would not take long to establish a scrub, if left.

Oxalis europaea, *O. exilis* and *Poa nemoralis* were introduced with various plants bought from nurseries; the two former died out after a few years, but the latter continues on a small scale.

It is perhaps worth recording that *Poa annua* occurs as three genetically distinct variants, a perennial one in wet places, a tall annual with little anthocyanin in fertile soils, and a dwarf annual with much anthocyanin on infertile clay which is not excessively wet.

Rumex sanguineus grows in moderate quantity in hedge-bottoms but does not invade cultivated ground. In 1971 a single seedling of var. *sanguineus*, with the characteristic purplish-red veins and thick leaves, appeared. I know of no possible source of introduction, so it is probable that this plant has arisen from var. *viridis*, either as a new mutation or through the segregation of a double recessive.

The following is a list of the species recorded as weeds, with numbers indicating the sections of the garden in which they occur. An asterisk indicates that they have now disappeared. Of the 95 species no fewer than 75% have Linnaean names, though some of these are no longer placed in their original genera and others have been raised from varietal rank. The corresponding percentage for the British flora as a whole (excluding microspecies) is about 62%.

<i>Achillea millefolium</i> L.	1	<i>C. rubrum</i> L.	1
<i>Aegopodium podagraria</i> L.	1	<i>Circaea lutetiana</i> L.	2
<i>Aethusa cynapium</i> L.	1	<i>Cirsium arvense</i> (L.) Scop.	3
<i>Agropyron donianum</i> F. B. White	3	<i>C. vulgare</i> (Savi) Ten.	1, 2, 3
<i>A. repens</i> (L.) Beauv.	1	<i>Convolvulus arvensis</i> L.	1
<i>Agrostis gigantea</i> Roth	3	<i>Corydalis lutea</i> (L.) DC.	1
<i>A. stolonifera</i> L.	3	<i>Crepis vesicaria</i> subsp. <i>haenseleri</i>	
<i>Alliaria petiolata</i> (Bieb.) Cavara		(DC.) P. D. Sell	1, 3
& Grande	1, 2	<i>Dipsacus fullonum</i> L.	1
<i>Anagallis arvensis</i> L.	3	<i>Epilobium adenocaulon</i> Hausskn.	1, 2, 3
<i>Anthriscus sylvestris</i> (L.) Hoffm.	1	<i>E. angustifolium</i> L.	1, 3
<i>Arabidopsis thaliana</i> (L.) Heynh.	1	<i>E. hirsutum</i> L.	3
<i>Arctium minus</i> Bernh.	1	<i>E. montanum</i> L.	1, 2, 3
<i>Atriplex hastata</i> L.	1	<i>E. roseum</i> Schreber	1, 3
<i>A. patula</i> L.	1, 3	<i>Erophila verna</i> (L.) Chevall.	1
<i>Brachypodium sylvaticum</i>		<i>Euphorbia peplus</i> L.	1, 2
(Hudson) Beauv.	3	<i>Festuca rubra</i> L.	3
<i>Bromus lepidus</i> Holmb.	3	<i>Galium aparine</i> L.	1, 3
<i>B. ramosus</i> Hudson	3	<i>Geranium robertianum</i> L.	1
<i>B. sterilis</i> L.	1	<i>Geum urbanum</i> L.	1
<i>Calystegia silvatica</i> (Kit.) Griseb.	1, 2	<i>Glechoma hederacea</i> L.	3
<i>Campanula rapunculoides</i> L.	1	<i>Hierochloe odorata</i> (L.) Beauv.	3
<i>Capsella bursa-pastoris</i> (L.) Medic.	3	<i>Holcus lanatus</i> L.	3
<i>Cardamine hirsuta</i> L.	3	<i>Lamium album</i> L.	1, 2, 3
<i>Chelidonium majus</i> L.	2	<i>L. purpureum</i> L.	1, 2, 3
<i>Chenopodium album</i> L.	1, 3	<i>Lapsana intermedia</i> Bieb.	3
* <i>C. ficifolium</i> Sm.	1	<i>Leucanthemum vulgare</i> Lam.	3
* <i>C. polyspermum</i> L.	1	<i>Linaria purpurea</i> (L.) Miller	1

<i>Lolium perenne</i> L.	3	<i>R. repens</i> L.	1, 3
<i>Matricaria matricarioides</i> (Less.) Porter	1	<i>Rumex crispus</i> L.	3
<i>Myosotis arvensis</i> (L.) Hill	1	<i>R. obtusifolius</i> L.	3
* <i>Oxalis corniculata</i> L.	1	<i>R. sanguineus</i> L.	3
* <i>O. europaea</i> Jordan	3	<i>Senecio squalidus</i> L.	1
* <i>O. exilis</i> A. Cunn.	3	<i>S. vulgaris</i> L.	1, 2, 3
<i>Papaver atlanticum</i> (Ball) Cosson	1	<i>Solanum dulcamara</i> L.	1
<i>P. lecoqii</i> Lamotte	1	<i>S. nigrum</i> L.	2, 3
<i>Plantago major</i> L.	1	<i>Sonchus arvensis</i> L.	1
<i>Poa annua</i> L.	1, 2, 3	<i>S. asper</i> (L.) Hill	1, 2, 3
<i>P. nemoralis</i> L.	3	<i>S. oleraceus</i> L.	1, 2, 3
<i>P. pratensis</i> L.	2, 3	<i>Stachys sylvatica</i> L.	2
<i>P. trivialis</i> L.	1, 2, 3	<i>Tanacetum parthenium</i> (L.) Schultz Bip.	1
<i>Polygonum arenastrum</i> Boreau	1, 3	<i>Taraxacum officinale</i> Weber	1, 2, 3
<i>P. aviculare</i> L.	1, 3	<i>Tragopogon pratensis</i> L.	3
<i>P. convolvulus</i> L.	3	<i>Urtica dioica</i> L.	1, 3
<i>P. persicaria</i> L.	1	<i>U. urens</i> L.	2
<i>Prunella vulgaris</i> L.	3	<i>Veronica agrestis</i> L.	1
* <i>Ranunculus arvensis</i> L.	3	<i>V. arvensis</i> L.	1, 3
<i>R. bulbosus</i> L.	3	<i>V. hederifolia</i> L.	1, 2, 3
		<i>V. persica</i> Poiret	1, 2, 3
		<i>V. serpyllifolia</i> L.	3

(Accepted May 1972)

Short Notes

252/1. HIPPOPHAE RHAMNOIDES L.—Attractiveness to birds.

The note on *Hippophae rhamnoides* L. near Torosay Castle, Mull (Groves 1971) dismisses as insignificant occasional reports of *Corvus corone cornix* (hooded crow) feeding on the fruit, apparently agreeing with a notion widely held that birds are not normally attracted to feed upon this fruit, or that “these are never eaten by birds” (Perry 1961).

While suckering plays a major part in the natural propagation of sea-buckthorn, the choice and therefore dispersal of its fruit by birds depends upon the extent of the availability of alternative winter fruits, especially in severe weather. Since, at a symposium on sand-dune flora in the Botany Section of the British Association Liverpool meeting in 1953, we were told that Nottingham University studies of sea-buckthorn ecology on the Lincolnshire coast found no birds associated with its distribution, the Merseyside Naturalists’ Association has made several field-studies and published notes on birds feeding on its fruits in south Lancashire. Our observations refer only to the south Lancashire coast, and thus we are not able to say to what extent they are true in Mull and Lincolnshire. Perhaps the situation in these latter places is different, although Pearson & Rogers (1962) commented upon the general significance of bird-dispersal and that several colonies in Britain may be bird-sown.

Birds observed to feed on *Hippophae* fruits in south Lancashire include: *Turdus pilaris* (fieldfare), *T. merula* (blackbird), *T. iliacus* (redwing), *T. viscivorus* (mistlethrush), *Pyrrhula pyrrhula* (bullfinch), *Bombycilla garrulus* (waxwing), over-wintering *Sylvia atricapilla* (blackcap warbler) and coastal migrating *T. torquatus* (ring-ouzel) (Hardy 1956–1971).

Hippophae is not included in the original plant-list of introductions to the south-west Lancashire dunes (Stanistreet 1818). Until it was introduced, c 1883 according to the pre-war local Weld-Blundell estate agent (now deceased), the so-called ‘Ainsdale’ Sand Dunes National Nature Reserve at Freshfield was almost barren of winter cover and largely deserted by passerine birds in winter, except for birds on passage. As I said in a paper read to the Liverpool Botanical Society in October 1932 (Green 1932), on studies of local plants distributed by birds, observations at the site had failed to find anything attractive to birds. *Hippophae* has since increased to what is now the largest colony on the west coast of Britain and a resident winter population of passerines (up to 300 fieldfares) uses the thickets from Formby to Ainsdale (chiefly Freshfield) for roosting and food. This is probably because of the lack of any alternative suitable food supply after the fruits of *Rubus caesius* have been consumed in the autumn, chiefly by Turdidae and *Columba palumbus* (wood-pigeon). *Hippophae* is then the only abundant orange-red ‘berry’ crop over a vast coastal and inland area, so that the normal reluctance of Turdidae to take orange-yellow fruits (e.g. *Ilex*, *Sorbus*, etc.) when red alternatives are at hand does not operate. In frosty winters fieldfares strip the Freshfield thickets by December or January, after which they feed inland but return to the *Hippophae* to roost. *Hippophae* fruits were found in the droppings of blackcaps ringed when feeding on the bushes. Some Turdidae (e.g. redwings and fieldfares) were observed to eject (cough-up) less digestible skin and ‘stone’, as thrushes sometimes do with berries.

REFERENCES

- GREEN, H. E. (1932). Liverpool Botanical Society. *NWest. Nat.*, 7: 338–339.
 GROVES, E. W. (1971). *Hippophae rhamnoides* L.—On the Isle of Mull, Argyllshire. *Watsonia*, 8: 396.

- HARDY, E. (1956-1971). *Northwestern Bird Report for 1954-55* (1956), *for 1957-58* (1958), *for 1960-62* (1962), *for 1963-66* (1966), *for 1966-71* (1971). Liverpool.
- PEARSON, M. C. & ROGERS, J. A. (1962). *Hippophae rhamnoides* L., in *Biological Flora of the British Isles*. *J. Ecol.*, **50**: 501-513.
- PERRY, F. (1961). *Shrubs and Trees*, p. 101. London.
- STANISTREET, W. (1818). *Minute Book of Proceedings of Commissioners, River Alt Drainage Board, 1776-1790*. Liverpool.

E. HARDY

TANNIN IN *EPHEDRA GERARDIANA* WALLICH AND ITS VAR. *SIKKIMENSIS* STAPF

According to Skene (1934) the Gnetaceae lack tannins, but I have recently obtained evidence contrary to this. Biosynthesis of tannin in *Ephedra gerardiana* var. *gerardiana* and var. *sikkimensis* is indicated by the presence of tannin-containing cells in the stem tissue.

Addition of solutions of ferric chloride and ferrous sulphate to transverse sections of the stem results in the development of a black precipitate in scattered cells of the cortex and medulla. The reaction can sometimes occur in other tissues. Confirmation of the tannin reaction is obtained by the use of amyl nitrite reagent which gives a brown precipitate in these cells.

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REFERENCE

- SKENE, M. (1934). Chapter 8, in NIERENSTEIN, M., ed. *The Botany of the Tannins*, p. 258. London.

J. H. FIELD

ECOLOGY AND PHENOLOGY OF ANNUAL COMMUNITIES ON INTERTIDAL MUDS

In the course of collecting data for the East Yorkshire Flora project a normally inaccessible locality in the tidal reaches of the River Ouse, Howdendyke Island (GR 44/753.260), was visited and extensive areas of annual communities were observed over a growing season. The communities are dominated by species of *Polygonum* (mainly *P. hydropiper* and *P. lapathifolium*, but also *P. nodosum*), *Rorippa islandica*, *Atriplex hastata* and *Bidens cernua*, all species typical of periodically-inundated habitats. They cover approximately 150 m² on the extending western end of Howdendyke Island on thin tidal muds, between 2 and 6 cm deep, overlying alluvial sands.

In situ observations with a set of Tide Tables (Kettlewell 1970) confirmed that a predicted high tide of 18 feet at Goole Docks is sufficient to flood the whole island to a depth of about six inches, and that a predicted tide of 16 feet will inundate the lower western end of the island. Extrapolations from field observations enabled the minimum frequency of diurnal flooding of the annual communities throughout the year to be predicted. It appears that these communities are flooded on no less than 155 days per annum for periods of up to two hours in every 24. This inundation is probably the major ecological influence on the habitat. Tidal scour is minimal on the western and

northern sides of the island and only the surface 0.5 cm of the mud is affected. The tidal waters which cover the island were shown to have a low chlorine content when compared with those flooding normal salt marshes (Chapman 1964), and the range of 45–180 ppm obtained from selected high tides at Boothferry Bridge (GR 44/733.263) is probably typical for the higher tidal reaches of the Ouse and other rivers.

Clearly the frequency of inundation must affect the germination and growth of the annual species, and observations on permanent quadrats were made on the time of germination of the two common *Polygonum* species. Germination was found to take place mainly in periods free from flooding and rarely during a period of high tides. The earliest germinations recorded were in the period April 10–19th when *P. lapathifolium* was the main germinator. Subsequent observations revealed that numbers increased only slightly in the inundation period of April 20–25th and that few seedlings were dislodged by tidal scour. *P. hydropiper* germinated mainly between May 9th and May 19th, and by the June 5–17th period the ratio of germinating plants (with cotyledons) to plants with at least two pairs of foliage leaves was 19:1. The evidence suggests that *P. hydropiper* has a later field germination period than *P. lapathifolium* and that this partly reflects the experimental observations of Timson (1965), who recorded a slower response in the former due to a phase of after-ripening. The absence of germination prior to April is contrary to the findings of Salisbury (1970) with *P. hydropiper* under experimental conditions.

ACKNOWLEDGMENT

The author is grateful to members of the Goole Natural History Society, particularly Mr & Mrs R. Hunt, for transport to the island.

REFERENCES

- CHAPMAN, V. (1964). *Coastal Vegetation*. Oxford.
 KETTLEWELL, T. E. (1970). *Tide tables for Goole, Hull and Whitby*. Hull.
 SALISBURY, E. (1970). The pioneer vegetation of exposed muds and its biological features. *Phil. Trans. R. Soc., Ser. B*, **259**: 207–254.
 TIMSON, J. (1965). Germination in *Polygonum*. *New Phytol.*, **64**: 179–186.

D.W. SHIMWELL

RECENT AND FOSSIL RECORDS FOR CLUB-MOSSES ON THE DERBYSHIRE LIMESTONE

Three species of the family Lycopodiaceae, *Huperzia selago*, *Lycopodium clavatum* and *Diphasium alpinum*, approach the southern limits of their British distribution in Derbyshire, whilst *Selaginella selaginoides* is now regarded as extinct in the county. *D. alpinum* has apparently recently extended its range and many of the modern records from the limestone region for all the species (Clapham 1969) are in different localities from those noted by Linton (1903). Several palynological studies by the author of humus podsollic soils on the limestone plateau have provided interesting data on the existence of these species in historical times.

Huperzia selago

Literature records: three localities were recorded by Linton in the period 1854–85 and three different ones by Clapham.

Spore records: in all localities humus accumulation in the soil was scanty and spore-preservation poor; the Brook Bottom site (GR 43/14.76) revealed spores only in the top 2.5 cm of the profile.

Lycopodium clavatum

Literature records: there are two records in the Buxton area in Linton but none in Clapham; there are several other modern sites recorded in the latter work and I have found additional ones.

Spore records: Present localities: Deep Dale, Ashford, (GR 43/15.68) on an area of undisturbed heathland alongside an enclosure road, with spores recorded to a depth of 7.5 cm; Kenslow Pits (GR 43/18.61), with spores found in the surface horizon only. Presumed extinct localities: spores were recorded in some abundance by Dimbleby (1962) on Parwich Moor (GR 43/17.57) in horizons dated as post-Bronze Age (from 500 B.C.); Hawkslow Plantation (GR 43/16.57), where spores were present at a depth of between 7 and 17 cm; Bradwell Moor (GR 43/14.79), with spores at depths between 16 and 33 cm.

Diphasium alpinum

Literature records: there are no records from the limestone in Linton.

Spore records: examination of the three known sites, Kenslow Pits, Minninglow Gravel Pit (GR 43/20.57) and Green Lane Pits (GR 43/16.62), revealed spores only on the surface moss carpet and top 1 cm of soil.

Selaginella selaginoides

Literature records: there is one probably erroneous record in Linton (as '*L. selaginoides*') on Kinderscout in 1805.

Spore records: spores were found in a profile from Calling Low Moor (GR 43/18.64) in horizons dated from palynological and related documentary evidence to the early 18th century.

Such evidence from spores in the podsolic soils on the limestone plateau of Derbyshire suggests that *L. clavatum* is definitely native to the region, having existed there at least since the start of the Iron Age (500 B.C.), and that it now occurs mainly on localised patches of relict heath. The absence of pollen of *D. alpinum* in the lower horizons of the three profiles and the absence of early literature records indicates that it is a recent coloniser of clay-pit spoil. *H. selago* occurs only in sites where spore preservation is poor and it is thus not possible to draw conclusions on the status of the plant. There is, however, no evidence to indicate that the spores of either *D. alpinum* or *H. selago* are broken down more rapidly than those of *L. clavatum*. *Selaginella selaginoides* occurred on the limestone until the early 18th century in a marsh vegetation dominated by *Carex* spp. and *Sphagnum* spp. It is now extinct in this locality but it could still occur in suitable habitats.

REFERENCES

- CLAPHAM, A. R. (1969). *Flora of Derbyshire*. Derby.
 DIMBLEBY, G. W. (1962). Pollen analysis. Appendix II, in LOMAS, J. A Bronze Age site at Parwich. *Derbys. arch. J.*, 82: 91-99.
 LINTON, W. R. (1903). *Flora of Derbyshire*. London.

D. W. SHIMWELL

Plant Records

Records for publication must be submitted in the form shown below to the appropriate vice-county Recorder (*Watsonia*, 8: 435–447 (1971)), and *not* to the Editors.

Records are arranged in the order given in the *List of British Vascular Plants* by J. E. Dandy (1958) and in his subsequent revision (*Watsonia*, 7: 157–178 (1969)) but *Taraxacum* is arranged according to Richards (*Watsonia*, 9, Suppl. (1972)). With the exception of collectors' initials, herbarium abbreviations are those used in *British Herbaria* by D. H. Kent (1958).

The following signs are used:

- * before the record: to indicate a new vice-county record.
- † before the species number: to indicate that the plant is not a native species of the British Isles.
- † before the record: to indicate a species which, though native in some parts of the British Isles, is not so in the locality recorded.
- [] enclosing a previously published record: to indicate that the record should be deleted.

†2/2. SELAGINELLA KRAUSSIANA (Kunze) A. Braun *9, Dorset: Brownsea Island, GR 40/02.87. Near old glasshouses. S. W. Limborn, 1965. (*Proc. Dorset nat. Hist. archaeol. Soc.*, 91: 134 (1970)).

4/10. EQUISETUM TELMATEIA Ehrh. 29, Cambs.: Roswell Pit, Ely, GR 52/55.80. P. H. L. Cook, CGE. 1st record for over 80 years.

21/3. DRYOPTERIS ABBREVIATA (DC.) Newm. *67, S. Northumberland: near Walltown, GR 35/68.66. Basaltic scree, 800 ft. 1967. Hazely Crag, GR 35/63.53. 1200 ft. 1968. 2nd record. *68, Cheviot: Hen Hole, GR 36/88.20. Porphyritic scree, 1750 ft. 1965. Carey Burn, GR 36/96.25. Porphyritic scree, 800 ft. 1970. 2nd record. All four records leg. G. A. & M. Swan, herb. G.A.S., det. J. A. Crabbe.

22/1. POLYSTICHUM SETIFERUM (Forsk.) Woyнар 29, Cambs.: south side of Bourn Church, GR 52/32.56. A. J. Worland, 1969, field record. 2nd record. 67, S. Northumberland: Morwick Banks, north of Acklington Station, GR 46/21.03. Wooded bank above river. G. A. & M. Swan, 1971, herb. G.A.S. 1st record for 60 years. 68, Cheviot: near Horncliffe, GR 36/93.50. By stream in wooded ravine. G. A. & M. Swan, 1971, herb. G.A.S. 2nd record, 1st for over 100 years.

25/1/1. POLYPODIUM VULGARE L. *sensu stricto* *80, Roxburgh: Hindhope Hill, GR 36/76.11. G. A. Swan, 1960, BM, det. A. C. Jermy.

25/1/2. POLYPODIUM AUSTRALE Fée *H6, Waterford: Lismore, GR 92/9.6. R. P. Vowell, 1882, DBN, det. D. Synnott.

25/1/3. POLYPODIUM INTERJECTUM Shivas *80, Roxburgh: Stichill Linn, GR 36/70.37. Damp shady rocks, 250 ft. R. W. M. Corner, 1971, BM, det. A. C. Jermy.

37/1. TROLLIUS EUROPAEUS L. 78, Peebles: Talla Linns, 4 miles south-west of Tweedsmuir, GR 36/13.20. R. Hunter, 1970, field record. 1st post-1930 record.

46/22/s. RANUNCULUS AQUATILIS subsp. SPHAEROSPERMUS (Bois. & Blanche) Clapham 8, S. Wilts: stream between Berwick St Leonard and Fonthill Bishop, GR 31/93.31. L. F. Stearn, 1969, herb. L.F.S. 2nd record.

49/1. *AQUILEGIA VULGARIS* L. **79**, Selkirk: Longhope Burn, Ettrick, GR 36/18.09. Rock-ledge by burn. R. W. M. Corner, 1971, **herb. R.W.M.C.** 1st post-1930 record.

77/1. *CAKILE MARITIMA* Scop. **H6**, Waterford: Tramore beach, GR 02/50.63. Sandy shore. I. K. Ferguson, 1964, **TCD**. 1st post-1930 record.

88/5. *COCHLEARIA DANICA* L. †**29**, Cambs.: north of Bridge Lane, Wimblington, GR 52/41.93. Railway ballast. J. O. Mountford & G. M. B. Smith, 1969, field record. 2nd record.

†96/1. *ARMORACIA RUSTICANA* Gaertn., Mey. & Scherb. ***106**, E. Ross: north-east of Strathpeffer, GR 28/4.5. Roadside verges, sterile. U. K. Duncan, 1971, **herb. U.K.D.**

†113/10. *VIOLA CORNUTA* L. ***68**, Cheviot: roadside near Lemmington Hall, GR 46/12.11. Hedge-bank, persisted several years. G. A. & M. Swan, 1970, **herb. G.A.S.**

156/1. *ATRIPLEX LITTORALIS* L. ***H6**, Waterford: Dunmore East, GR 02/5.6. H. J. Killick, 1971, field record.

212/6. *POTENTILLA ARGENTEA* L. **68**, Cheviot: disused airfield near Milfield, GR 36/95.33. G. A. & M. Swan, 1971, **herb. G.A.S.** 2nd record and 1st post-1930.

220/1. *ALCHEMILLA ALPINA* L. ***57**, Derby (*Watsonia*, **9**: 139–140 (1972)).

225/8/d. *ROSA DUMETORUM* Thuill. ***80**, Roxburgh: Bowmont Water, GR 36/8.2. F. H. Perring, 1963, field record, det. I. M. Vaughan.

†226/s. *PRUNUS SEROTINA* Ehrh. ***9**, Dorset: Sares Wood, Affpuddle, GR 30/80.92. Well-established in oak wood. H. J. M. Bowen, 1970, field record. ***28**, W. Norfolk: Ringmere, Thetford, GR 52/90.87. E. L. Swann, 1971, **herb. E.L.S.**

254/1. *EPILOBIUM HIRSUTUM* L. ***78**, Peebles: Crookston, 3 miles south of Peebles, GR 36/2.3. D. J. McCosh, 1969, field record. Probably 1st record.

254/2. *EPILOBIUM PARVIFLORUM* Schreb. **78**, Peebles: 2½ miles south-west of West Linton, GR 36/12.43. Ditch in wet meadow. D. J. McCosh, 1971, field record. 1st post-1930 record.

†254/k. *EPILOBIUM KOMAROVIANUM* Léveillé ***57**, Derby: Ashbourne, GR 43/17.46. Weed in damp garden path, 400 ft. K. Hollick, 1971, **DBY**, det. D. McClintock. Known since 1905. Ladmanlow, near Buxton, GR 43/04.71. Corporation tip, 1400 ft. K. Hollick, 1949, field record. 2nd record, probably now extinct. Both records wrongly cited in *Flora of Derbyshire* (Clapham 1969) as *E. nerteroides* (*Watsonia*, **9**: 141 (1972)).

†266/1. *CORNUS MAS* L. ***28**, W. Norfolk: wood at Hargham, GR 52/02.91. Abundant and regenerating naturally. A. L. Bull, 1967, field record.

†279/1. *CORIANDRUM SATIVUM* L. ***57**, Derby: Windmill Tip, Great Hucklow, GR 43/16.77. M. C. Hewitt, 1965, field record, det. Mrs R. C. L. Howitt.

†311/2. *HERACLEUM MANTEGAZZIANUM* Somm. & Levier *72, Dumfries: bank of R. Nith, Cowhill, GR 25/95.82. On alluvium by river. H. Milne-Redhead, 1959, field record. Mud by R. Nith, Dumfries, GR 25/96.76. O. M. Stewart, 1971, field record. 2nd record.

†320/20. *POLYGONUM SACHALINENSE* F. Schmidt *57, Derby: Bakewell tip, GR 43/20.68. M. C. Hewitt, 1960, field record.

343/4/d. *SALIX DECIPIENS* Hoffm. *78, Peebles: Walkerburn, GR 36/37.37. Roadside, 400 ft. R. C. L. Howitt, 1971, field record.

343/7. *SALIX DAPHNOIDES* Vill. *78, Peebles: by R. Tweed, Walkerburn, GR 36/36.36. R. C. L. Howitt, 1971, field record. Probably 1st record.

350/1. *ANDROMEDA POLIFOLIA* L. *80, Roxburgh: Burrowstown Moss, west of Newcastleton, GR 35/42.87. Peat bog, 1075 ft. R. W. M. Corner, 1972, **herb. R.W.M.C.** 1st post-1930 record.

†379/2. *VINCA MAJOR* L. *106, E. Ross: Kilmuir, Black Isle, GR 28/6.4. Rocky bank near village. U. K. Duncan, 1942, **herb. U.K.D.**

385/1. *GENTIANELLA CAMPESTRIS* (L.) Börner *78, Peebles: 6 miles north of Innerleithen, GR 36/31.44. Grassland by Williamslee Burn, 950 ft. D. J. McCosh, 1969, field record. 1st post-1930 record.

388/1. *POLEMONIUM CAERULEUM* L. *†106, E. Ross: near Blackwater, by Strathpeffer, GR 28/4.5. Rough grass between road and river. U. K. Duncan & W. J. Sutherland, 1967, **E.**

†393/1. *BORAGO OFFICINALIS* L. *106, E. Ross: north-east of Barbaraville, GR 28/7.7. Tip on small cliff above sea-shore. U. K. Duncan, 1971, **E.**

400/3. *MYOSOTIS STOLONIFERA* Guy *78, Peebles: Portmore Loch, north of Eddleston, GR 36/26.49. Wet flush on grassy slope, 1100 ft. D. J. McCosh, 1968, **E.** conf. I. Hedge. Possibly most northerly British locality.

411/1. *HYOSCYAMUS NIGER* L. *42, Brecon:Pencelli, GR 32/09.24. Garden weed, 500 ft. Mrs G. Batten, 1971, **NMW.** 1st definite record.

†413/4. *SOLANUM SARRACHOIDES* Sendtn. *57, Derby: Ashbourne, GR 43/17.46. Garden weed. K. Hollick, 1971, **DBY.**

420/3. *LINARIA REPENS* (L.) Mill. *80, Roxburgh: Steele Road Junction, Newcastleton, GR 35/52.93. Disused railway track, 600 ft. Lady E. Tennant, 1971, field record.

†428/1. *ERINUS ALPINUS* L. *106, E. Ross: Culbookie Loch, Black Isle, GR 28/6.5. Forestry track, flowers white. A. Currie & U. K. Duncan, 1971, field record.

430/20. *VERONICA HEDERIFOLIA* L. *sensu stricto* *48, Merioneth: Ceilwart, Llanaber, GR 23/60.17. Side of track, growing with *V. sublobata*. P. M. Benoit, 1970, field record. 2nd record.

430/s. *VERONICA SUBLOBATA* M. Fischer *48, Merioneth: near Rhydmain, Dolgellau, GR 23/80.22. Shady, humus-rich side of track, 150 ft. P. M. Benoit, 1969, field record. 1st record, 2nd already published. (*Watsonia*, 9: 156 (1972)).

435/1/10. *EUPHRASIA CURTA* (Fr.) Wettst. var. *OSTENFELDII* Pugsl. *106, E. Ross: Tarbat Ness, near Portmahomack, GR 28/9.8. Bare ground by lighthouse. U. K. Duncan, 1971, **herb. U.K.D.**, det. P. F. Yeo. 1st definite record.

439/1. *LATHRAEA SQUAMARIA* L. *78, Peebles: Between Innerleithen and Peebles by Glenormiston, GR 36/3.3. J. B. Lyall, 1880 (*Guide to Peebles*, 2nd ed., p. 118).

441/4. *PINGUICULA GRANDIFLORA* Lam. *†57, Derby: Grindsbrook, near Edale, GR 43/11.87. Dripping rocks, 900 ft. C. B. Waite, since c 1960, field record.

†445/3 × 5. *MENTHA* × *GENTILIS* L. 78, Peebles: Walkerburn, GR 36/36.36. R. C. L. Howitt, 1971, field record, det. R. M. Harley. 2nd record and 1st post-1930 record.

445/6 × 7. *MENTHA* × *NILIACA* Juss. ex Jacq. *78, Peebles: by Lyne, West Linton, GR 36/14.51. Streamside, 750 ft. D. J. McCosh, 1969, field record, det. R. M. Harley.

447/1. *ORIGANUM VULGARE* L. 78, Peebles: $\frac{3}{4}$ mile north of West Linton, GR 36/14.52. Cliffs of Lyne Water, 800 ft. A. McG. Stirling, 1971, field record. 1st post-1930 record.

462/2. *LAMIUM MOLUCCCELLIFOLIUM* Fr. *78, Peebles: Traquair, GR 36/32.34. Weed in turnip field. D. J. McCosh, 1968, field record. 1st definite record.

469/1. *SCUTELLARIA GALERICULATA* L. *78, Peebles: Cappercleuch, St Mary's Loch, GR 36/24.22. Marsh by loch, 800ft. D. J. McCosh, 1967, field record.

470/4. *TEUCRIUM SCORODONIA* L. 29, Cambs.: Whittlesey station, GR 52/28.96. J. O. Mountford, 1970, **CGE**. 2nd and only extant record.

†475/11. *CAMPANULA MEDIUM* L. *57, Derby: Shirebrook, GR 43/51.66. Railway cutting. M. C. Hewitt, 1970, field record.

487/1. *SAMBUCUS EBULUS* L. 80, Roxburgh: Upper Chatto, Morebattle, GR 36/76.17. Streamside, 650ft. Lady E. Tennant, 1969, field record. 1st post-1930 record.

†503/1. *GALINSOGA PARVIFLORA* Cav. *29, Cambs.: west of Gamlingay, GR 52/22.51. Arable field. S. Richardson, 1969, field record.

†518/2. *SOLIDAGO CANADENSIS* L. *73, Kirkcudbright: Southwick Merse, GR 25/92.56. Edge of burn. O. M. Stewart, 1971, field record.

†557/3. *CICERBITA MACROPHYLLA* (Willd.) Wallr. *72, Dumfries: Castle Loch, Lochmaben, GR 35/08.81. Clearing in scrub. M. E. R. Martin, 1971, field record.

558/1/42. *HIERACIUM SHOOLBREDII* E. S. Marshall *97, Westernness: Beinn na h-Uamha, Morvern, GR 17/67.53. E. F. Greenwood, 1971, **LIV**, det. J. N. Mills & P. D. Sell.

558/1/127. *HIERACIUM EUPREPES* F. J. Hanb. *97, Westernness: Beinn na h-Uamha, GR 17/67.53. E. F. Greenwood, 1971, **LIV**, det. P. D. Sell & C. West.

558/1/134. *HIERACIUM VENNICONTIUM* Pugsl. *97, Westernness: near Kilmory, Ardnamurchan, GR 17/57.70. Limestone cliffs. E. F. Greenwood, 1971, **LIV**, det. J. N. Mills & P. D. Sell.

558/1/163. *HIERACIUM STRUMOSUM* (W. R. Linton) A. Ley *101, Kintyre: Ronachan, near Clachan, GR 16/7.5. O. M. Stewart, 1971, **E**, det. C. West.

558/2/1. *PILOSELLA OFFICINARUM* C. H. & F. W. Schultz subsp. *CONCINNATA* (F. J. Hanb.) Sell & C. West *73, Kirkcudbright: near West Maryfield, New Abbey, GR 25/96.66. O. M. Stewart, 1970, **E**, det. C. West. Subsp. *NIGRESCENS* (Fr.) Sell & C. West *73, Kirkcudbright: Southernness golf course, GR 25/97.54. O. M. Stewart, 1970, **E**, det. C. West. Subsp. *TRICHOCARPA* (Naegeli & Peter) Sell & C. West *73, Kirkcudbright: Southernness golf course, GR 25/97.54. O. M. Stewart, 1970, **E**, det. C. West.

560/3. *TARAXACUM LACISTOPHYLLUM* (Dahlst.) Raunk. *69, Westmorland: Hazelslack, near Arnside, GR 34/47.78. Limestone meadow. V. Gordon, 1971, **herb. V.G.**, det. A. J. Richards.

560/4. *TARAXACUM RUBICUNDUM* (Dahlst.) Dahlst. *69, Westmorland: Arnside Park, GR 34/44.76. Limestone crags. V. Gordon, 1954, **herb. V.G.**, det. A. J. Richards.

560/6. *TARAXACUM SILESIAECUM* Dahlst. ex Hagl. *69, Westmorland: Hazelslack, near Arnside, GR 34/47.78. Limestone meadow. V. Gordon, 1971, **herb. V.G.**, det. A. J. Richards.

560/12. *TARAXACUM LAETUM* (Dahlst.) Dahlst. *75, Ayrshire: dune south of Irvine harbour, GR 26/30.37. A. G. Kenneth, 1971, **herb. A.G.K.**, det. A. J. Richards.

560/16. *TARAXACUM FULVIFORME* Dahlst. *75, Ayrshire: dune south of Irvine harbour, GR 26/30.37. A. G. Kenneth, 1971, **herb. A.G.K.**, det. A. J. Richards.

560/81. *TARAXACUM CROCEIFLORUM* Dahlst. *75, Ayrshire: Dreghorn, GR 26/35.38. Roadside. A. G. Kenneth, 1971, **herb. A.G.K.**, det. A. J. Richards.

560/105. *TARAXACUM LONGISQUAMEUM* H. Lindb. *69, Westmorland: Mill Lane, Appleby, GR 35/69.16. P. R. Hope & A. Little, 1971, **LIV**, det. A. J. Richards.

560/115. *TARAXACUM HAMATIFORME* Dahlst. *69, Westmorland: Mill Lane, Appleby, GR 35/69.16. P. R. Hope & A. Little, 1971, **LIV**, det. A. J. Richards.

560/116. *TARAXACUM MARKLUNDII* Palmgr. *75, Ayrshire: south of Irvine harbour, GR 26/31.37. Sand workings. A. G. Kenneth, 1971, **herb. A.G.K.**, det. A. J. Richards.

560/120. *TARAXACUM FASCIATUM* Dahlst. *69, Westmorland: Mill Lane, Appleby, GR 35/69.16. P. R. Hope & A. Little, 1971, **LIV**, det. A. J. Richards.

560/o. *TARAXACUM OBSCURANS* (Dahlst.) Hagl. (Section *Erythrosperma*) *45, Pembroke: 3.5km west of Marloes, GR 12/75.09. Short cliff turf. T. A. W. Davies, 1970, **OXF, NMW**, det. A. J. Richards. New to Britain.

594/1. *FRITILLARIA MELEAGRIS* L. *†41, Glamorgan: Llandough, Cardiff. Woodland, naturalised for many years. G. Ellis, NMW. (*Nature Wales*, 13: 42 (1972)).

†606/4. *LUZULA LUZULOIDES* (Lam.) Dandy & Wilmott *78, Peebles: Rachan, Broughton, GR 36/12.34. Shady grassland. D. J. McCosh, 1970, E, det. C. W. Muirhead.

†620/1. *CROCOSMIA* × *CROCOSMIFLORA* (Lemoine) N.E.Br. *57, Derby: Barlow, GR 43/35.74. Tip, 500ft. M. C. Hewitt, post-1960, field record.

†647/1. *CALLA PALUSTRIS* L. *57, Derby: Allestree park lake, GR 43/34.40. H. Lucking, 1970, DBY.

652/4. *SPARGANIUM MINIMUM* Wallr. 67, S. Northumberland: Rayburn Lake, 2 miles north of Netherwitton, GR 45/11.92. Jenkins Burn, GR 35/78.69. Both records G. A. & M. Swan, 1971, herb. G.A.S., det. J. E. Dandy & A. Melderis. 1st and 2nd definite records of fruiting material.

654/3. *ERIPHORUM LATIFOLIUM* Hoppe 78, Peebles: Boddingsill reservoir, West Linton, GR 36/13.55. Grassy flush on western edge. D. J. McCosh, 1965, field record. 1st definite record this century.

656/4. *ELEOCHARIS MULTICAULIS* (Sm.) Sm. *78, Peebles: 2½ miles north-east of Dolphinton, GR 36/12.48. Basic marshy meadows. A. McG. Stirling, 1971, field record. 1st definite record.

663/47. *CAREX ACUTA* L. *106, E. Ross: streamside in 'Park' behind 'Spa House', GR 28/48.58. M. Mullin, 1967, BM, det. A. C. Jermy.

663/64. *CAREX MARITIMA* Gunn. *69b, Furness: Humphrey Head, GR 34/3.7. E. J. Harling, 1971, BM, det. A. C. Jermy.

663/69. *CAREX ELONGATA* L. *H40, Derry: north-west corner of Lough Neagh near Toome, GR 15/1.4. Swamp-margin. J. Harron, 1971, herb. J.H.

669/3. *GLYCERIA DECLINATA* Bréb. *78, Peebles: edge of Eddleston Water, GR 36/24.47. D. J. McCosh, 1971, field record. Probably 1st record.

670/3. *FESTUCA GIGANTEA* (L.) Vill. *78, Peebles: Traquair, GR 36/33.34. 1832, BM, ex herb. Campbell & Shuttleworth. The only record.

676/12. *POA SUBCAERULEA* Sm. *79, Selkirk: west end of Alemoor Loch, GR 36/38.14. Damp grassland, 900ft. R. W. M. Corner, 1970, BM, det. A. Melderis. *80, Roxburgh: Bowmont Water, GR 36/8.2. Gravel banks. F. H. Perring, 1963, CGE.

683/10 × 13. *BROMUS* × *PSEUDOTHOMINII* P. Smith *73, Kirkcudbright: near Kirkconnel Moss, GR 25/98.69. Grassy field. O. M. Stewart, 1971, DFS, det. C. E. Hubbard.

688/1. *HORDELYMUS EUROPAEUS* (L.) Harz *69, Westmorland: Middlebarrow Wood, Arnside, GR 34/46.77. Limestone woodland, 200ft. G. M. Kay, 1971, field record, det. P. Jepson.

†720/i. *SETARIA ITALICA* L. *57, Derby: Hady tip, Chesterfield, GR 43/39.70. M. C. Hewitt, 1969, field record, det. D. McClintock.

Book Reviews

Introduction to Biogeography. Brian Seddon. Pp. 220. Duckworth, London, 1971. Price £3.25.

This is a good introductory textbook to biogeography. It is written by a geographer, the outlook being refreshingly broad-based, with evidence and argument from both botany and zoology. Naturally, the emphasis of this book is mainly on the British Isles and Europe, though to a lesser extent North American data are also used. Understandably, considerable importance is given to the various cartographic techniques of presenting biogeographical data and a consideration of their relative merits and demerits. It is pleasing to see how frequently the distribution maps in the Atlas of the British Flora, to which the Botanical Society of the British Isles contributed so much, are used and cited. Due regard is paid to the deductions to be drawn from biogeographical evidence in cartographic form, and the correlations between the distribution of animals and plants and the factors of soil, climate, and history.

The European biogeographical elements are described on pages 36–42. It seems a pity that No 6, the Iberian Element, has a misleading name in that it includes species such as *Rubia peregrina* which, although certainly occurring in the Iberian peninsula, also extend from southern England eastwards to Greece; a different name—West Mediterranean, for instance—might be more appropriate. Not only species but vegetation-types are considered. Inevitably, the difficulty of how to describe and classify vegetation is encountered and discussed (though not resolved). The theory of vegetational convergence under unifying climatic influences is shown to be often misplaced, although it seems to the reviewer wrong to dismiss it as completely as is done on page 131. The movement of species and vegetation in time is considered both in its short-time (seasonal) and long-term (historic) effects. The evidence to be derived from relic species and refugia is discussed and this leads on to a consideration of the effects of glaciation and the interpretation of present-day distribution against the background of the fossil record.

The text does not make an attractive impression at first sight, the spacing between individual words being irregular and often too wide. The margins to the pages are, however, narrow. The numerous text-maps are often clear, but sometimes, as in the diagrams illustrating Schmid's system (5.3 and 5.4 on pages 94–95), the reduction has been too great, resulting in the wording's becoming so small as to be scarcely legible. Map 9.9 on page 162 is unclear, and there are other maps whose appearance seems less satisfactory than it might be.

I have noticed very few textual errors. The caption to the photograph on page 153 should read "9.3", not "9.4", and in the map 6.2 the solid triangle in the legend has been printed inverted.

In spite of these minor blemishes, this is a book likely to be of considerable value both to biological students and those in other disciplines wishing to obtain a clear picture of the principles of biogeography.

J. P. M. BRENNAN

British Wild Flowers. John Hutchinson. 2 vol., pp. 947 + 809 figs. David & Charles, Newton Abbott. 1972. Price £3.50 per volume.

The preface of this book states that it comprises the author's three Pelican books, *Common wild flowers*, *More common wild flowers* and *Uncommon wild flowers*, published in 1945, 1948 and 1950, to which have been added new drawings and descriptions of

more uncommon flowers, making a total of 809, the whole rearranged in systematic order. This bibliographic history understates the case, for this is in effect a completely new book, which, with Mr Lousley's *Flora of the Isles of Scilly*, clearly indicates the publishers' intention of breaking into an already crowded market. It might also have been stated that the dust wrapper design is that of the author's *British flowering plants* (1948); but perhaps they felt it wiser not to draw attention to it, as the text gives no help in identifying *Gentiana verna* or the grass in the top right hand corner; indeed grasses are excluded from this work altogether. On the other hand, the key to families is new and works well (but *Viola* does not have more than 1 style or stigma).

The usefulness of these volumes will undoubtedly prove in practice to be the excellent line drawings, which give much better value for money than the more comprehensive (and complete) sets by Roles and Ross-Craig. But to the reviewer their interest is chiefly in the occasional sights of the author's idiosyncrasies. '*Argentina anserina* (Linn.) Rydb.' appears flanked by Potentillas, and its text includes a mention of an unrelated South African tree; but the only Parsley Piert is '*Alchemilla arvensis* L.'. *Scorzonera humilis* 'in one locality in Dorset' only, *Cotula coronopifolia* and *Xanthium spinosum* are included, but not *Picris hieracioides* or *Epilobium tetragonum*. *Sorbus torminalis* is 'not wild in Britain, but planted in the southern half of England'. Only one *Potamogeton* and one *Sparganium* get a mention, but the drawing of *Saxifraga cernua* shows a plant with three flowers. Again, we are presented with the history of '*Sibthorpia australis* Hutch.'; and the systematic order is of course very different from that in 'the more general Floras . . . and other more popularly written books which have appeared since the second world war'. One may allow that it is salutary to be reminded of the strong element of tradition in conventional arrangements, but a popular introduction to standard works of reference is surely not the place for such a reminder.

R. M. BURTON

The Biology and Chemistry of the Umbelliferae. Edited by V. H. Heywood. Pp. 438. Published for the Linnean Society of London by Academic Press. 1971. Price £8.50.

Today, when the sources of information at the disposal of the biologist have become so numerous and so varied, often demanding a detailed appreciation of several widely differing disciplines each with its own jargon and complex techniques, the general systematist may perhaps be pardoned if on occasion he is plaintively heard to complain that he cannot see the wood for the trees. For this reason the Linnean Society is specially to be congratulated on the International Symposium on the *Biology and Chemistry of the Umbelliferae* arranged by Professor V. H. Heywood in September 1970. The meeting brought together workers on the family from many countries and the attitude of real mutual interest shown by all the participants, from fields as widely separated as traditional morphology and macro-molecular biochemistry was a particularly gratifying feature of the meeting. There was a real spirit of co-operation and of confidence that the pooling of resources could lead to an advance in knowledge greater than the sum total of the individual contributions. Fortunately for those not present at the meeting, this same spirit is faithfully reflected in the present volume, which provides a detailed report of the proceedings.

The papers fall naturally into three groups. The first, with contributions from Constance, Mathias, Heywood, Dawson and Rodriguez, deals with our present understanding of the family based mainly on traditional methods. The first three papers deal with the history of Umbelliferology and the state of knowledge at the generic level and above in the Old and New Worlds. The fourth paper takes a closer look at the genera and species of a very limited area—New Zealand, while the fifth paper places the family within the wider setting of the *Umbellales*. The second group, with papers by Bell, Cerceau-Larriual, Froebe, Theobald, Guyot, Heywood & Dakshini, Moore and Cauwet, takes us through a more diverse series of topics, ranging from floral biology, the

developmental morphology of the well-known umbel fruit, and cytology to the micro-morphology of the pollen as revealed by the Scanning Electron Microscope. Dr Froebe's paper on the inflorescence may come as a salutary shock to workers in other groups who are accustomed to dismiss the umbel as a very uniform structure. The third group of papers, by Hegnauer, Bohlmann, Harborne, Fairbrothers & Pickering, Molho *et al.*, Nielsen, Fairbairn and Hiller, provides an excellent insight into the biochemistry going on inside the plants. In a family in which the poisonous properties of some of the species have commanded respect at least since a well-known event in classical Greece, but which also contains plants which have delighted the palates of gourmets throughout the world, it is obvious that the biochemistry behind these properties is of more than academic interest. The papers range from wide reviews of groups of compounds in the family as a whole to a detailed consideration of the alkaloids of a single species.

It is greatly to be hoped that this meeting will lead to similar occasions and consequent publications through which other families can be placed under simultaneous intensive and extensive review. Professor Heywood and his colleagues are greatly to be congratulated on the Symposium and, along with Academic Press, on the production of a fine volume that will make the results of the meeting widely available. The book production is of the high standard that we are accustomed to expect from the Linnean Society/Academic Press partnership. Two minor points of criticism perhaps deserve attention. The intimate mixing of glazed paper with ordinary paper is distasteful when both are in use for ordinary printed pages. The glazed paper is in use elsewhere, of course, for photographs and it may be that pressing reasons of economy have suggested the procedure, which should however be given serious reconsideration before use in future publications. The book jacket is very pleasant but the same cannot be said of the title page. Perhaps the extraordinary layout of the latter represents a fine piece of modern typography; if so, there is at least one swine that does not appreciate the pearls that have been cast before him. For a substantial, well-produced book, with a limited market, the cost may not be excessive by today's regrettable standards. However, the reviewer fears that the price may speak louder and with greater eloquence than the commendatory words he has tried to use.

J. F. M. CANNON

Shoot Organization in Vascular Plants. K. J. Dormer. Pp. 240. Chapman & Hall Ltd., London. 1972. Price £4.50.

Here is a very good book! Its substance, the interpretation of selected aspects of developmental morphology within a mathematical framework, is presented as seven essays; and as the author's skill with figures is matched by his command of words, it deserves to be widely read. His predilection for deductive inference from mature structures in preference to direct observation of embryonic phases adds to the interest, but on occasion the exclusion of the more orthodox 'meristematic' approach leaves a void.

As an appetizer, we have a discussion of regeneration phenomena. Then comes 'The measurement of growth', an examination of the mathematical formulations which have been applied to the processes of growth and of the need for further sophistication. The ideas are extended in 'Cell-enlargement and cell-division'.

'The succession of parts' begins with a mathematical treatment of phyllotaxis (reference to the observations on living apices by M. & R. Snow and C. W. Wardlaw would have given balance) and concludes with a survey of heteroblastic development which, appropriately, takes account of external factors. The intrinsic elements in pattern are brought back into the limelight in 'The symmetry of the shoot', an essay which cannot fail to interest morphologists and taxonomists.

'The vascular system' is concerned not with the familiar cell types but with the design

of the primary vascular system as manifest in Angiosperms—an awesome topic for the modern anatomist but presented here with authority, though the omission from the discussion of the formative procambial phase must be judged a deficiency.

The final chapter deals with the plant's responses (both physiological and morphogenetic) to external stimuli and, as Dr Dormer doubts whether the behaviour of a plant is in any way simpler than that of an animal hunting its prey or building a nest, the botanist puts down the book in a state of elation.

F. CUSICK

A Computer-mapped Flora, a Study of the County of Warwickshire. D. A. Cadbury, J. G. Hawkes and R. C. Readett, with a section on Bryophytes by T. Laflin. Pp. 768. Published for the Birmingham Natural History Society by Academic Press. 1971. Price £10.00.

This marks an important stage in the study of the British flora, as we have here in a manner more complete than ever achieved before the phytogeography of a relatively small area. In addition to this, it shows what can be accomplished by a small team of dedicated workers who have set themselves a goal. The plan was conceived in 1949, when Good's *Geographical Index of the Dorset Flora* (1948) was adopted as a guide line. For my own part, excellent as Good's methods may have been, I found the results of his work disappointing as only 30 distribution maps were shown and, notwithstanding that 7,500 small areas were studied intensively, very few records indeed were added to the flora. Grose's *Flora of Wiltshire* (1957) I found more satisfying in its attempt to solve what had hitherto been missing in Local Floras. It deserved some mention by the authors of this present Flora with other works of this nature which they list.

The Warwickshire team decided at the outset to record plants from units of area of 100m × 100m, of which there were about 200,000 in the county. It was soon realised that the task of dealing with the records from so many units would be formidable, with the result that this was soon amended and one square kilometre was adopted as the unit. To ensure a uniform intensive survey, this was still further modified in 1955 with the selection at random of one square kilometre in each block of four (tetrad) as the basis of the survey. Work had already been done on a number of one-kilometre squares, mainly in the north and west of the county, and the records from these, even if they were not random squares, were incorporated into the system. The result is that, of the 2,450 one-kilometre squares comprising the area of the study—Watsonian vice-county 38, there are records from 613 random squares and 256 additional ones not evenly distributed within the area. The decisions which gave rise to this could be criticised on the grounds that it would have been better to have studied the whole of the area on a tetrad basis or, having adopted random squares, it would have been wise to have scrapped the work done on the other squares regardless of the disappointment to the workers who had spent so much time recording from them. Any such criticism could only stem from preconceived notions of the nature of a Local Flora. The compilers of this Flora were less concerned with the plants which happened to be in the area of their study than they were with the various habitats in which the plants were growing and the frequency of the plants within these habitats.

Recorders were asked to list all the wild plants that they could find growing in a one-kilometre square in 34 categories of habitat and 6 of frequency. Many a recorder must have hesitated as to which was the most appropriate habitat, e.g. meadow or pasture, pond or lake, in which a plant was growing and as to whether it was frequent or only locally frequent within this habitat in the square as a whole. The final result of the survey was that a total of 170,733 records of species were made in the 869 units which were surveyed. This gives the very satisfactory average of 196.4 species per sq. kilometre. The survey was indeed a thorough one, the like of which has not been achieved before. The highest total was high indeed, 323, and the lowest apparently about 150.

In the course of the survey about 110 species were added to the list for the vice-county. These included walnut, plane, acacia and norway maple, which may have been well known to Bagnall but not considered worthy of inclusion in his excellent *Flora of Warwickshire* (1891). Others are casuals, e.g. *Medicago laciniata*, *Asperula arvensis* and *Saxifraga cymbalaria*, or newcomers which have presumably come to stay in most Midland counties, e.g. *Azolla filiculoides*, *Cerastium pumilum*, *Veronica filiformis* and *Galinsoga ciliata*. Some good native species were, however, found for the first time in the county, including *Aceras anthropophorum*, *Eleocharis uniglumis* and *Hordelymus europaeus*. By contrast about 130 species known previously to have been in the county were not found during the survey. These include a number of casuals which were recorded more often for most counties in the nineteenth century than they are today; but one wonders how many of the native species presumed to have been lost could not have been found in the 65% of the area which was not surveyed. It must, however, be stressed again that the main object of the survey was not to produce a recital of the wild plants known to grow in Warwickshire.

In addition to listing the plants they found in the various categories of habitat and frequency, the recorders were asked to collect material of plants in a number of critical groups for expert determination. The interpretation of all the data so brought together presented a tremendous task, met by the authors meeting with Mr M. Clark, perhaps the most active of all the recorders, on almost every Tuesday evening during the greater part of the period of the survey. The manner in which they solved their problems will be for many readers the greatest interest they will have in the Flora. The 34 categories of habitat which were originally in eight major groups were revised and placed in nine major groups into which the minor categories were submerged. The six categories of frequency were reduced to two. This gave for each species a possibility of a combination of 18 degrees of status, 9 of which were exclusive of each other, within a unit of recording.

This much-simplified interpretation allowed various means of presentation. It could have been done by having a series of small habitat maps for each species, by which means there would have been eight maps for a ubiquitous species such as *Urtica dioica* and only one for species of very restricted habitat like the Potamogetons. Most species would have needed an intermediate number of maps. To have found one's way through such a series of maps would have been very difficult indeed. The problem was ultimately solved by having large maps 19.5 cm. $\times$ 13.5 cm. for the 718 more common species. A different symbol was chosen for each of the nine major categories of habitat and this was printed more boldly if the species were abundant in this habitat. The symbols were, if need be, superimposed one above the other and placed in the tetrad appropriate to the one-kilometre square surveyed. Some symbols are much more prominent than others, with the result that plants of roadsides and waste places could appear to be more common than they indeed are. The maps are exceedingly clear, as they are printed on a pale blue background enabling the urban areas and rivers to be shown, which is not usually the case in distribution maps of this nature.

In addition to the large maps there are smaller ones 11.5 cm $\times$ 9.4 cm of 59 less common species. On these maps presence alone is shown, but a distinction is made if the species is abundant. For these maps the vertical scale has been ingeniously reduced to make them fit more neatly on the page. Similar maps are used to show the distribution of 184 bryophyte species in the section contributed by T. Laflin. For his work Laflin used the tetrad system, managing to collect records from 438 tetrads (69% of the total number). His maps distinguish only between the presence of fruiting and non-fruiting material. This is without doubt the most thorough study yet made of the distribution of mosses and liverworts in any county.

For the larger maps there are eight overlays showing not only the usual physical features but areas of woodland, parkland etc., as well as one showing the areas which were well wooded three centuries ago. For the smaller maps four overlays are provided.

It is left to the reader to form his own conclusions from all the data so excellently displayed, and there is sufficient to provide students with material for many generations. The final result may reveal some deficiencies in the system of recording. One wonders whether such species as *Urtica dioica*, *Poa annua* and *Lolium perenne* were absent from any squares and whether they would not have been recorded for all squares if record cards had been used and not lists made. The large amount of work done by the recorders in listing the habitat categories is not lost completely but summarised in lists in which usually the 30 most common species of these habitats are shown. These are not localised, but the overlays will in many instances give some clue as to their distribution.

The maps are the most distinctive feature of the Flora since they account for 420 pages, or 54.4% of the total. What of the rest? The Flora proper occupies by contrast only 142 pages, of which 110 are devoted to flowering and other vascular plants and the rest to the bryophytes. The familiar feature of the first record is given. I am, by the way, glad to see that this is not limited to printed records. When known, the last evidence of a species in the county is also added. Apart from stations for the first records few are given, but instead there is the one-kilometre square reference for rare species and, for the species which are mapped, an analysis of the major habitat categories. The occurrence of the species in neighbouring vice-counties is also given. It seems a pity that recorders get full and detailed credit for being the first to bother to record garden throw-outs but no mention at all for recording exceedingly rare native species now known from only one or two stations, e.g. *Teesdalia nudicaulis*, *Cerastium arvense*, *Ranunculus parviflorus* and *Gymnocarpium limbospermum*. Apart from those cited in the first records no mention is made of herbarium specimens. It is surprising to see so many records of *Prunus cerasus*, *Viola tricolor* and *Juncus effusus* $\times$ *inflexus*, which one hopes are supported by some voucher material.

It would have been useful if some symbol could have been used to indicate which of the new species and the very rare ones were recorded from random squares and others which were surveyed. Similarly some indication could have been given of those records of rare species which confirm earlier records by Bagnall, such as those from Sutton Park, where it is good to know so many choice plants still survive.

The sections on *Rubus*, *Rosa*, *Ulmus*, *Salix* and *Hieracium* are all well prepared, with keys to the Warwickshire species. The county is indeed fortunate in having found workers prepared to give so much attention to these otherwise difficult groups.

In introductory chapters, G. T. Warwick deals with the Physical Background and Prof. F. W. Shotton with Geology and Soils, the latter at short length as his excellent large-scale map relates more than could be told in pages of print. The chapter by Prof. H. Thorpe on the historical geography of Warwickshire makes fascinating reading, as it contains most of the material needed to account for the changing pattern of the natural vegetation. The historical survey of Warwickshire botanists is brief, and the account of the computer-processing makes heavy reading for those not specialised in this skill. For my part I fail to see how the map on page 77 'took only 3 seconds to produce'. I would have thought its time of production should have included the operator's time in preparing the data for processing. If the data so prepared would be sufficient to produce 'x' entirely different maps then the operator's time should be divided by 'x'. But if only 'y' of the maps so produced were of any practical use then the operator's time should be divided by 'y'. One wonders at this stage whether it would have been almost as quick to produce the maps manually. If it would not have been as quick it could still have been cheaper, bearing in mind the high cost of computer apparatus and its rapid depreciation. It is not clear whether the costs of computer-processing are included in the costs of producing this Flora, which is one of the largest and certainly the most expensive Local Flora we have yet seen. If they were, what we have is exceedingly cheap; but if they were not, the exercise could well deter others having no prospect of free computer time and processing from embarking on a similar venture.

There is much that can be learned from this Flora: for many of us it will be the necessity to see clearly how the goal is to be achieved before the task is begun. It seems a pity that so much of the data collected together by the faithful hard-working team of recorders was not used in the final presentation. It is to be hoped that this will be preserved for comparison with a future survey at a time when computers may be as obsolete as penny-farthing bicycles are now.

The amount of work which has gone into the preparation of this Flora is most impressive. Much of it is summarised in a Vascular Plant Check List which many readers will consult even more than the text and maps. It lists over 1,600 taxa for which the distribution is given in v.c. 38 (Warwick) and six neighbouring vice-counties, with an analysis of the categories of habitat and frequency, as shown on the maps, for those which now occur in v.c. 38. It is a pity that some of the additional data not used for the maps could not have been shown here, even if it made the Check List longer.

We are at a turning point in the study of Local Floras. The old familiar pattern which has stood the test of time for well over a century will still have its use. An entirely satisfactory alternative has not yet emerged. We are grateful to the compilers of this Flora for their most valuable contribution in a period of inevitable change.

J. G. DONY

Scientific Writing for Graduate Students. Edited by H. Peter Woodford. Pp. x + 190. Macmillan & Co., Ltd., London. 1968. Price £4.25.

Scientific writing for graduate students, which was prepared by the United States Council of Biology Editors' Committee on Graduate Training in Scientific Writing, is a companion volume to the Council's *Style manual for biological journals*. Dr Woodford's experience as a University lecturer and journal editor convinced him that the scientific information problem could be much improved if scientists were taught the art of writing logical, clear and precise prose. Although this volume is designed to assist university tutors to plan such a course of instruction, it can profitably be read by all who contribute to the literature explosion!

The U.S. Council on Biological Sciences Information report *Information handling in the life sciences* (1970) makes two recommendations. The first is that the standard of writing in journal articles should be raised and rigorously enforced. To ensure this end courses of instruction must be provided for biologists as authors, for editors and for referees. The second recommendation is that university students should receive formal instruction in scientific communication, in oral presentation and in methods of searching the literature by traditional methods and by using the modern computer services.

Dr Woodford, who is a member of COBSI, has, in this book under review, provided an excellent tool to carry out such courses of instruction. Ph.D. students would find some useful words of wisdom in Chapter 11: the special mental preparation needed before writing a doctoral thesis. Details of format and presentation of a thesis are omitted as these are covered in a number of excellent manuals on the subject. The difference between oral and written presentation of a scientific paper are given in Chapter 13 and include some very practical advice in the art of delivery. A paper given at a meeting or a conference should endeavour to be informative, interesting and above all, concise. Dr Woodford, in a recent paper (*Improving the communication of scientific information*), urges us as members of professional societies to organise livelier and more firmly structured meetings. We are all familiar with the dull, boring paper and with the paper ruined by bad delivery. This volume naturally does not deal with methods of searching the literature; nevertheless Chapter 14 offers suggestions as to the most opportune moment for giving such instruction.

The ideal course for university students is one which, over their three years, covers both the output and the input end of the information-transfer chain. Such courses of this nature as exist are, at the moment, generally optional. As students cannot be

expected to realise the importance of such instruction in their future research career and to the scientific community, they should not be given the choice.

Our secondary services have been improved in recent years, but they will only succeed in easing the information problem when we deal as effectively with the input end of the information chain. Dr Woodford in *Scientific writing for graduate students* provides university tutors with the framework on which to organise a comprehensive course for students. It is hoped that University Board of Studies will appreciate this urgent need for such instruction. Only in this way will our future scientists be able to meet the challenge of our time—to communicate effectively to his fellow scientists and, in this age of mass media, to the public at large.

P. I. EDWARDS

Mathematical Taxonomy. N. Jardine & R. Sibson. Pp. 286. J. Wiley & Sons Ltd., London. 1971. Price £6.00.

Over the past decade, the number of publications involving numerical taxonomic studies has increased sharply, but a corresponding understanding of the theoretical background has not always been so apparent; indeed, the theory and justification has tended to become submerged beneath the assertion 'it seems to work'.

This book sets out to remedy this situation. It tidies up the terminology, regarding classification in terms of elementary set theory. Part I then goes on to consider measures of dissimilarity between populations, their meaning and appropriateness and emerges with the conclusion that the only adequate measures are those derived from information theory, at least where quantitative characters are involved.

Part II provides a critical examination of various methods of cluster analysis and reaches the not surprising conclusion that many of those which have been used are of doubtful validity. New methods based on information theory are derived and different types of cluster analysis examined. Part III is concerned with biological applications and looks at a wide range of practical aspects and utility of automatic classification, including a substantial review of relevant literature.

The book concludes with 8 appendices (a quarter of its length) including tables and computer programs; unfortunately, the program which would implement the methods described is incomplete (why include it anyway unless it is excluded from the copyright restrictions?). A short glossary seems designed more for the mathematician than the biologist—there is a definition of a chromosome, but none of an algorithm.

It is not by any means clear to whom this book is addressed. Several of the chapters in Part II will not be readily comprehended by biologists not well versed in mathematics. Yet the practice of taxonomy is in the hands of biologists; and while the authors have been at pains to point out the weaknesses of many existing methods of automatic classification, they do not demonstrate in a manner clear to a non-mathematician the ways of putting their preferred methods into practice. The only relevant example is taken from a doctorate thesis which is unlikely to be readily available for consultation.

With the exception of the reproduction of actual computer output, where legibility is poor, the book is well produced and only on p. 240 does something appear to have gone awry in the printing. One would like to hope that all numerical taxonomists would read, and taxonomy benefit from, this book; it could well be that difficulties in practical implementation will deter all but the most persistent.

R. B. IVIMEY-COOK

Flora der Schweiz und angrenzender Gebiete. Vol. II: Nymphaeaceae—Primulaceae. Hans Ernst Hess, Elias Landolt & Rosmarie Hirzel. Pp. 956 + numerous text illustrations. Birkhäuser Verlag, Basel. 1971. Price S.Fr. 148.

Much sooner than had been expected the second volume of this elaborate work has appeared on the market. Following the system of Engler & Prantl, it contains the

families Nymphaeaceae to Primulaceae. Since I have discussed the merits and shortcomings of the work in general in my review of Vol. I (*Watsonia*, 7: 108–109, (1969)), there is no need to repeat relevant details. The statistically minded reader may perhaps like to know that with a total weight of 8 lb 10½ oz he receives 39½ oz less for more money. (The price of Vol. I was S.Fr.118). The volume is lavishly illustrated. As a matter of fact there is almost a line drawing for each individual species described in the book! These drawings are beautifully executed by Rosmarie Hirzel and depict the habit of each plant clearly. I think Miss Hirzel's illustrations are the most attractive aspect of the entire work and it is comforting to see that she is included in the list of authors as an equal among equals. However, it is quite infuriating that in no instance is a scale given for the habit drawings. I gather that the reductions vary from $\frac{1}{3}$ to $\frac{1}{2}$. More amazing is the fact that in many cases (it may apply to 40% of the illustrations) the available space would have easily allowed a habit illustration of natural size. Anyone looking at drawings like that of *Dryas octopetala* (perhaps the most striking case!) (p. 405), *Amelanchier ovalis* (p. 470), *Crataegus* spp. (p. 471), *Pyracantha coccinea* (p. 472), *Pyrus* spp. (p. 477), *Seseli hippomarathrum* (p. 824), etc. etc. will agree that eccentricity has been carried beyond the acceptable limit. The reverse of a common editorial mishap occurs on p. 17, where one finds a caption without an illustration.

I can only repeat here that the discrepancy between the names used in this work and the ones adopted for *Flora Europaea* is deeply deplorable. Nevertheless the authors' stubborn non-conformity is of such a magnitude that one is bound to admire it. At least in a few instances, the reviewer is in sympathy with them: why on earth should one call a plant *Filipendula vulgaris* when it has been known to generations of botanists as *F. hexapetala*? In reviewing this volume, I arrived at the depressing conclusion that perhaps one has to face up to the rules of botanical nomenclature in the same way that one has to face up to certain phenomena in the realm of current affairs. The situation remains hopeless. A few more botanical rebels like Doctors Landolt and Hess, however, may force the nomenclaturalists to see the pressing need for a list of *nomina specifica conservanda*.

E. LAUNERT

The Scented Wild Flowers of Britain. Roy Genders. Pp. 256 + 32 plates in colour. Collins, London. 1971. £2.50.

Mr Genders set out to write a book on scented flowers but has included a hotch-potch of miscellaneous information. Unfortunately many of his statements on the history, distribution and habitats of British species are inaccurate or misleading. We are told, for example, that *Sedum rosea* grows 'especially near the sea in N. Yorkshire' (p. 105), that *Myrica gale* is 'Absent from the Midland counties and the north' (p. 129), *Asperula cynanchica*'s habitat is 'On calcareous mountainous pastures, chiefly in E. Yorkshire and in Ireland' (p. 178), *Leucorchis albida* is 'present in the calcareous downlands of Sussex and Kent' etc. (p. 228).

Such statements continue until the last species, *Dryopteris aemula*, which, contrary to the truth, grows 'Among limestone rocks and on sunny banks' (p. 242). *Himantoglossum hircinum* is found 'Also on river-banks for it appears to enjoy moisture about its roots' (p. 229). He confuses John Ray with John Rea and is apparently unacquainted with the spread of introduced species such as *Acorus calamus*. The nicely drawn colour plates by Marjorie Blamey might have justified the book but unfortunately she seems to have been given little botanical assistance. Thus, for example, some of the plants have been grouped in absurd ecological associations.

J. E. LOUSLEY

The Price of Amenity: Five Studies in Conservation & Government. R. Gregory. Pp. xvi + 319 + 4 maps. Macmillan, London. 1971. Price £8.00.

This would appear at first an unusual volume to be reviewed here. However, the sub-title 'Five Studies in Conservation & Government' gives the clue. As Dr Gregory says in the Preface: 'For this reason alone those who earn their bread and butter in the world of planning may find something of interest in these reconstructions of five of the more celebrated amenity disputes in the last decade. They are likely to be typical of many more to come.' This statement is also true for conservationists. The threat is always present, as the last sentence indicates, but we must learn to counteract the threats more efficiently and successfully.

Chapter 1 entitled 'Naming the Parts' does just that, describing the types of organisations involved in development and those that speak for environmental protection, etc. It also indicates how the decision-making process is organized. The author is to be congratulated for the way in which he unravels and explains how the Civil Service and Parliamentary machine functions and how decisions are reached in that complex world of Public Enquiries, Statutory Orders, Private Bills and Selected Committees, now all too familiar to the conservation movement.

One of the five cases studied, Chapter 4, is entitled with the indelible name for all botanists 'The Cow Green Reservoir'. It is most valuable to see how Dr Gregory viewed the battle, as one outside the conflict. For all B.S.B.I. members it will make fascinating reading, the background to why Cow Green was selected, the gathering of the two conflicting camps and eventually the battle from the first approaches to the Nature Conservancy all the way through both Houses of Parliament to the Royal Assent.

Dr Gregory's leading extract for this chapter quotes from Lord Leatherland's speech in the Lords in February 1967 on the Third Reading of the Tees Valley and Cleveland Water Bill and it points to the still common danger: 'In my own simple way I am asking whether I should decide between flowers on the one hand and people on the other—people and their prosperity, Britain and its industrial prosperity. I come down solidly against the flowers.' While this attitude is still predominant in people's mind, we shall go on fighting and *losing* the case for protecting our rare species.

The history as to why ICI needed more water is given and the early development of the Water Board's case is followed along with the Nature Conservancy's shaky beginnings as to its objections over the suggested sites. The development of the Teesdale Defence Committee and the Defence Fund is covered, and here I should perhaps correct one or two of the minor errors in Dr Gregory's paper. It would appear that they were not checked with those who knew best. Mr J. C. Gardiner was in fact Treasurer of the B.S.B.I. at that time, and while Professor Pigott gave most valuable evidence in the Lords, he was not a member of the Teesdale Defence Fund. There were several other minor and obvious errors, but to continue—the full battle line-up is discussed, with the Bill's presentation to Parliament and its reference to the Select Committee; the various Government Departments' roles are discussed and here again Dr Gregory's reconstruction shows how the Nature Conservancy's weakness, by not having direct representation to a Minister, hampers the whole conservation movement.

The various stages of the battle in both the House of Commons and the Lords are covered, ending with Lord Kennett's words on behalf of the Government and in favour of the Bill: 'Seen in perspective it [the destruction of the plant communities] was a sacrifice that could hardly justify the very considerable cost necessary to avoid it'. And so, on the 22nd March 1967, the Bill received the Royal Assent.

We must learn how we can improve on what was a superb performance by the Teesdale Defence Committee, mainly by persuading public opinion with regard to long-term water policies and the non-equatability of environmental quality with economics in terms of £'s sterling. Dr Gregory's last chapter 'Value for Money' lays down only too clearly some of the views that exist.

It was unfortunate that Macmillan's 'valued' Dr Gregory's work so highly, as it

rightly deserved, but it means that to buy a copy of the 319 pages the 'money' outlay is £8.00—far too much for what should be a 50p handbook for all conservationists willing to learn.

The 4 other cases, 'Oxfordshire Ironstone', 'Holme Pierrepont and the Power Station', 'Bacton and North Sea Gas', and 'Abingdon and the Gasholder', show some of the other problems faced and even won. The cost, however, is often that another area is even more adversely effected—an almost insoluble problem which must be resolved by overall long-term planning.

G. LL. LUCAS

Wildlife Conservation in Woodlands. R. C. Steele. Pp. 68. H.M.S.O., London. 1972. Price 40p.

One of the many heartening changes of attitude in recent years has been that of the Forestry Commission in what it plants and how. The original rectangular straight-ridged blocks of coniferous monoculture have given way to woods shaped to the landscape and contours, and edged or diluted with broad-leaved trees, with pools and special habitats left intact or, indeed, fostered. As a result Forestry Commission woods are now of great potential, and increasingly actual, importance for wild life. The introduction says 'The term *wildlife* is used throughout this booklet to mean all the plants and animals of a woodland'. Despite my dislike of adjective and noun being run into one portmanteau word, I much wish that this wider and sensible meaning could be much more generally understood: at present to the vast majority of people wild life means animals only. That this attractive booklet was written by a member of the Nature Conservancy staff and published by the Forestry Commission is typical of the collaboration which now exists in this important field. Here are large and fine illustrations, and a good, if repetitious, text, half of which is in the form of appendices and tables. These include *catalogues raisonnées* of native woodland trees and shrubs, birds, mammals, butterflies, the flowering periods of insect-pollinated trees and shrubs, and the period when tree and shrub fruits and seeds taken by animals ripen. These matters are aspects which still need a book to themselves on the lines of *American Wildlife and Plants*, now 22 years old. This production deserves to be bought and read by more than just those who have direct control of woodlands.

D. McCLINTOCK

Nature Conservation: A Practical Handbook. W. M. M. Baron. Pp. 74. Methuen Educational Ltd., London, 1971. 90p. (Schools edition 65p.)

Mr Baron, who is the head of the Science Department at Winchester College, has obviously drawn on his experience of teaching conservation when writing this book. In the foreword he warns his readers that the text will deal largely with aspects of conservation in southern Hampshire, but most of what he says can be applied without difficulty to any conservation area.

Beginning with a statement of the need for conservation in the face of the increases in population planned for the south east, the book then outlines the major aspects of pollution of air, water and land, emphasising the need for a constructive conservation policy at all levels. A short chapter on the organisation of nature conservation in Britain cannot hope to do justice to the complexities of the subject but there are useful lists of National Nature Reserves and the major types of habitats represented in them. All of this is leading up to the main part of the book, which deals with reserve management. The need for accurate surveys of reserve areas is stressed and some techniques are suggested which can be employed by school or other amateur groups. The Cairngorms National Nature Reserve is taken as an example of professional conservation and management, with a synopsis of the Loch an Eilan nature trail given as a model of how

the visitor to such an area can be willingly controlled and interested in his surroundings.

The longest chapter deals with the local nature reserve, and here Mr Baron describes in some detail the work done on the Fal Winchester College Falloden Reserve. This will be of interest to any Naturalists' Trust, school or private individual who wishes to enhance the natural history value of any area of land, although some purists might not agree with the policy of planting species and varieties of trees and shrubs which are not strictly native to the area. The final chapter concerns conservation of a single species and here one suspects the author of being a fisherman, for the brown trout on the River Itchen is chosen. Although there is much of interest here about trout, game preservation rather than conservation seem to be the theme. One of the many small reserves set up to protect a single species of insect or orchid might have made a better example. The book also contains a brief but up-to-date bibliography.

In so short a work it is inevitable that some rather sweeping statements should be made which might have been qualified in a more detailed survey; but apart from this and the poor quality of some of the black and white photographic illustrations, it is to be wholeheartedly recommended to everybody with an interest in conservation. Its suitability as a school text has been recognised by the publishers, who have produced a schools edition for 65p.

J. POPE

Hilliers' Manual of Trees and Shrubs. Pp. 576. Hillier & Sons, Winchester, Hants. 1972. Price (paper) £1.50, postage 25p; (boards, with 16 black and white photographs, published by David & Charles, Newton Abbott, Devon. £3.25, postage 25p.)

The centenary edition of Hilliers' tree and shrub catalogue was published in 1964, under the title *Catalogue of trees and shrubs including climbers, conifers and bamboos*. This was no mere nurserymen's catalogue, however, but included much descriptive detail and other relevant data about the largest and most varied collection of hardy woody plants in any nursery in the British Isles. Special attention was paid to nomenclature—an unusual concern in the horticultural trade.

Now, entitled *Hilliers' Manual of Trees and Shrubs*, we have a much-expanded (more than twice as large) and thoroughly revised version of this work. Although the new version, like the original, has been published without any indication of authorship, the driving force behind it has clearly been Mr H. G. Hillier. On the other hand, the Introduction acknowledges the research and detailed work done by Roy Lancaster to produce this comprehensive guide to the trees, shrubs, climbers, conifers and bamboos that are hardy (to varying degrees) in the British Isles.

In the systematic section, each species, hybrid and cultivar is described in one or two sentences, giving essential characters (often including flowering time), followed by data on country of origin, date of first introduction and any R.H.S. Awards that it may have received. The most impressive feature of this, by far the largest part of the work is the care and attention given to ensure that the nomenclature (including authorities) and the identifications are as correct and up-to-date as possible. This emphasis on botanical accuracy makes the *Manual* a valuable source of information for others besides those concerned with purely horticultural topics. Indeed, it could be consulted with profit by those seeking information on native British trees and shrubs. It is a pity, therefore, that one nomenclatural point has been consistently omitted, namely the authorities of basionyms. Although this omission is usual in horticultural circles (where the citation of authorities of any description is rare), adherence to gardening traditions does not extend to the confusion of varieties and cultivars: these are strictly differentiated.

The remainder of the book also contains much of interest to the botanist or botanically interested gardener, including useful sections on basic nomenclature and classification, the meaning of botanical names, an illustrated glossary of botanical terms and thumb-nail biographical sketches of several botanical collectors who have contributed notably

to the number and variety of trees and shrubs in our gardens, as well as sections on more particularly horticultural topics.

Hilliers' *Manual of Trees and Shrubs* can therefore be thoroughly recommended, not only as an authoritative source of information on almost all the trees and shrubs grown outside anywhere in the British Isles, but also (in the reviewer's experience) as a handy means of identifying them in the field—or (should one say?) in the garden.

N. K. B. ROBSON

Heaths and Heathers. Calluna, Daboecia and Erica. Terry L. Underhill. Pp. 256. David & Charles, Newton Abbott, Devon. 1971. Price £2.50.

In the late eighteenth and early nineteenth centuries there was a great vogue for growing heaths from South Africa under glass, and some 400 species were in cultivation. There is much less interest in these nowadays, but the use of hardy heaths as garden plants has grown greatly in popularity. Mr Underhill's book will be welcomed by all who cultivate these plants, for it deals almost entirely with them. It gives sound advice, based on practical experience, on their propagation and culture, and on the placing of them in the garden. There is, too, much interesting lore about the plants. Over half the book is taken up by lists of cultivars with short descriptions of the characteristics of each; these are based to a large extent on first-hand knowledge and will be of great help in choosing which variety to grow.

The botanical content of the book will, however, be of most interest to readers of this journal. There is a certain amount of botanical information scattered through the general chapters and a technical description of each species with notes on its habitat and distribution. The species covered are *Calluna vulgaris*, *Daboecia azorica* and *D. cantabrica*, and the European species of *Erica*, together with two from South Africa that are grown in the open in this country, *E. canaliculata* and *E. pageana*. The notes on habitat will help gardeners in placing their plants, but the botanical descriptions are not very satisfactory and unfortunately include errors. There is a key to the species of *Erica* on p. 84 in which *E. arborea* and *E. lusitanica* are separated on colour of stigma, white in the first, pink in the second. It is true that the form of *E. arborea* normally grown in Britain has a white stigma, but most of those encountered in the wild have a deep pink one. The compound hairs present in *E. arborea* but absent in *E. lusitanica* are the surest guide to identity if one has a lens, and shape of flower also distinguishes the two species. Reliance on the plant as seen in gardens may also account for the statement that *E. manipuliflora* grows to 20 inches. In the Peloponnese it reaches at least 5 feet. Any specimen of *E. mediterranea* less than 4 feet tall would run down to *E. carnea* in the key to the species, although a number of cultivars of *E. mediterranea* listed on pp. 170–171 are said to have heights ranging from 18 inches to 3 feet. *Calluna vulgaris* is said to have a polypetalous corolla, although this is actually divided to not much below half way down.

That Mr Underhill found it a problem to decide 'which was the now recognised specific epithet' is not surprising. It is only a few years ago that I pointed out that there was no published name that could be correctly applied to what used to be called *E. mediterranea* and introduced for it the name *E. erigena*. At the same time I pointed out that, of the three names used by Linnaeus in 1753 for the winter-flowering heath, the correct one under the rules is *E. herbacea*, not *E. carnea*. It takes time for changes like this to be assimilated, but Mr Underhill uses *E. manipuliflora*, not *E. verticillata*, and the need for this change was pointed out only a few years earlier. He quotes 'Ross 1968' as the authority for *E. herbacea*, but I am not guilty in this case; it was Linnaeus.

Another nomenclatural muddle has led Mr Underhill astray when he says that the first 'public description of a Cape Heath was in 1601' (p. 60). In 1753 Linnaeus used the name *Erica viridipurpurea* for what was probably *E. multiflora* but included in its synonymy a description and illustration of a Portuguese specimen of *E. erigena* published

by Clusius in 1601. In 1770 Linnaeus switched the name *E. viridipurpurea* to a South African heath that bears no resemblance to Clusius's account and figure.

Those who are not botanists will be misled by the definition of 'septicidal' in the glossary: 'when a capsule dehisces through lines or junctions'. This would apply equally to loculicidal capsules.

More criticisms like those above could be made of points that will niggle a botanist. They detract little from the value of the book to those who grow or plan to grow heaths in their gardens, but it should not be used without checking as a source of botanical detail.

R. ROSS

Flore et Végétation du Massif Armoricain. I. Flore Vasculaire. H. des Abbayes, G. Claustres, R. Corillon, P. Dupont. Pp. lxxv + 1227 + 46 text figures. Presses Universitaires de Bretagne, Saint-Brieuc. 1971. Price unstated.

The publication of this book is an important event in French floristic botany, for there is, as the introduction by Professor Gaussen points out, a regrettable lack of modern Floras of France. For anyone intent on doing some serious botanising in at least the northern or western part of lowland France, the book will be an essential accessory.

The area covered, about 60,000 sq. km., is just under half that of England and takes in the Brittany peninsula and most of the Cherbourg peninsula, with their hinterland, as well as the Iles Anglo-Normandes (Channel Isles to us!). This Flora is therefore more comparable with Clapham, Tutin and Warburg's *Flora of the British Isles* than with British county Floras; and it is, in fact, rather similar to it. It contains keys down to the level of species, full descriptions of each species (1748 in number), accompanied where appropriate by accounts of species of dubious status, subspecies and, occasionally, varieties, and an illustrated glossary. The main differences from 'C.T.W.' are that chromosome numbers are not normally given, and that distributional information is given mainly under Departmental headings and normally with a citation of an authority for the statement. Place names are given for the occurrence of the rare or local species, though it is stated that these are in some cases only of historical interest.

The authors have taken account of recent taxonomic researches, though they do not necessarily follow them in their treatment, and they admit that they have recoiled before some of the results of a strict application of the International Code of Botanical Nomenclature. I find that this extends to the 'rules of spelling' governing the termination of epithets based on personal names. The line drawings, included to clarify structures difficult to describe, are very clearly executed, and the typography and layout are satisfactory, though it would have been an improvement to have included the numbering of the genera in the page headings. The thin but apparently strong paper is unfortunately too transparent.

The authors state that in their keys they have tried to use only easily observable characters, and as the book is of portable size it should become a standard work for use in the field and herbarium. It is part of a series which will cover also the non-vascular flora and the phytogeography and vegetation, and these last two topics are therefore not dealt with in the introduction to the present volume. A convenient way of referring to this would be 'Flora Vasculaire du Massif Armoricain'.

The provision of localities for rare plants should, the authors say, 'permit those botanising in our region to know where to collect whatever plant they desire and also to report if a collection made by them is unpublished'. Such an unqualified invitation to collect rarities reads strangely in these days; one wishes that Professor des Abbayes had counterbalanced it with words such as those of Fournier in *Les Quatre Flores de la France* written as long ago as 1936: 'Détruire ce qu'on aime est une assez mauvaise façon d'aimer'.

P. F. YEO

Obituaries

DALLAS FAWDRY

(1933–1972)

It was with deep regret that we learned of the untimely death of Miss Dallas Fawdry in March 1972, at the early age of thirty-nine.

She was educated during the war years at various schools in Gloucestershire and Berkshire and finally at the Portsmouth High School. Dallas then studied English at St. Hugh's College, Oxford, from where she graduated with honours in 1955. While at Oxford she played lacrosse for the University and later for the West of England, also being an All England reserve.

Her career as a professional journalist started with the Leonard Hill Technical Group and in 1959 she was appointed Editor of their journal *Dairy Engineering*. This subsequently combined with *Dairy Industries*, of which Dallas became the Editor in 1964. Displaying enormous energy, enthusiasm and devotion to her work, coupled with a journalistic flair for getting at the news, she helped *Dairy Industries* to become one of the world's leading technical journals in its field.

Together with her outstanding success in her profession—a success rarely achieved in this field by a woman—went a wide interest in outdoor pursuits and a love of the countryside. A member of the B.S.B.I. since 1958, she was a keen and able field botanist and brought to her botany her characteristic attention to detail and methodical approach, while her sense of fun brought enjoyment to herself and others on the many field meetings that she attended. Dallas was a member of the Council of this Society at the time of her death, and previously she had been a member of the Development and Rules Committee, on which she gave generously of her specialised knowledge; and she was responsible for the design and production of the new prospectus.

Ornithologist as well as botanist, Dallas was an active member of the Wild Flower Society, the London National History Society, the Hampshire and Isle of Wight Naturalists' Trust, and the Royal Society of the Protection of Birds, and she will be sadly missed by many friends. We should like to extend our sympathy to Colonel and Mrs Fawdry on the loss of their only child, a daughter of whom they can be justly proud.

M. BRIGGS

DONALD PETER YOUNG

(1917–1972)

Donald Peter Young was born on 20th May, 1917, and educated at Whitgift School. He proceeded to Battersea Polytechnic, where he graduated B.Sc with first class honours in Chemistry in 1937. Subsequently he gained a Ph.D. (1940) and became F.R.I.C. He worked as a research chemist for British Celanese Ltd. from 1940 to '47 and joined the The Distillers Co. (now part of B.P. Chemicals International), where he worked for 25 years, being a senior research chemist at the time of his death. He was a recognised expert on oxidation processes, and was one of the initiators of the D.F. Acids process, which is well known in the chemical industry; at the time of his death he was working on vinyl chlorides.

Apart from his work as a chemist, Dr D. P. Young's great interest in life was systematic botany, and he was one of the most able amateur botanists of his day. He specialised in the genera *Epipactis* and *Oxalis*, on which he was recognised as the

expert both at home and abroad. His papers on these subjects as well as the accounts of the latter genus for *Flora Europaea* are models of scientific precision.

Dr Young was greatly interested in the flora of Surrey. He organised the recording of the Croydon area for the *Atlas of the British Flora* and later, together with a number of other botanists, was actively engaged in the preparation of a new Flora of the county. He was Recorder and Editor of the project at the time of his death, and it is a matter of great sadness that he was not spared to see this task completed.

Dr Young joined the Botanical Society of the British Isles in 1945 and took a full part in the activities of the Society. He acted as Distributor for the years 1952–3, and was a member of Council for 1952–6 and again from 1959–63. He served on the Conservation Committee for 1956–64, was district secretary for Home Counties South in 1961 and County Recorder for Surrey.

Dr Young joined the Croydon Natural History Society in 1947 and was elected to the Council in the following year. He acted as botany secretary for a short space of time in 1952–53, until the services of Dr (now Professor) Sutcliffe were obtained. After this he was Chairman until succeeded by Mr R. Clarke, and he was Curator of the Society's collections from 1953 to 1962. Dr Young had a strong interest in local history; he was active in the formative years of the Surrey Naturalists' Trust, and for some time acted as the Trust's local secretary for the Croydon area. He was recently invited to become a member of the joint committee of the National Trust and the Croydon Corporation responsible for the administration of Selsdon woods. Another study of his concerned Surrey common land and he compiled a useful index to the parcel numbers and land-owners mentioned in John Corbet Anderson's *Croydon Inclosure*.

Donald Young was born with severe spinal curvature, and his whole life was a triumph over great physical disability. Unable to play games, he managed to walk up mountains and to drive a sports car. Not surprisingly he was shy and reserved and tended always to be solitary. However, he was always ready to assist anyone in any way that he could, and in company he showed himself to be possessed of a strong sense of humour and a very kindly and friendly nature. In 1971 he was admitted to Redhill General Hospital with heart trouble and made a fair recovery, but he was forced to enter Guy's Hospital later. He returned home for Christmas and in February he went for a short holiday. Unfortunately, his progress was not maintained and he died peacefully in his sleep on March 18th, 1972. He was unmarried. He will be greatly missed by those who knew him for his scientific integrity and for the man he was.

BIOLOGICAL PUBLICATIONS

1948

The Parsons Herbarium. *Proc. Croydon nat. Hist. sci. Soc.*, **12**: 76–77.

1949

Studies in the British *Epipactis*, I. *Epipactis dunensis* and *E. pendula*. *Watsonia*, **1**: 102–108.

Studies in the British *Epipactis*, II. The differentiation of *E. pendula* and *E. vectensis*. *Watsonia*, **1**: 108–113.

1951

H. F. Parsons' Herbaria. *Watsonia*, **2**: 100–101.

Studies in the British *Epipactis*, III. *Epipactis phyllanthes* G.E. Sm., an overlooked species. *Watsonia*, **2**: 253–259.

Studies in the British *Epipactis*, IV. A revision of the *phyllanthes-vectensis-pendula* group. *Watsonia*, **2**: 259–276.

1953

Autogamous *Epipactis* in Scandinavia. *Bot. Notiser*, **1953**: 253–270.

1954

A key to the Danish *Epipactis*. *Bot. Tidsskr.*, **50**: 140–145.

1955

Epipactis phyllanthos in Yorkshire. *Naturalist, Hull*, 1955: 65.

1958

(With J. Renz) *Epipactis leptochila* Godf.—its occurrence in Switzerland and its relationship to other *Epipactis* species. *Bauhinia*, 1: 151–156.

Le genre *Epipactis* en Belgique. *Bull. Jard. bot. État Brux.*, 28: 123–127.

Oxalis in the British Isles. *Watsonia*, 4: 51–59.

1959

Alien plants on the Mitcham Common Tip. *Proc. Croydon nat. Hist. sci. Soc.*, 12: 258–262.

1962

Studies in the British *Epipactis*, V. *Epipactis leptochila*; with some notes on *E. dunensis* and *E. muelleri*. *Watsonia*, 5: 127–135.

Studies in the British *Epipactis*, VI. Some further notes on *E. phyllanthos*. *Watsonia*, 5: 136–139.

Studies in the British *Epipactis*, VII. Seed dimensions and root diameters. *Watsonia*, 5: 140–142.

1968

Oxalis L., in Tutin, T. G. *et al.*, ed. *Flora Europaea*, 2: 192–193.

ALSO

Corbet Anderson's 'Croydon Inclosure'. Index to Parcel Numbers. (Unpublished typescript in Croydon N.H.S.S. library, 1962).

C. T. PRIME

NILS HYLANDER

(1904–1970)

Professor Nils Hylander, a distinguished Honorary Member of the Botanical Society of the British Isles since 1955, died on 28th July, 1970 in his native country, Sweden. He had an international reputation as an authority on the taxonomy and nomenclature of wild and cultivated plants, and a wide circle of friends amongst British botanists. In 1959 he took part in the Darwin Centenary Conference arranged by the Society in London, where he gave a paper entitled 'Some trends in modern research work on Scandinavian vascular plants'. During the 1950's he had paid several visits to Britain and Ireland in his capacity as an expert on horticultural taxonomy (he served on the international commission of nomenclature of cultivated plants), and also for a variety of studies of the taxonomy and nomenclature of native European species. As Regional Adviser for Sweden in the *Flora Europaea* organisation he naturally made many contacts both in Britain and throughout Europe, and his unfinished critical Flora of the Nordic countries '*Nordisk Kärleväxtflora*' (vol. I, 1953, vol. II, 1966) was accepted as a basic Flora in *Flora Europaea*. Some members of the Society will remember him best because of his great interest in the two critical genera *Alchemilla* and *Hieracium*, an enthusiasm which began early in his botanical career and which he developed during his remarkably detailed research on the problem of plant introductions through grass seed into Swedish parks.

My own acquaintance with Nils Hylander began in the summer of 1948 when as a research student I spent several weeks in Sweden and Finland, centred on the University of Uppsala. It was the height of the summer vacation, and there were relatively few botanists around. This situation, which could have been unfortunate, turned out to be greatly in my favour, for all who were there were uniformly helpful and hospitable to the young visiting Englishman, and even suppressed their (usually excellent) English to

give me practice with my halting attempts to speak Swedish. Nils Hylander was particularly helpful, because we quickly found that we shared the same enthusiasms for critical taxonomy of N. European plants. It was a most valuable and formative experience in my career, and it is pleasant to recall the details of that time, and record a debt to Swedish colleagues past and present.

It is not easy to fill the gap left by Hylander's death. His colleagues will feel particularly sad that only the first two volumes of the Nordic Flora have appeared, for this work represented a condensation of the author's very special and detailed knowledge of critical taxonomy, and was unusual both in form and depth of content. Nor can there be many to bridge the gap between taxonomic botany and horticulture so effectively as he did. Nevertheless we hope that the unbroken tradition of Swedish botanical taxonomy since Linnaeus can continue to produce botanists of such international standing in the years to come.

No single complete list of Hylander's publications has yet been published, but a duplicated list containing 100 of his papers is obtainable on request from the Institute of Systematic Botany, Box 541, Uppsala, Sweden, and many of these papers are still available for exchange.

S. M. WALTERS

Reports

ANNUAL GENERAL MEETING, MAY 13TH 1972

The Annual General Meeting of the Society was held in the rooms of the Linnean Society of London, Burlington House, Piccadilly, London W.1. on Saturday 13th May at 11.45. Mr D. McClintock (President) was in the Chair and 58 members were present.

The minutes of the last Annual General Meeting as published in *Watsonia*, Vol. 9, part 1 pages 54-55, were adopted.

REPORT OF COUNCIL

The Report together with the Accounts for the year 1971 had been circulated to members. There were no queries and it was unanimously adopted.

ELECTION OF OFFICERS

Mr J. C. Gardiner had been nominated as a Vice-President by Council. Mr McClintock said that members were well aware of the many ways in which Mr Gardiner had furthered the interests of the Society during his thirteen years as Treasurer, from which office he had retired in 1971. During his term he had contributed competently and generously of his time and services to a number of the Society's projects. Mr Gardiner's election as Vice-President was approved.

Mr McClintock reported that Dr I. K. Ferguson wished to retire as General Secretary, and he warmly thanked him for his three years of able service. Mrs M. Briggs, who had been a model Meetings Secretary for eight years, was then appointed Honorary General Secretary, the second woman to hold this office of the Society. Mr M. Walpole was thanked and re-elected as Honorary Treasurer.

Mr E. F. Greenwood, Dr G. Halliday, Dr N. K. B. Robson and Dr C. A. Stace were re-elected as Honorary Editors. Mr McClintock expressed his thanks to them all and commented on the volume of work undertaken by them, and on the importance of the publications to the Society.

Miss G. Tuck had been nominated to fill the vacancy of Meetings Secretary, and the President described her as a natural successor to Mrs Briggs as she had already been responsible for the Field Meetings and the collation of the programmes and calendar. Miss Tuck's appointment was duly approved.

Mrs J. G. Dony was re-elected as Honorary Membership Secretary, the President paying tribute to the large and punctilious contribution made by her to the smooth running of the Society's affairs.

ELECTION OF NEW MEMBERS TO COUNCIL

According to Rule 10, Mr R. W. David, Mr P. S. Green and Dr A. J. Richards retired from Council, and Dr D. J. Ockenden had expressed a wish to resign. Four nominations had been received to fill these vacancies: Mrs B. H. S. Russell, Dr R. B. Ivimey-Cook, Dr J. T. Williams and Dr R. K. Brummitt. Their order of precedence, as given, was determined by ballot.

ELECTION OF HONORARY MEMBERS

Council had proposed the election of Mr J. E. Dandy and Prof. D. A. Webb as Honorary Members. The President recommended the meeting to approve these, saying that, in both cases, the nominations were long overdue in the light of the service given to the Society by these internationally known botanists of the highest calibre. Their election as Honorary Members was unanimously agreed.

ELECTION OF HONORARY AUDITORS

The President reported that Messrs Price, Waterhouse & Co. wished to retire from auditing the Society's accounts and he stressed that they had earned the Society's gratitude for their excellent and unpaid services over so many years. The Honorary General Secretary was instructed to write to thank them. The Treasurer had reported that his firm's accountants, Messrs Thornton Baker & Co., would undertake the work on an honorary basis, and he was thanked for arranging this. The transfer was approved by the Meeting.

There being no other business, the meeting closed at 12.00.

M. BRIGGS

COMMITTEE FOR THE STUDY OF THE SCOTTISH FLORA

SEVENTEENTH ANNUAL REPORT TO 31ST DECEMBER, 1971

The Committee met twice in Perth and arranged an Exhibition Meeting at the Royal Botanic Garden, Edinburgh (by kind permission of the Regius Keeper). Ten field meetings were included in the Scottish programme for the year.

The Exhibition Meeting was held on Saturday, 6th November, 1971 and about seventy people were present. The following exhibits were shown: ballast aliens in Fife (G. H. Ballantyne); habitats and affinities of *Ranunculus 'reptans'* from the Loch of Strathbeg, North Aberdeen, v.c. 93 and specimens from Islay and Loch Awe (Mrs E. M. Birse); some plant records from Selkirk, v.c. 79 and Roxburgh, v.c. 80 (R. W. M. Corner); *Mimulus* spp. and hybrids and variations in spur of corolla of *Pinguicula vulgaris* (Miss U. K. Duncan); *Rumex maritimus* and *Parentucellia* from Kintyre, v.c. 101 (A. G. Kenneth); specimens of double-flowered *Calluna* (D. McClintock); variation in *Potamogeton natans* L. and *P. polygonifolius* Pourr., with particular reference to Scotland (R. R. Mill); *Arctous* in Mid Perth, v.c. 88, ?*Heracleum sphondylium* × *mantegazzianum* with the parents (Miss C. W. Muirhead); *Corallorhiza trifida* in Scotland (G. Rodway); information on the British Fern Society (Miss A. Rutherford); *Polypodium australe* in Scotland (Miss A. Rutherford and A. McG. Stirling); map showing progress of C.S.S.F. Inverness-shire survey (A. A. P. Slack); colour sketches of plants (Mrs O. Stewart); species which become coastal in Scotland, *Rubus ulmifolius* in S.W. Scotland and *Carex elongata* in Dunbarton, v.c. 99 (A. McG. Stirling); new county records in N. Scotland (Miss M. McC. Webster). After tea Dr G. Halliday of the University of Lancaster, and one of the Honorary Editors of the B.S.B.I., spoke on 'A botanist in East Greenland'. Following a buffet supper in the University of Edinburgh Staff Club, colour transparencies of C.S.S.F. field meetings held during 1971 were shown by Miss E. R. T. Conacher, B. W. Ribbons, J. Grant Roger and A. McG. Stirling. Transparencies of orchids, mainly Scottish, were shown by F. G. Rodway.

Of the ten field meetings in the programme, one was cancelled (Isle of Arran); one to Glas Tulaichean, East Perth was arranged by the Alpine Botanical Secretary of the B.S.E. (for report see *Trans. bot. Soc. Edinb.*, 41: 565-566 (1972)); the other meetings were held at Flanders Moss, West Perth (30 May) led by Dr J. H. Dickson (22), at Achnacree Moss, Benderloch and Glen Lonan, Taynuilt, Main Argyll (13 June) led by Miss E. R. T. Conacher (11), at Lethan's Den, Fife (19 June) led by G. H. Ballantyne (4), at Meall Ghaordie and Creag Laoghain, Mid Perth (4 July) led by A. W. Robson (12), at Kindrogan Field Centre, East Perth (23-30 June) led by J. Grant Roger (16), at Invergarry, Westernness (10-17 July) led by A. A. P. Slack (11), at Glens Affric, Cannich and Strathfarrar, Easternness (17-24 July) led by A. Currie (9) and at Ben Ledi, West Perth (25 September) led by A. C. Crundwell (12). The attendance figures are given in brackets. For reports of these meetings see *Watsonia*, 9: 191-195 (1972) and *B.S.E. Newsletters* Nos. 5 and 6.

Mr A. W. Robson resigned in March and Mr B. S. Brookes was appointed in his place. The eight elected members appointed Miss E. R. T. Conacher, Dr H. A. P. Ingram and Mr B. S. Brookes to serve as members for the calendar year 1972. Mr R. Mackechnie was appointed Chairman, Mr B. W. Ribbons Honorary Secretary, Mrs A. H. Sommerville Honorary Treasurer, Mr A. McG. Stirling Honorary Field Meetings Secretary and the Chairman, member of the B.S.B.I. Records Committee for 1972. The Chairman attended the B.S.B.I. Council on 8 May and was represented by Mr Ribbons on 23 March and 20 October. He was represented by Mr Ribbons at the B.S.B.I. Records Committee on 16 March and 28 September. The Honorary Secretary attended a meeting of the B.S.B.I. Co-ordinating Committee on 12 October.

The sub-committee responsible for organising the Inverness-shire survey met twice, in March and October. Decisions were taken to obtain wider publicity for the project, and to invite B.S.E. and B.S.B.I. members to help by examining herbaria and field notebooks in private hands for Inverness-shire records. It was agreed to make application to the Carnegie United Kingdom Trust for a grant to defray clerical expenses incurred during the survey. The sub-committee hopes to publish and distribute a Newsletter relating to the survey. An exhibit illustrating the progress of the survey was presented at both C.S.S.F. and B.S.B.I. Exhibition meetings in November. The field meetings planned for the Invergarry area and for the Glens Affric, Cannich and Strathfarrar regions were successfully carried out; as a result of these and other activities the total number of 5×5 km squares visited now exceeds 100, with upwards of 15,000 records. For 1972 similar meetings, each of a week's duration, are planned for the Laggan Bridge and Kingussie areas. Further offers of assistance with the work in Inverness-shire, either in the field or otherwise, will be welcomed by the Convener of the Organising Sub-committee, R. Mackechnie, 9 Skirving Street, Glasgow, G41 3AB.

The list of Recorders for the Scottish vice-counties was kept under review and recommendations were made to the B.S.B.I.; both sponsoring Societies and the Council for Nature were asked to support the inclusion of Scotland in the Wild Plants Protection Bill and this was successfully achieved; the definitive list of Scottish rare species as approved by the Committee was published in *Watsonia*: 9, 70-71; (1972) the terms of reference of the Committee became an Appendix to the Constitution of the B.S.E. and were thus made known to all the members; proposed changes in the Rules of the B.S.B.I. designed to improve communications between the Council and members in Scotland were discussed with the B.S.B.I. and notified to all Scottish members; and the Committee arranged with Mr J. Anthony for his manuscript *Flora of Sutherland* to be submitted for publication. Numerous matters of detail have been discussed with the Officers and Councils of the two Societies.

The accounts showed a deficit of £36.08 and £30.00 of this has been refunded in equal sums by the two sponsoring Societies.

The Committee wishes to express thanks to Mr A. W. Robson for serving as a member for 1969-71, to the officers of the sponsoring Societies, to the leaders of the field meetings and to other members and friends who helped the Committee during the year.

B. W. RIBBONS

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LOCAL FLORAS

Edited by P. J. Wanstall

The purpose of this volume is to make available to a wider public the papers read at the Conference held by the Botanical Society of the British Isles in 1961. The contributors include D. E. Allen, Dr H. J. M. Bowen, Dr J. G. Dony, J. S. L. Gilmour, Prof. J. G. Hawkes, D. H. Kent, J. E. Lousley, D. McClintock, R. D. Meikle, Dr F. H. Perring, R. C. Readett and C. C. Townsend.

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THE *TARAXACUM* FLORA OF THE BRITISH ISLES

By A. J. RICHARDS

*A Supplement to Watsonia, Journal and Proceedings of the
Botanical Society of the British Isles, vol. 9, 1972*

Price £2.00 plus postage

The genus *Taraxacum*, commonly known as Dandelions, has been largely neglected in the British Isles, although it is of botanical, ecological and economic importance. Most accounts of the genus in this country consider only four species, which are too general in scope to be of much service.

In the present account the author shows that, due to the apomictic (non-sexual) means of reproduction usual in the genus, a much larger number of clear-cut species can be recognised in Britain, 132 in all, and that these demonstrate characteristic ecological and distributional behaviour.

A substantial introduction, with notes on the taxonomic history, biology, genetics, taxonomy, distribution, identification, cultivation and collection of the British species is followed by a key to the species. In the main account, each species is treated individually with nomenclature, a full description, breeding behaviour, ecology, British distribution (including a vice-county list), European distribution and general notes and comments repeated in each case.

Each species is illustrated with line drawings and there is a full index.

Although our knowledge of the British species of the genus is still incomplete, it is hoped that this work will form a standard reference for a number of years and thus should be valuable to Universities, Colleges, Field Stations, Museums and to all botanists interested in the higher plants of the British Isles.

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INSTRUCTIONS TO CONTRIBUTORS

PAPERS and short notes concerning the systematics and distribution of British and European vascular plants as well as topics of a more general character and wider appeal are invited from both members and non-members of the Society. Careful attention to these notes before a paper is submitted can save the author and editors much work, and do much to speed publication.

Papers must be submitted in final, fully-corrected form. They should be typewritten, with wide margins, double-spaced, on one side of the paper only. If possible, two copies should be sent, of which one must be a top copy. Authors should keep a fully-corrected carbon copy of their typescripts for reference.

Write clearly and concisely, rigorously excluding extraneous matter. It sometimes helps the clarity of an argument to place extensive experimental or tabular data in appendices, rather than in the main text. Technical terms are of value only as aids to clarity, precision and conciseness of expression. Take care that they are used consistently, and defined where necessary. Ill-defined or general terms often need definition in a particular context, and can often with advantage be replaced by something more precise, as by the 'deme' terminology of Gilmour and Gregor in genecology. Make certain that the main conclusions of the paper are clearly displayed to the reader.

Avoid complicated hierarchies of headings, and check carefully the consistency of those that you use; a table of contents, setting out the full hierarchy of headings with the MS. page numbers, is often helpful even if it is not to be printed with the paper. Avoid footnotes as far as possible, and keep cross references by page number to a minimum.

Tables, unless very small, should be typed on separate sheets and attached at the end of the typescript. They should be kept within a reasonable size, and as simple in structure as possible.

Keys should be in one of the generally accepted forms; *Flora of the British Isles* by Clapham, Tutin and Warburg (2nd ed., Cambridge, 1962) and *Flora Europaea* (Cambridge, 1964-8) provide suitable patterns.

Names of genera and species should be underlined, but any other typographical indications should be inserted lightly in pencil. Names of vascular plants should normally follow the *List of British Vascular Plants* by J. E. Dandy (British Museum (NH) and BSBI, London, 1958) and changes published in *Watsonia*, 7: 157-178 (1969) or *Flora Europaea* (Cambridge, 1964-8) and may then be cited without authorities. Otherwise authors' names must be cited, at least on the first occasion where they appear in the text and followed by the 'Dandy' or *Flora Europaea* name in parenthesis. Authors must follow strictly the *International Code of Botanical Nomenclature* (Utrecht, 1966). Synonyms should be cited in chronological order; misapplied or illegitimate names should be placed in square brackets. Examples will be found in recent parts of *Watsonia*.

Except for citations of the place of publication of plant names, which may be given in abbreviated form in the text, full references should be listed in alphabetical order of authors' names at the end of the paper; the form used for references in a recent part of *Watsonia* should be followed carefully. Names of periodicals should be abbreviated as in the *World List of Scientific Periodicals* (4th ed., London, 1963-1965). References to herbaria should follow the abbreviations given in *British Herbaria* (BSBI, London, 1958) and *Index Herbariorum* Part I (5th ed., IAPT, Utrecht, 1964). Foreign language references should, where necessary, be transliterated into the roman alphabet according to a recognized convention; for Cyrillic script (Russian, etc.) the Royal Society (BS 2979: 1959) or UNESCO schemes are acceptable. Unless authors expressly indicate that they cannot get access to the necessary literature, the editors will assume that they have checked the correctness of all titles, abbreviations, transliterations and references.

Papers should begin with a short abstract, in the form of a piece of connected prose conveying briefly the content of the paper, and drawing attention to new information, new names and taxa, and the main conclusions.

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Watsonia

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**Journal and Proceedings of the Botanical
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Volume 9 Part 4 July, 1973

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N. K. B. Robson, C. A. Stace**

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An upland race of *Potentilla erecta* (L.) Räusch. in the British Isles

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ABSTRACT

Plants of *Potentilla erecta* from three different environments in Scotland showed considerable phenotypic differences. After cultivation in standard conditions those from dwarf-shrub communities at about 800 m retained a number of distinctive features. A survey of some herbaria disclosed that similar plants are widespread and not uncommon above 500m in the British Isles and are identical with *Potentilla strictissima* Zimm. from the Alps. The new combination *Potentilla erecta* (L.) Räusch. subsp. *strictissima* (Zimm.) A. J. Richards is made for this taxon, and its origin and status are discussed. Both this subspecies and *P. erecta* subsp. *erecta* proved tetraploid ($2n = 28$). In one locality where they occur together some intermediates were found.

INTRODUCTION

Potentilla erecta is widespread in the British Isles and is often very common in acid habitats, being found in grassland, heath, mire and woodland. It is also less commonly found in base-rich grassland and fen. It is not surprising that considerable inter-population variability is found, although intra-population variability is usually slight. Some of the more extreme variants on the Continent have been given taxonomic recognition, e.g. *P. sylvestris* Necker, *P. pubescens* Poevlele, *P. favrati* Zimm. and *P. strictissima* Zimm. A number of other variants were given infraspecific recognition as *varietas* and *forma* by Zimmeter (1884, 1889) and Wolf (1908), and the complex infraspecific taxonomy of *P. erecta* was usefully summarised by Hegi (1922), who listed no fewer than 19 taxa (excluding synonyms) under this species. Recent work has been published on the experimental hybridisation and genetic relationships of *P. erecta* with related species (e.g. Matfield *et alii* 1970), and Vasari (1968) and Watson (1969) both reported the experimental testing of phenotypes of *P. erecta* in cultivation.

This paper reports the occurrence of a distinct genotype of *P. erecta* from dwarf-shrub heaths usually above 500m altitude in the British Isles, apparently identical with *P. strictissima*. Chromosome counts of both this taxon and the commoner one (*P. erecta* subsp. *erecta*) are reported and the origin and ecology of both are discussed.

CULTIVATION EXPERIMENTS

MATERIAL

Three Scottish populations were chosen for detailed examination in August 1968

(Table 1). Measurements were made in the field and plants were removed and grown in constant conditions at Oxford.

TABLE 1. ORIGIN OF MATERIAL USED IN CULTIVATION EXPERIMENTS

Population	Locality	Habitat	No. sampled	
			In field	In cultivation
Calgary	Calgary Bay, Mull, Scotland GR 17/372.512	Grassland on shell-sand 5m	50	13
Kilbrenan	Kilbrenan, opposite Ulva, Mull, Scotland GR 17/444.423	Wet peaty grassland 50m	50	27
Cairngorm	White Lady, Cairn Gorm, Inverness, Scotland GR 28/992.055	Dwarf-shrub heath 780m	47	16

METHOD

Four characters were scored in the field from about 50 flowering individuals chosen without conscious bias. These were length of plant, length of stem-leaf, length of fruiting pedicel and length of petal (Table 2).

TABLE 2. CHARACTERS SCORED ON WILD AND CULTIVATED POPULATIONS

Definition of characters

Length of longest stem from flower to ground (fully extended)

Length of longest leaflet from base to apex on uppermost stem-leaf

Maximum breadth of (same) longest leaflet

Length of terminal tooth of (same) longest leaflet

Length of longest leaflet on longest radical leaf

Maximum breadth of (same) longest radical leaflet

Length of petiole of (same) longest radical leaf

Whether or not leaflets of basal leaf overlap

Colour of basal leaf, scored as blue-green, green or yellow-green

Length of longest petal of largest flower from notch in emarginate apex to base of claw

Length of longest fruiting pedicel

Plants taken into cultivation were grown in 4-inch plastic pots in John Innes soil mixture No. 3. They were subjected to illumination from mercury-vapour lights for 14 hours out of 24 and were maintained at a fairly constant temperature of about 18°C. Characters were scored on these plants when they first flowered and fruited, in June–August 1969, 10–12 months after transplantation. These plants were kept in cultivation for a further year but no subsequent phenotypic change was noted and it was assumed that phenotypic differences noted in cultivation were under genetic control. In all, 12 characters were scored (Table 2).

RESULTS

Each population is compared before and after cultivation by means of histograms for each character:

Length of longest stem (Fig. 1). The plants of the Cairngorm population are substantially larger in the field than those of the two lowland populations. This distinction is maintained, albeit less clearly, after cultivation. The larger size of plants of the Calgary population in relation to those of the Kilbrenan one in the field is not maintained in cultivation.

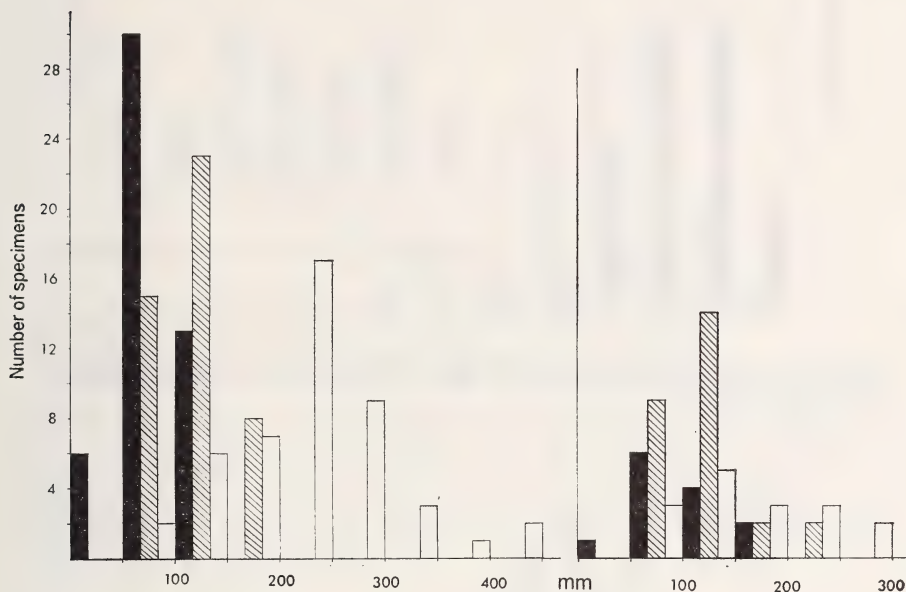


FIGURE 1. Length of longest stem. Left, field results; right, after transplantation. Black, Kilbrenan; hatched Calgary; unshaded, Cairngorm.

Length of uppermost stem-leaf (Fig. 2). Plants of the Cairngorm population in the field have much longer stem-leaves than the two lowland populations. This distinction is maintained after cultivation. The larger stem-leaves of the Calgary population in the field in relation to those of the Kilbrenan one are not maintained in cultivation.

Length of fruiting pedicel (Fig. 3). The greater length of the pedicels of plants of the Cairngorm population in the field is at least partly lost after cultivation. The Calgary and Kilbrenan populations do not differ in cultivation.

Petal-length (Fig. 4). The much longer petals displayed by the Cairngorm population in the field are maintained in cultivation. However, the lowland populations show increased petal-length after cultivation and become indistinguishable from the Cairngorm population in this character.

The length of petiole, breadth of stem-leaf leaflet, breadth of radical leaf leaflet, and length of terminal tooth were found not to differ after cultivation. The qualitative characters (colour and overlapping) were found to be difficult to score and were not employed in the final analysis. The length of the radical leaf,

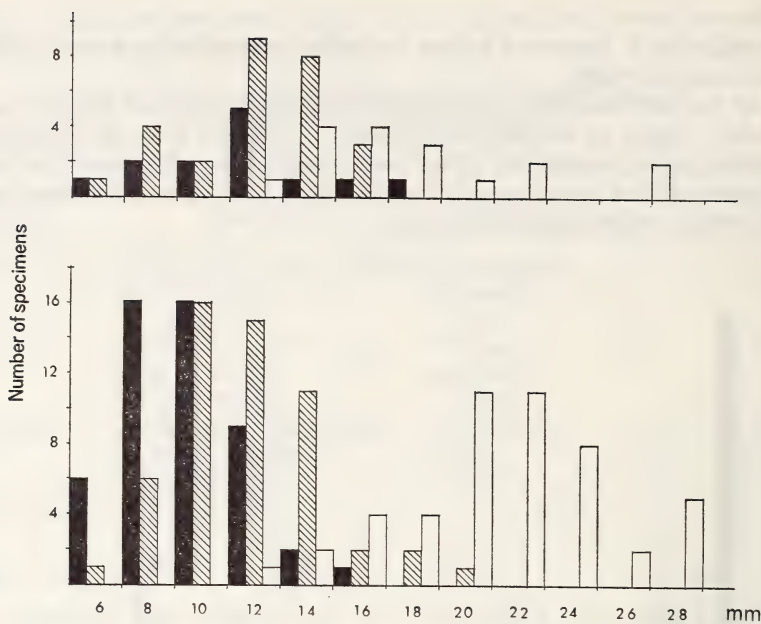


FIGURE 2. Length of uppermost stem-leaf. Below, field results; above, after transplantation. Key as in Fig. 1.

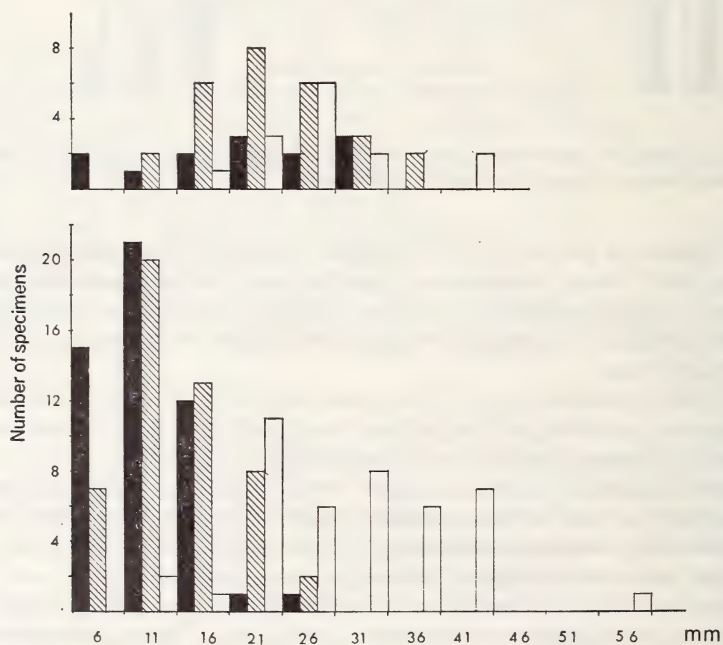


FIGURE 3. Length of fruiting pedicel. Below, field results; above, after transplantation. Key as in Fig. 1.

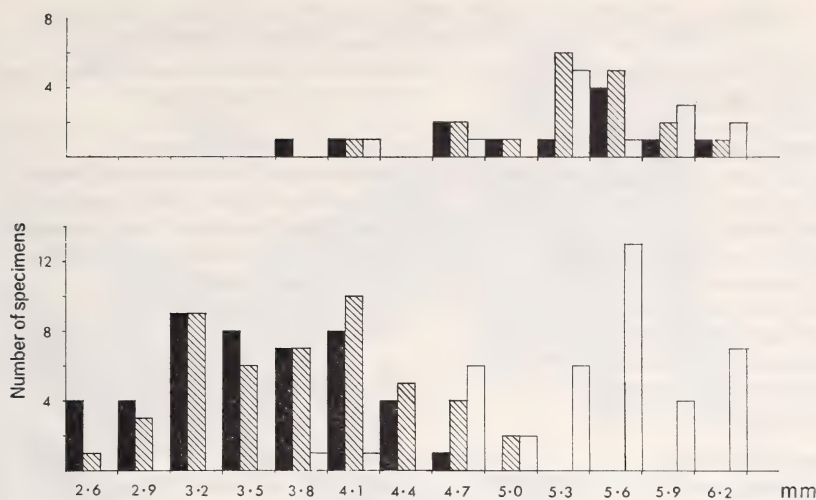


FIGURE 4. Petal-length. Below, field results; above, after transplantation. Key as in Fig. 1.

although not recorded in the field, was found to be a discriminant between the Cairngorm and the two lowland populations after cultivation.

In conclusion, it can be said that the Cairngorm population can be distinguished from the two lowland populations through several characters in the field, and that these are maintained, although usually less distinctly, after cultivation (Table 3). The lowland populations are scarcely separable in the field through the biometric techniques employed here, although they looked quite distinct to the eye, and both biometrically and visually they became indistinguishable after cultivation.

TAXONOMY AND DISTRIBUTION

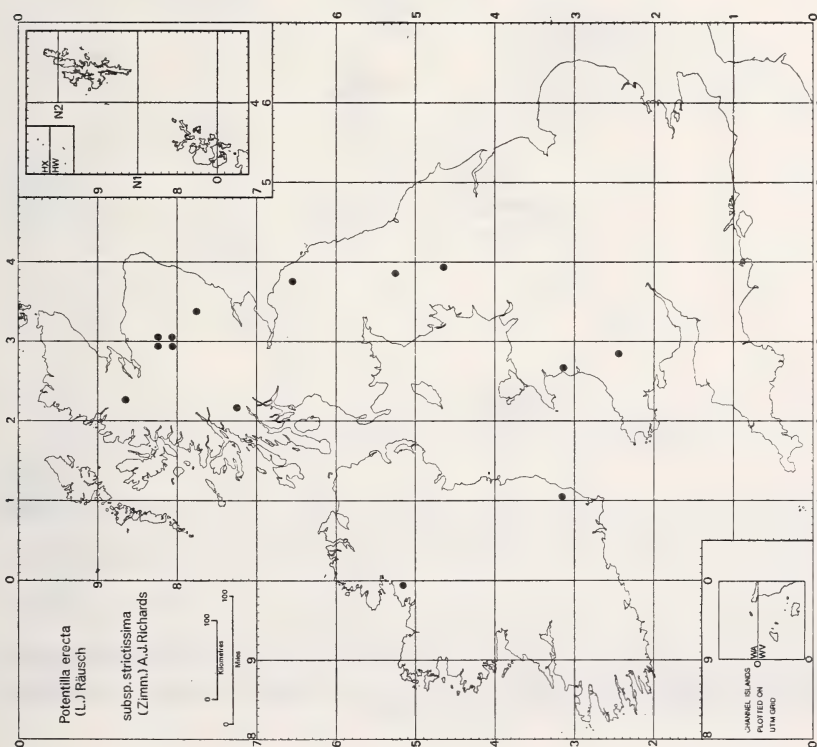
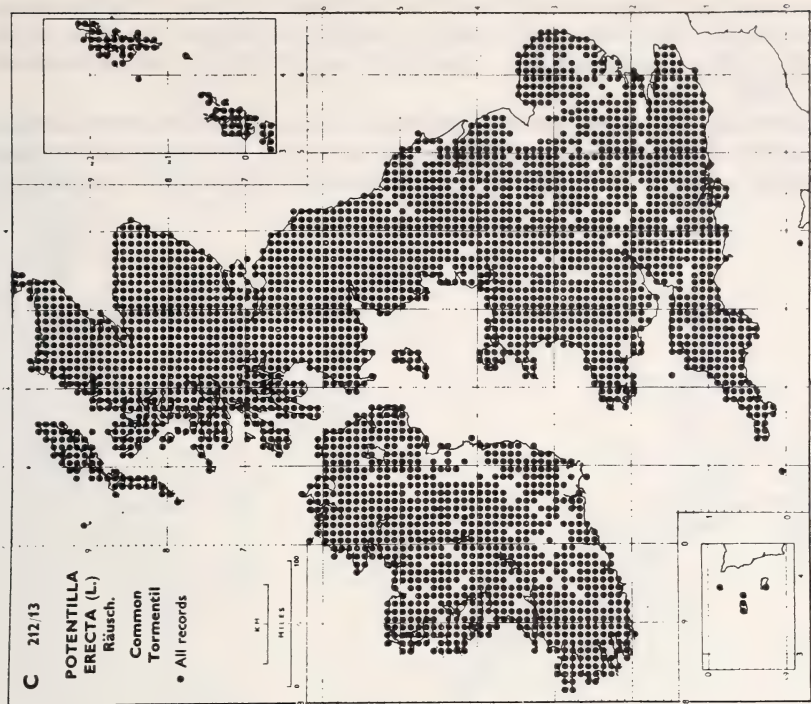
The cultivation experiment established that an upland population of *Potentilla erecta* from Scotland remained distinct from two lowland populations with respect to several characters, and thus apparently constituted a recognisable ecodeme. Consequently, a search was made in the Druce Herbarium, Oxford (OXF), to determine whether phenotypes similar to the Cairngorm population could be found elsewhere in the British Isles. Three different collections were found apparently corresponding to this ecodeme, two from the Cairngorm range of mountains and one from about 500 m in Brecon (central Wales), the latter annotated by Wolf. As a result the search for similar phenotypes was extended to the British Museum (BM), where a number of other collections was found that apparently agreed with the Cairngorm population. The localities were plotted on the 10 km square grid of the Ordnance Survey and a map was produced with the assistance of the Biological Records Centre at Monkswood, Huntingdonshire (Fig. 5). This is compared with an updated version (Fig. 6) of the map of *Potentilla erecta* published in Perring & Walters (1962). All stations of the upland ecodeme are in upland areas of the British Isles, and most are above 500 m (about 1600ft) (Table 4).

TABLE 3. CHARACTERS IN WHICH LOWLAND AND UPLAND POPULATIONS OF *POTENTILLA ERECTA* DIFFER

IN THE FIELD	AFTER CULTIVATION
<i>Lowland (Calgary, Kilbrenan)</i> plant less than 150 mm in total length stem-leaf less than 16 mm in length fruiting pedicel less than 25 mm in length petal less than 4.5 mm in length plant weak and often decumbent leaves not coarsely dentate; teeth rarely exceeding 1.5 mm in length; leaves dentate to $\frac{1}{2}$ way stipules less than 10 mm in length, divided to $\frac{1}{2}$ way	<i>Lowland (Calgary, Kilbrenan)</i> plant less than 200 mm in total length stem-leaf less than 18 mm in length fruiting pedicel less than 30 mm in length not separable from upland populations plant weak and decumbent leaves not coarsely dentate; teeth variable in size stipules less than 10 mm in length, divided to $\frac{1}{2}$ way
<i>Upland (Cairngorm)</i> plant usually more than 150 mm in total length stem-leaf usually more than 16 mm in length fruiting pedicel usually more than 20 mm in length petal usually more than 4.7 mm in length plant stiffly erect leaves coarsely dentate; teeth usually exceeding 1.5 mm in length; leaves dentate to base stipules usually exceeding 10 mm in length, divided nearly to base	<i>Upland (Cairngorm)</i> plant usually more than 150 mm in total length stem-leaf usually more than 14 mm in length fruiting pedicel usually more than 20 mm in length not separable from lowland populations plant erect leaves coarsely dentate; teeth always exceeding 1.0 mm in length stipules more than 10 mm in length, divided nearly to base

TABLE 4. LOCALITIES FOR THE UPLAND ECODEME OF *POTENTILLA ERECTA* IN THE BRITISH ISLES

- v.c. 42 Brecon, Llanwrtyd Wells. G. C. Druce. No date. OXF
v.c. 48 Merioneth, near Barmouth. H. W. Mornington. July 1890. BM
v.c. 64 Mid-W. Yorks., near Grassington. T. J. Foggitt. 24 June 1922. BM
v.c. 66 Durham, Widdybank Fell, GR 35/817.295. A. J. Richards. 29 July 1971. OXF
v.c. 81 Berwick, pathside near Rathburne Ford. E. B. Bangerter. 1 August 1960. BM
v.c. 90 Forfar, rocks above Loch Brandy, 2300 ft. A. H. G. Alston. 6 July 1947. BM
v.c. 95 Elgin, woods of Castle Grant, Grantown-on-Spey. C. Bailey. 25 July 1895. OXF (two sheets)
v.c. 96 Easternness, Boat of Garten. G. C. Druce. 1888. OXF
v.c. 96 Easternness, Coire an Lochan, near Loch, Cairngorm, GR 28/982.028. A. Melderis. 1 July 1953. BM
v.c. 96 Easternness, near White Lady Shieling, Cairn Gorm, GR 28/992.055. A. J. Richards. OXF
v.c. 98 Argyll, Dalmally. G. C. Druce 1885. OXF
v.c. 106 Ross, Fannich. H. J. Riddelsdell. July 1902. BM
v.c.H12 Wexford, between Mount Street, Benedict and Croonford. A. H. G. Alston. 27 June 1952. BM
v.c.H29 Leitrim, Glenade Cliffs. W. C. Barton. 18 August 1913. BM



In all cases the upland ecodeme could be identified by means of the characters listed in Table 3. In a few cases it was not possible to assign a specimen to the lowland or upland ecodemes, but in the great majority the two seemed clear-cut (Figs. 7 & 8).

At this stage in the investigation it appeared that an upland ecodeme, distinct in a number of characters from lowland ecodemes and remaining distinct after cultivation, occurred in a number of widespread localities (and possibly not



FIGURE 7. *Potentilla erecta* subsp. *strictissima*. Drawing of specimen from BM: Rocks above Loch Brandy, Forfar, Scotland, 2300 ft, 6th July 1947. A. H. G. Alston. Annotated by Alston: "approaches var. *strictissima*".



FIGURE 8. *Potentilla erecta* subsp. *erecta*. Drawing of specimen from **BM**: In wood on chalk, Funtingdon, Sussex, England, 14th June 1931. R. Meinertzhagen.

uncommonly) above 500 m in the British Isles, perhaps usually in dwarf-shrub communities. It seemed that this ecodeme was worthy of taxonomic recognition at the subspecific level, so it was necessary to discover whether a similar phenotype had been described elsewhere.

Two British specimens of this ecodeme had been identified as *Potentilla erecta* var. *strictissima* (Zimm.) Hegi, namely:

1. Brecon, Llanwrtyd Wells. G. C. Druce. **OXF**. This specimen is annotated

by T. Wolf: '*Potentilla tormentilla* (Crtz.) Neck. var. *strictissima* (Zimmerer) Focke, quae flores habet multo majores quam aliae varietates'.

2. Forfar, rocks above Loch Brandy, 2300 ft. *A. H. G. Alston*. 6 July 1947. **BM**. This is annotated by Alston: 'approaches the var. *strictissima* (Beck) Focke in Wolf's key on p. 645 of the monograph'. (Fig. 7).

It appears that the former record is responsible for the inclusion of var. *strictissima* by Druce (1928) in his *British Plant List*. Both specimens closely match material of the Cairngorm population as it appears in the field. The basionym of *P. erecta* var. *strictissima* seems to be *P. strictissima* Zimmerer (1884, p. 5), the original description of which is as follows:

'Caudiculis stricte erectis, apice tantum dichotomis, paucifloris, ramis non divergentibus, foliolis oblongo-lanceolatis, sessilibus, magnis, interdum aliquantum sericeis, incise et acute serratis; stipulis magnis profunde incisis, incisuris lanceolatis'.

My translation of this Latin description is:

'Stems rigidly erect with the apex somewhat dichotomously branched, few-flowered, with the branches not spreading; leaflets oblong-lanceolate, sessile, large, sometimes somewhat sericeous, deeply and sharply serrate; stipules deeply divided with lanceolate divisions'.

This description might refer to the Cairngorm population, but is somewhat vague as to the essential features of this variant. However, in Hegi (1922, p. 883) there is a German description of *Potentilla erecta* var. *strictissima* (Zimm.) Hegi, which translates as follows: 'Stem strong, mostly erect, to 50 cm, simple or 1-2-branched only in upper part, few-flowered. Leaflets large, to over 3 cm long, sessile, coarsely dentate, sparsely or moderately hairy, often glabrescent above, often densely hairy on nerves below. Bracts often over 2 cm long, deeply 3-partite. Petals large, considerably exceeding sepals'.

This description resembled that of the Cairngorm population closely and I felt it worthwhile obtaining authentic material of *P. strictissima*. I have been unable to trace any material collected by Zimmerer, but a specimen at the Botanical Museum, Zürich University (**Z**), was collected by H. Siegfried in June 1884; it was checked by Zimmerer, who acknowledged the collector when he published *P. strictissima* in November 1884. This specimen (Fig. 9), which is very similar to the Cairngorm population, is here selected as the lectotype for *P. strictissima*. The details are as follows:

Potentilla strictissima Zimm., teste A. Zimmerer. Hoch. Wülflingen, c 550m [near Winterthur, Switzerland], 13.6.1884. *H. Siegfried*. **Z**.

A search in the European herbarium at **BM** revealed a further eighteen specimens similar to the British upland ecodeme, including seven labelled *P. strictissima*, and there are eight specimens at the Botanical Museum of the Technical High School, Zürich (**ZT**), also labelled *P. strictissima*, which closely resemble the British plant. They include two exsiccatae:

1. *Potentilla strictissima* Zimmerer. Tirolia australis: in locis fruticosis apricis vallis 'Vestino' in Judicaria. Solo calcareo. 15.7.1893. *P. Porta*.
2. Flora Exsiccata Austro-Hungarica 2836. *Potentilla strictissima* Zimmerer.



FIGURE 9. *Potentilla erecta* subsp. *strictissima*. Drawing of part of lectotype specimen (for details see p. 310).

Austria superior. Ad ripas graminosas rivi 'grosser Weissenbach' prope pagum Reichramring. *Steininger*.

Although there is little doubt that the upland ecodeme of *P. erecta* in the British Isles is the same as *P. strictissima*, there being a very close resemblance to and no important differences from the lectotype, other Continental material, and Hegi's description, there remains the question of the taxonomic rank to which it should be referred. It is clear that it is genetically distinct from lowland plants with regard to several morphological characters and that it is ecologically and geographically distinct, at least in the British Isles. Thus, it would seem to warrant a higher rank than *varietas*. The distinction between species and subspecies can be a delicate one, in which much is left to the taste of the taxonomist. In the present case, it appears that interbreeding between the ecodemes can and does occur on occasions (see below), and there is no indication that a barrier to gene-exchange exists apart from that imposed by habitat differences. Although several character differences are found, these are quantitative, and both ecodemes would seem to fall into the same species when interspecific differences in the remainder of section *Potentilla* are considered. In fact I see no reason why subspecies should not be adopted in the circumstances, although opinions have differed in the past, and may well differ in the future.

I have examined the sheet of *Tormentilla erecta* in the Linnaean herbarium in London (LINN). There are three specimens, one larger than the others, but all clearly belong to the lowland British ecodeme and are quite different from subsp. *strictissima*. Thus the lowland British ecodeme is subsp. *erecta*.

As a result I have decided to make the following new combination:

POTENTILLA ERECTA (L.) Räuschel

Subsp. STRICTISSIMA (Zimmerer) A. J. Richards, **comb. et stat. nov.**

Potentilla strictissima Zimmerer, Europ. Art. Potentilla, p. 5 (1884)

Potentilla erecta var. *strictissima* (Zimmerer) Hegi, Illustrierte Flora von Mittel-Europa, 4: 883 (1922)

Subsp. *strictissima* differs from subsp. *erecta* as follows (Figs. 7 & 8):

Plant stiffly erect, usually exceeding 150 mm in maximum length. Stem-leaves coarsely and acutely serrate to base, usually exceeding 20 mm in length; radical leaves coarsely and obtusely serrate, leaflets oblong-lanceolate to obovate; stipules long, usually exceeding 10 mm, divided almost to base. Peduncles exceeding 20 mm in fruit, erect, stiff. Flowers sparse, exceeding 11 mm in diameter; petals exceeding 4.5 mm in length.

Dwarf-shrub heath, or less commonly in grassland, on peat or mineral soils, usually above 500 m in the British Isles. Not uncommon, and doubtless under-recorded at present, but apparently local: Brecon, Merioneth, Mid-W. Yorks., Durham, Berwick, Scottish Highlands from Argyll to W. Ross, Wexford and Leitrim (Fig. 5, Table 4).

It is recorded in the literature from much of the European range of *P. erecta* subsp. *erecta*, although only a thorough survey of the herbaria would reveal to what extent these records are correct. Literature records have been traced from Austria, France, Germany, Hungary, Italy, Sicilia, Poland, Switzerland, Yugoslavia and several districts of the U.S.S.R., including the Ukraine, Caucasus, central Urals and parts of Siberia. In most areas it seems to be alpine or sub-

arctic in distribution, being mostly restricted to high mountains in central Europe although intergrading with subsp. *erecta* at lower altitudes (Hegi 1922). I have examined the European collection at **BM**, where specimens from the following countries agree with subsp. *strictissima*: Austria, Belgium (at 250 m), Bulgaria, Finland, Norway, Sweden, Poland and the Ukraine.

I became acquainted with the work of Vasari (1968) after I had reached the tentative conclusion that the British upland ecodeme merited subspecific status and that subsp. *strictissima* would be its correct name. I was thus very interested to find that Vasari, who had conducted a very thorough genecological survey of *P. erecta* in Finland, had reached similar conclusions about the race from isolated bog habitats in northern Finland, which is north of the main distribution of the species in that country. Like Juzepczuk (1959), Vasari (1968) suggested that this race may be referable to *P. strictissima*, as, following the description given by Wolf (1908), it shares with that species a low degree of branching, a small number of flowers, leaves which are longer than 3 cm and tend to be glabrous, and a red stem. However, he pointed out that the Finnish race is much smaller than *P. strictissima*. From the characters mentioned, and from his Fig. 7, it seems that this northern race cannot be placed here, and Vasari (pers. comm., 1972) now concurs with this opinion. Further, a number of the points in the descriptions of Hegi and Zimmeter (for instance: large flowers; strong, erect, rigid stems; sharply and deeply serrated leaves; and large, deeply divided stipules) were not mentioned by Vasari, although these characters are all typical of the upland British plant. In fact, the plant illustrated by Vasari in his Fig. 6 as the southern Finnish race bears a strong resemblance to subsp. *strictissima* and may well be referable to this taxon. I have found herbarium material of subsp. *strictissima* from a number of localities in southern Finland, Sweden and Norway at **BM**. Vasari (pers. comm.) suggests, no doubt rightly, that the northern Finnish race is a new subspecies, and agrees that most of the southern race can be referred to subsp. *strictissima*, although plants from the southern extremity of Finland seem to be subsp. *erecta*.

CYTOLOGY

There are published chromosome counts of *P. erecta* from the British Isles, Holland, Iceland, Finland and Poland. In all cases $2n = 28$, a tetraploid count, is reported. I can find no chromosome reports of plants which from morphological or ecological considerations might be subsp. *strictissima*, and it was decided to examine some British material of both subspecies.

MATERIAL

Plants were collected under licence from *Calluna* heath on peat at 1650 ft (500 m) on Widdybank Fell, Upper Teesdale, Co. Durham, England, during July 1971. This site was chosen partly for convenience and partly because both subspecies appear to grow together at this station (no other site is at present known in Britain where this occurs).

METHOD

The plants were potted in John Innes No. 3 compost and were grown in a greenhouse. After two months they were sufficiently established for root-tips to be

examined. These were excised and pretreated in a saturated solution of 1-bromonaphthalene for 2 hours. They were fixed in a freshly made mixture of 3:1 (v/v) absolute alcohol: glacial acetic acid overnight and hydrolysed for 8 minutes in normal HCl at 60°C. Staining in Feulgen Reagent for 2 hours preceded squashing in acetocarmine.

RESULTS

Useful preparations were obtained for 9 individuals. 4 of these were referable to subsp. *strictissima*, 3 to subsp. *erecta* and 2 were intermediate. In all 9 the count $2n = 28$ was recorded. Several cells were examined from each of 2 to 4 root-tips per individual and, in all, some 75 cells were examined. No cytological variation was observed. The chromosomes are small (1.0–1.4 μm in length) and rather characterless.

DISCUSSION

It will be clear that the investigations reported here were not designed as a thorough genecological survey of *Potentilla erecta*. The experiments were intended as a preliminary investigation, but from these arose data of taxonomic interest which were considered to merit publication. Much more thorough genecological surveys have been published by Vasari (1968) and Watson (1969), and cytogenetic surveys by Matfield *et alii* (1970). The sample sizes employed in the present survey were too small for statistical treatment and no study was made of filial populations. However, it is instructive to consider the present report in the light of previous work.

Watson (1969) showed that genetic differentiation may occur in *P. erecta* over very small distances (about 5 m) at a sharply defined ecotone and concluded that differentiation is maintained through contrasting selection pressures in adjacent habitats, and is aided by habitat conservatism in pollinators. She pointed out that *P. erecta* is entomophilous and self-incompatible, requiring cross-pollination for reproduction to occur. Nevertheless, analysis of families grown from seed showed that some considerable gene-exchange occurred between individuals in different habitats. Watson's populations came from Scotland (the altitude is not mentioned), but were not from dwarf-shrub communities. Of the character discriminants reported in the present work, only plant-length was found by Watson to differ between habitats, and the other characters that she found to differ are probably developmentally linked to plant-length, as she herself commented. However, Watson's work is important in the present context in demonstrating that *P. erecta* is a variable species that readily undergoes genotypic differentiation. It should be noted that the Calgary and Kilbrenan populations in the present study show no such differentiation after cultivation.

Vasari (1968) also demonstrated some genotypic differentiation, but in this case it was dominated by a clear-cut difference in 5 characters (none of which has been examined quantitatively in the present study) between southern and northern populations in Finland. These characters are:

- the branching of the stem and inflorescence
- anthocyanin coloration (not varying in British material)
- length/breadth ratio of terminal leaflets (measured in British material but

discounted in favour of length alone)
hairiness of leaflets
number of styles per flower.

It would appear that most of Vasari's southern race may be referable to subsp. *strictissima*. This race he finds common and widespread in a clearly demarcated zone of southern Finland, in which it occurs in a wide range of acidic habitats, although usually on mineral soils. He suggested that, while the northern race may have entered Finland from the north and east, the southern race migrated from the south during the Post-Glacial climatic optimum. Although the position with regard to subsp. *strictissima* and subsp. *erecta* in southern Fennoscandia is not yet clear, an examination of herbarium specimens shows that both subspecies occur in Sweden and Norway and in southern Finland, while another race is found in the north. Vasari and I agree (pers. comm.) that his northern race is a new subspecies and is not equivalent to var. *strictissima* as had been earlier suggested. Elsewhere in its range, subsp. *strictissima* seems usually to occur at a greater altitude than subsp. *erecta*.

At present subsp. *strictissima* is only recorded from 14 sites in the British Isles (Table 4). These sites have been traced through an examination of only two herbaria, although perhaps 600 gatherings of *P. erecta* have been examined in all. Many gatherings from upland sites have proved to be subsp. *erecta* and a search in suitable habitats in northern England in August 1971 confirms the suspicion that subsp. *strictissima* is local and apparently absent from many suitable sites. Nevertheless, it is likely that many stations for this subspecies remain undiscovered and that it is widespread, if local, in suitable habitats above 500 m.

In only one case so far in Britain has it been shown that the two subspecies occur together. In nearly all stations there are few problems of identification, the plants being readily identified with one of the two subspecies. However, on Widdybank Fell, Co. Durham, both occur, and some intermediates were noted in the field there by Vasari and myself. Thirteen of these brought into cultivation are maintaining their intermediate status. At this station, communities dominated by *Calluna* occur in juxtaposition with limestone grassland at 500 m. Subsp. *erecta* is confined to the limestone, and subsp. *strictissima* to the *Calluna*-dominated peat, where intermediates are also found, although the latter are commonest in transition zones.

Zimmerer (1884) noted that subsp. *erecta* and subsp. *strictissima* sometimes occur together in central Europe, and Hegi (1922) has recorded intermediates from the same area. Vasari (1968) showed that some populations occurring in the boundary zone between the northern and southern Finnish races are intermediate, and a recent examination of his herbarium material has revealed that all three sorts of intermediate between the northern race (as yet unnamed), subsp. *erecta* and subsp. *strictissima* are occasionally found in Finland. It is likely that, although each of these races originated in isolation, they meet in geographically and ecologically intermediate stations in Finland, and that the resulting hybridisation can give rise to new genetic combinations which are more successful in the intermediate habitats in which they are found, and which are not identifiable with any of the three subspecies. Intermediates do not seem to be very common in Finland, however, and in both Finland and the British Isles they would seem to be sufficiently infrequent to allow the subspecific separation of the races.

We may assume that the subspecies are usually kept separate through environmental pressures. The high-altitude dwarf-shrub communities favoured by subsp. *strictissima* in the British Isles (and in central Europe?) are substantially different from the majority of communities in which subsp. *erecta* is found, and at least some of the characters of the former could be interpreted as being of advantage in the dwarf-shrub community. The stiff, erect, long stems would enable it to compete with the relatively tall *Empetrum* and *Calluna* with which it grows; the larger flowers would enhance their visibility in this tall community; and the long pedicels would similarly aid seed dispersal. However, dwarf-shrub communities are also found at low altitudes, where *P. erecta* is not frequent and in the British Isles occurs only as the subsp. *erecta*. It may be that subsp. *strictissima* maintains a physiological advantage at high altitudes and latitudes, perhaps enabling it to survive low temperatures more readily, and that this adaptation confers a disadvantage in warmer areas, possibly with respect to growth rates. This much is conjecture, but one may assume that subsp. *strictissima* is adapted to colder habitats, being apparently restricted to upland or northern sites.

The wide distribution of subsp. *strictissima* through much of Europe suggests that it may have once inhabited lowland areas from which it is now largely absent (although a relatively low altitude record from Belgium is of interest). It may be an arctic-alpine relic, surviving from the Full-Glacial period. Alternatively, it may have arisen more recently, and have spread in relatively cool conditions, as in the Pre-Boreal or Boreal periods. Whatever the means of origin and spread, it seems likely that subsp. *strictissima* is found in upland and northern areas of Europe as a relic from colder times, only able to survive in conditions resembling the period in which it evolved.

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REFERENCES

- BALL, P. W., PAWLOWSKI, B. & WALTERS, S. M. (1968). *Potentilla*, in TUTIN, T. G., *et alii*, ed. *Flora Europaea*, 2: 36–47. Cambridge.
- DRUCE, G. C. (1928). *British Plant List*, 2nd ed., p. 36. Arbroath.
- HEGI, G. (1922). *Potentilla*, in *Illustrierte Flora von Mittel-Europa*, 4: 809–892. Munich.
- JUZEPCZUK, S. V. (1959). *Comarum*, *Potentilla*, *Alchemilla*, in POJARKOVA, A. I., ed. *Flora Murmanskoy Oblasti*, 4: 70–84, 96–110. Moscow & Leningrad.
- MATFIELD, B., JONES, J. K. & ELLIS, J. R. (1970). Natural and experimental hybridisation in *Potentilla*. *New Phytol.*, 69: 171–186.
- PERRING, F. H. & WALTERS, S. M., ed. (1962). *Atlas of the British Flora*, p. 122. London.
- VASARI, Y. (1968). Studies on the racial variation of *Potentilla erecta* (L.) Rausch. in Finland. *Aquilo (Bot.)*, 7: 57–87.

- WARBURG, E. F. (1962). *Potentilla*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F., *Flora of the British Isles*, 2nd ed., pp. 380–389. Cambridge.
- WATSON, P. J. (1969). Evolution in closely adjacent plant populations, VI. An entomophilous species, *Potentilla erecta*, in two contrasting habitats. *Heredity*, **24**: 407–422.
- WOLF, T. (1908). Monographie der Gattung *Potentilla*. *Bibliotheca bot.*, **71**: 1–714.
- ZIMMETER, A. (1884). *Die europäischen Arten der Gattung Potentilla*. Steyr.
- ZIMMETER, A. (1889). Beiträge zur Kenntnis der Gattung *Potentilla*. *Programm K. K. ober-Realschule Innsbruck*, **1889**: 1–36.

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Observations on some critical Bromegrasses

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ABSTRACT

A group of critical bromegrasses (in *Bromus* L. section *Bromus*) is defined. Critical characters which may be used to distinguish the taxa are listed and illustrated. The status, variation and relationships of *B. grossus* Desf. ex Lam. & DC., *B. secalinus* L., *B. pseudosecalinus* P. M. Smith, *B. commutatus* Schrad., *B. racemosus* L. and *B. multiflorus* J. E. Smith non Weigel are examined, and a key is provided. It is suggested that *B. commutatus* and *B. racemosus* hybridise in Britain. An account of the known distribution of *B. pseudosecalinus* is given, with a map.

INTRODUCTION

The grasses in the annual section *Bromus* of the genus *Bromus* L. (Smith 1970, 1972) have for two centuries been regarded as a critical group. This paper attempts to identify the reasons for this with respect to species which are found in Britain. Species involved in the discussion, not all of which are native to Britain, are listed in Table 1 with their somatic chromosome numbers. The confusion of species in this section has been partly due to the difficulty of communicating certain of their subtle differences on the printed page. It is hoped that the key, the table of principle differences (Table 2) and the illustrations, provided below, will lessen this problem.

This account does not discuss the bromegrasses related to the *Bromus hordeaceus* aggregate, which were the subject of a previous paper (Smith 1968a). For reasons developed in the text, the present account concentrates on six taxa only, viz. *Bromus multiflorus*, *B. grossus*, *B. secalinus*, *B. pseudosecalinus*, *B. commutatus* and *B. racemosus*.

TABLE 1. CRITICAL SPECIES OF *BROMUS* SECTION
BROMUS MENTIONED IN THE TEXT

Name of species	Somatic chromosome number (2n)
<i>B. hordeaceus</i> L.	28
<i>B. lepidus</i> Holmberg	28
<i>B. racemosus</i> L.	28
<i>B. commutatus</i> Schrad.	28
<i>B. interruptus</i> (Hack.) Druce	28
<i>B. arvensis</i> L.	14
<i>B. secalinus</i> L.	28
<i>B. grossus</i> Desf. ex Lam. & DC.	28
<i>B. bromoideus</i> (Lej.) Crép.	28
<i>B. pseudosecalinus</i> P. M. Smith	14
<i>B. squarrosus</i> L.	14

HISTORICAL ASPECTS

Linnaeus changed his concept of some of the species of *Bromus* several times (Smith 1968a) and when his specific names were uncritically taken up by botanists outside Sweden a number of mistaken typifications occurred. Linnaean binomials were applied not only to material of the wrong Linnaean species, but also to taxa unknown to Linnaeus himself. Gradually there arose a confused situation where the limits of no species were properly recognised, and where the synonymy grew more complex and intractable every year.

Some eighteenth century botanists appreciated the difficulty of ensuring the correct use of Linnaeus' binomials in other territories. One solution in critical genera was to lump all or most of the awkward species into a single taxon. Thus Hudson (1762) put them all into *B. polymorphus* Hudson.

Among the first efforts to clarify the taxonomy of these brome-grasses were those of Sir James Edward Smith. With the powerful advantage given by his personal acquisition of the Linnaean herbarium and library, he tried, not without some success, to correct the record, at least so far as the British flora was concerned. His *Observations on the British species of Bromus* (Smith 1798) marked a useful advance in our understanding of these very variable plants. Even though he included *Brachypodium silvaticum* (Huds.) Beauv. and *B. pinnatum* (L.) Beauv. in the genus, he decided that Linnaeus' *Bromus giganteus* should be transferred to *Festuca*.

In British material J. E. Smith was able to distinguish six species in the section *Bromus*, and he firmly discounted the idea that all were varieties of a single polymorphic species. These six species are listed below:

<i>B. secalinus</i> L.	<i>B. racemosus</i> L.
<i>B. multiflorus</i> J. E. Smith non Weigel	<i>B. squarrosus</i> L.
<i>B. hordeaceus</i> L. (with var. <i>nanus</i> Weigel)	<i>B. arvensis</i> L.

He satisfied himself that the Linnaean names he used were correctly applied. Since then, other studies of the Linnaean specimens (Munro 1861, Smith 1968a) have confirmed that these names applied to British material are compatible with Linnaeus' identifications of his own plants.

Not everyone was persuaded of the distinctness of these taxa. Bentham (1858) amalgamated *B. arvensis*, *B. secalinus*, *B. hordeaceus* and *B. racemosus*, together with a fifth species, *B. commutatus* Schrad., under *B. arvensis*. Such was Bentham's authority that this treatment was retained up to the last revised edition of his work.

Of J. E. Smith's six taxa, *B. arvensis* and *B. squarrosus* are now well understood and are known to occur only as casuals in Britain. The variation in *B. hordeaceus* L. has been discussed by Smith (1968a).

Holmberg (1924) used the texture of the glumes and lemmas to separate two groups of annual brome-grasses (Smith 1972). Of British species, *B. hordeaceus*, *B. lepidus* and *B. interruptus* fall into the group Molles, with thin, papery lemmas (Smith 1968a). Holmberg's second group, Coriacei, included species with thicker, hornier lemmas and glumes. The remaining three species from J. E. Smith's list, *B. secalinus*, *B. racemosus* and *B. multiflorus*, belong here.

Since the time of Linnaeus and J. E. Smith, other species with horny lemmas and glumes have been described, and all have at least a morphological affinity with northern and western European species included in Coriacei by Holmberg. Not

all these species are well described or illustrated in the literature and not surprisingly they have often been poorly understood and confused by collectors. Seed proteins of all these species have now been studied serologically and found to be rather similar, with the exception of *B. pseudosecalinus* (Smith 1972). The list below is of the species with horny lemmas which are involved:

<i>B. bromoideus</i> (Lej.) Crép.	<i>B. pseudosecalinus</i> P. M. Smith
<i>B. commutatus</i> Schrad.	<i>B. racemosus</i> L.
<i>B. grossus</i> Desf. ex Lam. & DC.	<i>B. secalinus</i> L.
<i>B. multiflorus</i> J. E. Smith non Weigel	

Bromus bromoideus is (or was, for it is probably extinct in the wild) an endemic of the Ardennes region of Belgium and France, where it contaminated fields of spelt (*Triticum spelta* L.). With improved seed-cleaning techniques and a decline in spelt cultivation, the weed species has declined in abundance and probably has now been lost. So closely is it related to *B. grossus* in terms of genetics, geographical distribution and morphology, that Tournay (1968) regarded it as a subspecies of that taxon. Nevertheless it is so easily identified by its unique marginal lemma tooth that it cannot be regarded as critical. For British botanists it can be of only academic interest.

The rest of the species are difficult to identify because of their variability and the subtlety of their diagnostic characters. Communication of accurate descriptions has been bedevilled by confusion of juvenile and depauperate states, and by the overweighting of trivial characters, e.g. spikelet indumentum. The six species can be arranged in three groups within which it is difficult to delimit and identify the constituent taxa. These three groups are discussed and illustrated below in terms of their similarities and differences and possible explanations of the variation observed. The principal distinguishing features of the five species which are here recognised are summarised in Table 2.

CLASSIFICATION AND BIOSYSTEMATICS

1. *Bromus grossus* Desf. ex Lam. & DC. *B. multiflorus* J. E. Smith non Weigel, and *B. secalinus* L.

Bromus grossus is a plant of spelt fields mainly in the Ardennes and has decreased in frequency with the decline of spelt as a crop (Cugnac & Camus 1936). It survives at least in Belgium (Tournay 1971 *in litt.*). Adaptations which it shows to life as a weed of cereal fields are similar to those more familiar to British botanists in the rye-brome, *B. secalinus*. These are chiefly the slow disarticulation of the spikelet and the large, longitudinally rolled or furrowed caryopsis which is enclosed by the inrolled lemma and mimics the size and shape of the grain of the cereal crop. The difficulty of separating weed and crop caryopses led to the wide distribution and abundance of *B. secalinus* and *B. grossus* in the recent past. Tournay (1968) meticulously studied the variation of these two taxa, and of their close relative *B. bromoideus*. The principal differences between the former two are incorporated in Table 2. They are completely interfertile (Cugnac & Camus 1936).

B. grossus is larger in all its parts than *B. secalinus*, but robust specimens of the latter have frequently been mistaken for *B. grossus*. On the basis of actual specimens, or measurements in the literature, Tournay (1968) concluded that

TABLE 2. PRINCIPAL DISTINGUISHING FEATURES OF *B. GROSSUS*,
B. SECALINUS, *B. PSEUDOSECALINUS*, *B. COMMUTATUS* AND
B. RACEMOSUS

Character	Character-state				
	<i>B. grossus</i>	<i>B. secalinus</i>	<i>B. pseudo-secalinus</i>	<i>B. commutatus</i>	<i>B. racemosus</i>
Hairs on lower leaf-sheath	absent, rarely sparse	absent, rarely sparse	present	present	present
Panicle-shape	spreading, later drooping	secund	erect, stiff	erect, later drooping	erect, narrow, sometimes drooping later
Spikelet-length (mm)	18-50	10-30	8-12	15-25	10-15
Spikelet-width (mm)	9-13	5-9	2-4	4-6	3-5
Hairs on spikelet	present or absent	present or absent	absent	present or absent	absent
Disarticulation of mature spikelet	slow	slow	slow	rapid	rapid
Awns on glumes	always present	very rarely present	absent	absent	absent
Lemma-length (mm)	10-14	6.5-10	5-6	8-11	6.5-8
Shape of lemma in transverse section	± terete	± terete	± terete	± terete	somewhat compressed laterally
Position of mature lemmas	divaricate	divaricate	divaricate	imbricate	imbricate
Marginal angle of lemma	blunt	blunt, sometimes absent	blunt	blunt	absent
Margins of mature lemma	rolled around caryopsis	rolled around caryopsis	rolled around caryopsis	free	free
Lemma-apex	not cucullate	not cucullate	not cucullate	not cucullate	cucullate
Anther-length (mm)	2-3	1-2	1.25-1.75	up to 1.5	1.5-3
Margins of mature caryopsis	inrolled	inrolled	inrolled	free	free
Relative length of caryopsis	markedly shorter than lemma	equalling lemma	slightly shorter than lemma	slightly shorter than lemma	slightly shorter than lemma
Thickness of mature caryopsis	thick	thick	thin	thin	thin
Length of basal internode of rachilla (mm)	1.5-2	0.75-1.5	0.5-0.75	c 1.5	0.5-1

B. grossus has been reliably recorded as an indigenous plant only in Belgium, France, Luxembourg, S. Germany, Switzerland, N. Italy, W. Austria and W. Czechoslovakia. In Britain the only apparently genuine record is from Wiltshire (Grose 1957). Many other reports of *B. grossus* are certainly errors for *B. secalinus*.

The appearance of these two species is illustrated in Figs. 1 & 2 and Plates 1 & 2.

Tournay (1968) commented on the uncertainty of identity of material, particularly from Britain, which is named *B. multiflorus* J. E. Smith. Although Smith (1798) cited Weigel as the source of this name, it is clear from his very full account of the plant that *B. multiflorus* Weigel (= *B. arvensis* L.) is *not* intended. Therefore he misapplied the name. Tournay considered it possible that some of

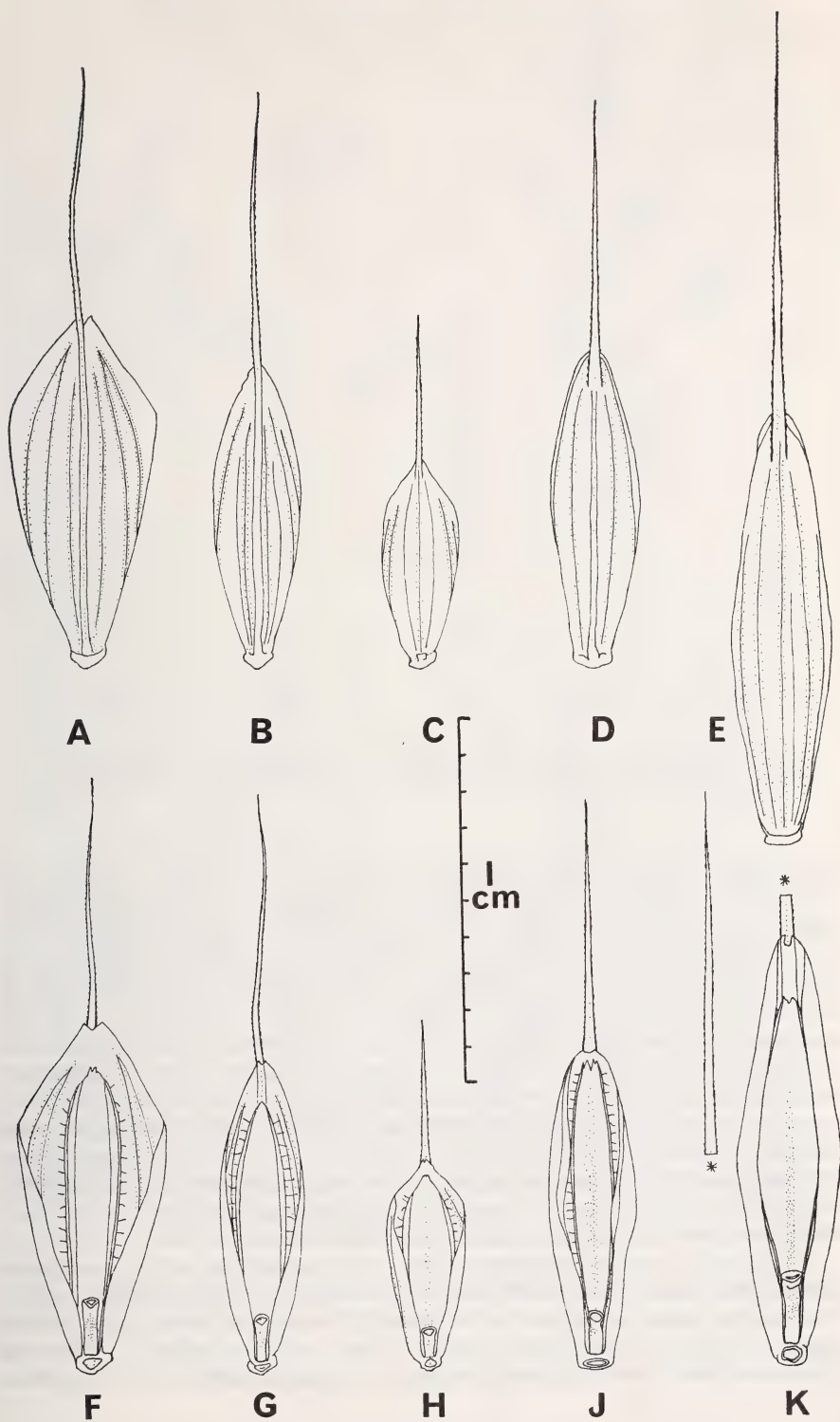


FIGURE 1. Abaxial (A-E) and adaxial (F-K) views of basal florets: A & F. *Bromus commutatus*; B & G. *B. racemosus*; C & H. *B. pseudosecalinus*; D & J. *B. secalinus*; E & K. *B. grossus*.

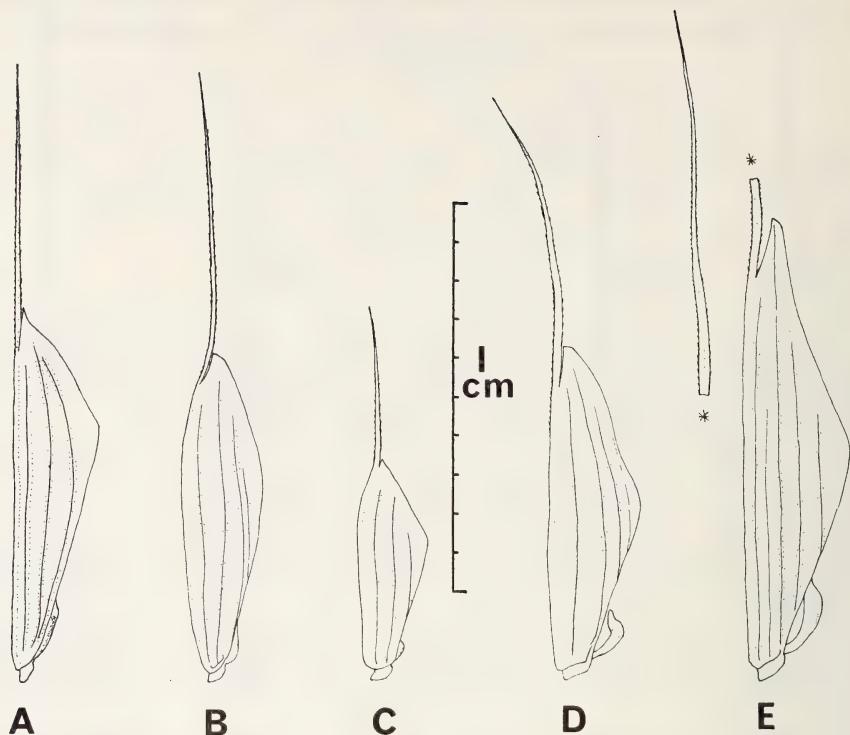


FIGURE 2. Side views of basal florets: A. *Bromus commutatus*; B. *B. racemosus*; C. *B. pseudosecalinus*; D. *B. secalinus*; E. *B. grossus*.

the material referred by British botanists to *B. multiflorus* sensu J. E. Smith *non* Weigel is in fact *B. grossus*. The figures of *B. multiflorus* provided in *English Botany* (Smith & Sowerby 1808) confirm that Smith did not intend his name to be a synonym of *B. arvensis*, but they do not closely resemble *B. grossus*. In his *English Flora* (Smith 1824) J. E. Smith recorded that Schrader had told him of the true application of Weigel's *B. multiflorus* (i.e. to *B. arvensis*), and that he now named his own plant *B. velutinus* Schrader (*Fl. Germ.*, 1:349, t.6, f.3 (1806)). Smith adopted the name *B. velutinus* Schrader in his *English Flora*, but nevertheless he indicated that Schrader's material differs from British specimens in having fewer florets less closely packed together and with the lemma investing the grain less tightly. His acceptance of *B. velutinus* Schrad. as a synonym of *B. multiflorus* J. E. Smith *non* Weigel therefore seems to have been rather grudging. *B. velutinus* Schrad. is now recognised as a synonym of *B. grossus* Desf. ex Lam. & DC., which was presumably what Schrader sent for Smith's inspection.

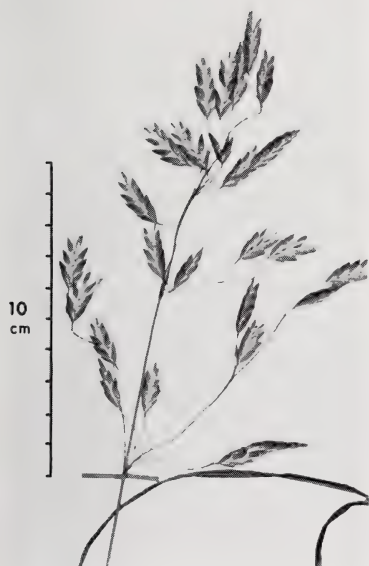
J. E. Smith's original description and observations on his *B. multiflorus* (Smith 1798) do not leave much room for doubt about what he actually meant. The common name he supplied for the plant is 'Downy Rye-brome grass', which surely underlines his statement that this plant and *B. secalinus* L. ('Smooth Rye-brome grass') are very closely related. It was said to differ from *B. secalinus*



A



B



C



D

PLATE 1. Panicles of *Bromus* species: A. *B. grossus* (one node only); B. *B. secalinus*; C. *B. commutatus*; D. *B. racemosus*.

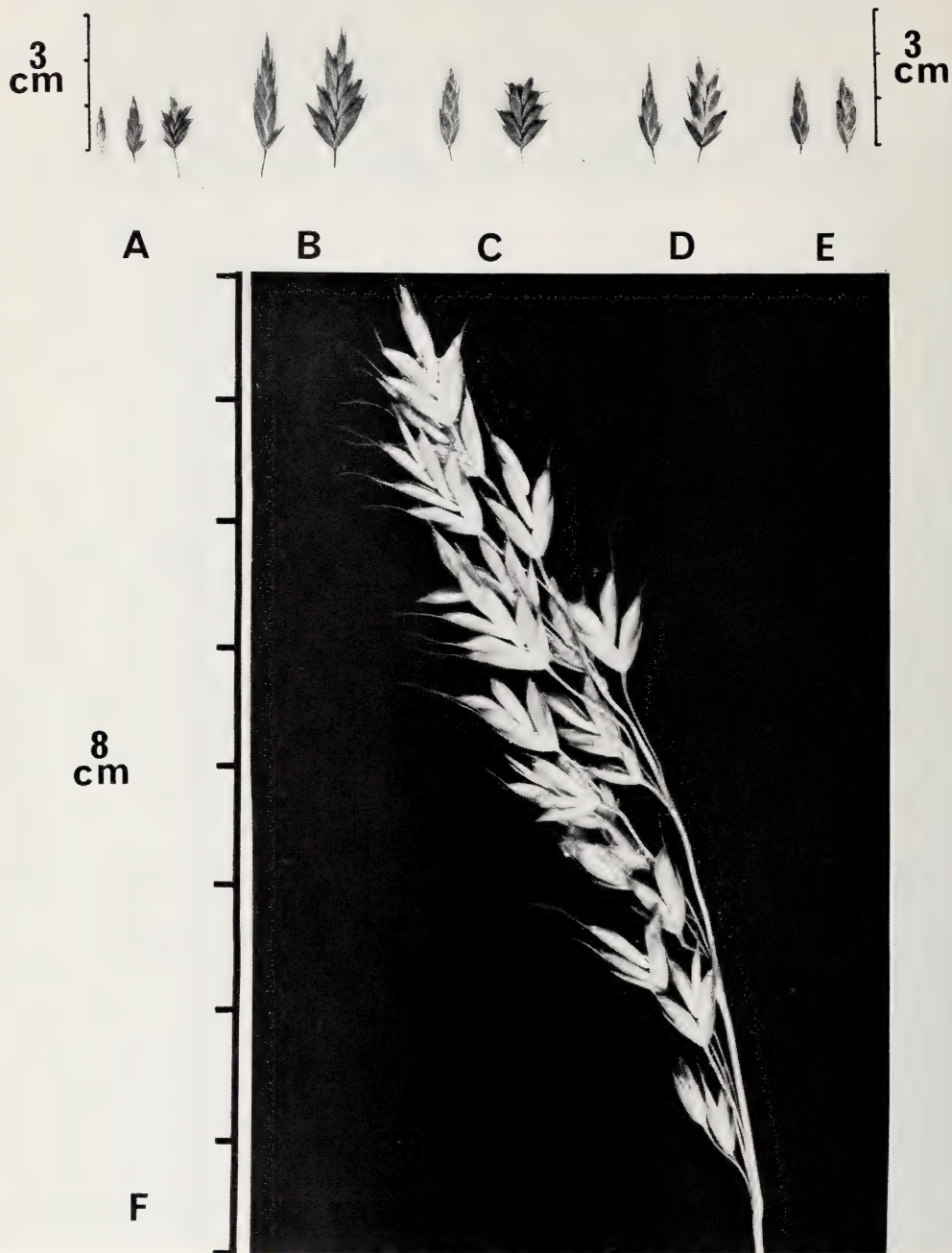


PLATE 2. A-E: Young and mature spikelets of *Bromus* species: A. *B. pseudosecalinus*; B. *B. grossus*; C. *B. secalinus*; D. *B. commutatus*; E. *B. racemosus*. F: Mature panicle of *Bromus pseudosecalinus*.

mainly in its larger number of florets, in its usually hairy spikelets, and in the fact that its florets are more imbricate at maturity.

Thus it seems clear from Smith's account that he sought to divide the material which we now refer to *B. secalinus* into two groups. In one the plants have a larger number of florets (12–16) and hairy spikelets; this is *B. multiflorus* J. E. Smith *non* Weigel. The other group is of grasses with fewer florets (9–12) and usually glabrous spikelets; this group he named *B. secalinus* L. Probably *B. multiflorus* J. E. Smith *non* Weigel therefore consists of robust specimens of *B. secalinus* which develop more florets in the spikelet owing mainly to their growth in richer soils. It is certainly true that specimens of *B. secalinus* with glabrous spikelets are much rarer in Britain than are those with hairy ones. It may therefore be anticipated that robust specimens, which are in any case more often noticed and collected, will usually have hairy spikelets.

Nowhere in his descriptions of his *B. multiflorus* did J. E. Smith comment on differences in the size of the glumes and lemmas, in the development of awns on the glumes, or in the shape of florets and spikelets, such as occur between *B. secalinus* and *B. grossus*. They are unlikely to have been overlooked by so careful a botanist as J. E. Smith. When eventually he saw a specimen of *B. grossus* (as *B. velutinus* Schrad.) he at once noticed how it differed from British material in having looser margins to the lemmas.

The name *B. multiflorus* J. E. Smith *non* Weigel persists in herbaria up to the present. I have examined plants so named from major British herbaria. In all cases the name has been applied to unusually robust or many-flowered variants of *B. secalinus*. Foreign specimens of *B. grossus* are occasionally found in these folders but I have found among them no plant originating in the British Isles which is not referable to *B. secalinus* or, in a few cases, to *B. commutatus*.

An examination of the plants of *Bromus* in the Smith herbarium, which is kept by the Linnean Society of London (LINN), shows that Smith's *B. multiflorus* (Sheet 133.5) is undoubtedly a variant of *B. secalinus* with unusually numerous florets in the spikelets. His herbarium contains no plants of *B. grossus* of British origin, but several European specimens which may have been sent to him by Schrader under the name *B. velutinus* Schrad. He altered his identifications of his own specimens of *B. multiflorus* to *B. velutinus* Schrad.

Taking all these considerations into account it seems safe to assume that *B. multiflorus* J. E. Smith *non* Weigel is not synonymous with *B. grossus* Desf. ex Lam. & DC., and that the latter plant has never been indigenous to the British Isles.

It has proved difficult to obtain living material of *B. grossus* for observation and experiment. I am grateful to Professor A. de Cugnac for supplying living material recently. Plate 1A is of a portion of a fruiting panicle of *B. grossus*. In earlier work on the species relationships of annual bromes (Smith 1972) it was not possible to provide serological evidence of the affinities of this interesting species. From knowledge of morphology and crossability, a strong relationship with *B. secalinus* and *B. bromoideus*, and a slightly weaker one with *B. racemosus* and *B. commutatus*, were suspected. The techniques and theory underlying serological assessment of species affinities have already been described (Smith 1968b). The spectrum of seed proteins revealed in *B. grossus* extracts is in all respects exceedingly similar to those previously demonstrated for *B. bromoideus*, *B. secalinus*, *B. racemosus* and *B. commutatus* (Smith 1972). This confirms the

close relationship, forecast earlier, of *B. grossus* with these four better-known brome-grasses.

2. *Bromus commutatus* Schrad. and *B. racemosus* L.

These two species are very similar morphologically and are often confused by collectors. Because of this their ranges and abundances are uncertain. *B. racemosus*, with a narrow, rather erect panicle, is easily overlooked in roadside populations of *B. hordeaceus*. In Britain, and probably western Europe in general, *B. racemosus* is certainly under-recorded.

Many workers have been tempted to lump these two taxa into a single species (e.g. Bentham 1858, Wilson 1956) because of the difficulty they experienced in distinguishing between them. Some of the difficulty has been caused by too great an attention to the shape of the panicle, which is often narrow and erect in *B. racemosus*, but rarely racemose. This type of panicle may quite commonly be seen in specimens of *B. commutatus*, which normally has a larger, more branched and spreading panicle. Plates 1C & 1D indicate the typical appearance of panicles of the two taxa.

The chief differences between *B. racemosus* and *B. commutatus* are summarised in Table 2. Figs. 1 & 2 include illustrations of the mature lemmas of both taxa from adaxial, abaxial and side views, and show significant differences. *B. racemosus* has a cucullate lemma which is narrower in relation to its length than is that of *B. commutatus*. The markedly convex lemma-back of *B. racemosus*, seen from the side, lends a distinctive appearance to the spikelets (Plates 1D & 2E) in which the upper part of each lemma appears to be slightly bulged outwards below its hyaline tip and margin. This striking feature has not been observed in material of *B. commutatus*. The shape of the lemma-margin (Fig. 2 and Plate 2) is a widely used character. In *B. racemosus* it is gradually rounded in the upper third whereas in *B. commutatus* there is a blunt marginal angle. The character has proved difficult for generations of field botanists to distinguish reliably, and it must be confessed that intermediate conditions are not infrequently seen.

Characters of the two taxa have been scored for a large number of herbarium specimens from different parts of Britain, and the most useful characters are represented in a scatter diagram (Fig. 3). The diagnostic characters and their variation are now thought to be better established, and it is these revised measurements that are given in Table 2.

From these data there seems to be little doubt that two taxa can be recognised but also that there are a significant number of intermediates. Interspecific hybridisation may well be the explanation for this. Wilson (1956) managed to produce completely fertile F_1 and F_2 hybrids of the two taxa, which were morphologically intermediate between the parents. Plants of both taxa often grow together, especially in the lush water-meadows of southern and south-western England, and both frequently have exserted anthers. Self-pollination is undoubtedly usual, but crossing to some degree is highly likely.

Ecological differences between the two taxa are obscured by the difficulties in identification encountered by collectors. My personal impression is that *B. racemosus* is more often a plant of waysides than *B. commutatus*, which is commoner in hayfields and water-meadows. The data (Smith 1971) in the *Flora of Warwickshire* do not support this view. In Warwickshire 34% of *B. commutatus* records are from roadside habitats compared with only 14% for *B.*

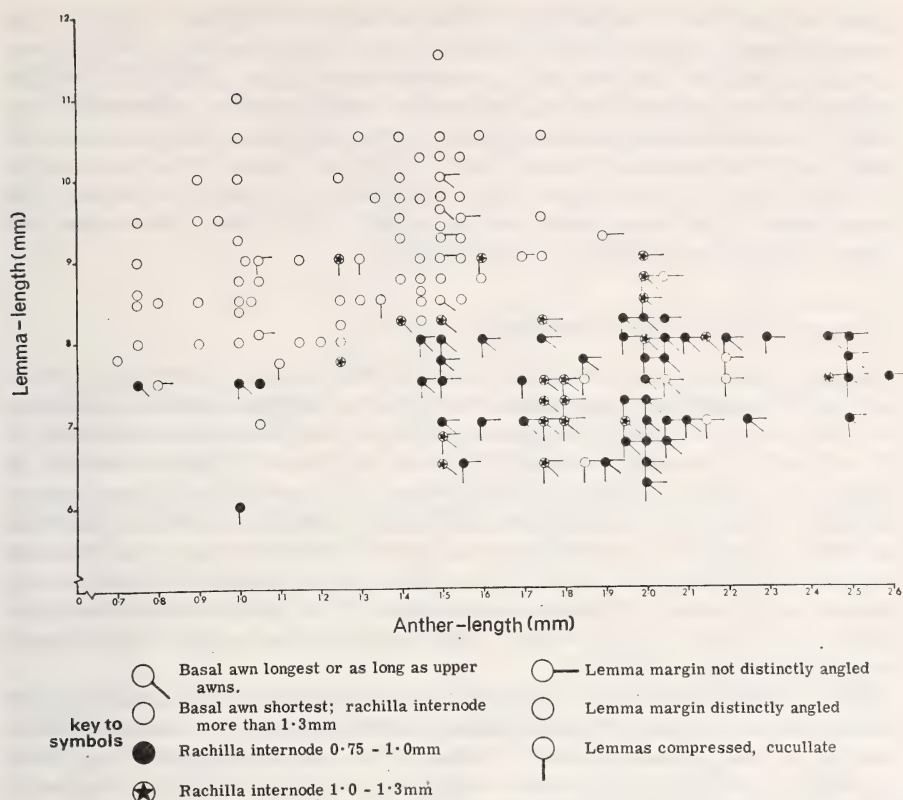


FIGURE 3. Scatter diagram showing range of variation in *Bromus commutatus* and *B. racemosus*.

racemosus. I am sure, however, that this does not represent the actual situation. *B. commutatus* is more easily noticed than *B. racemosus*, therefore appearing to be the commoner plant. In wet grassland habitats *B. racemosus* is perhaps sought for with greater diligence by collectors. On roadsides it is frequently overlooked because it is obscured by the very common *B. hordeaceus*. These populations may appear uniform and somewhat dull, but they will repay more careful scrutiny.

With the demonstration of interfertility of the taxa and their notable similarity of form, there might be a school of thought suggesting lumping them together as one species. Wilson (1956) has already proposed this. I believe the morphological differences are sufficient to be easily recognised once they are communicated adequately, and that the ecological preferences of the two taxa will eventually be shown to be different. Lumping them as one species solely on the basis of interfertility and possibly ephemeral difficulties of identification would be premature. At least until the distributions of the two taxa are better known they should be recognised as species.

B. neglectus (Parl.) Nyman is a Continental taxon very similar to *B. commutatus* and *B. racemosus*. It closely resembles *B. racemosus* in anther-length and

panicle-shape, but is similar to *B. commutatus* in lemma-size. The awns are somewhat more spreading than in the two British species and the spikelets seem always to be hairy. Variants of *B. commutatus* with hairy spikelets are usually referred to var. *pubens* Watson, but despite long searching I have never seen such a variant of undoubted *B. racemosus*. *Bromus neglectus* has been recorded only from Mediterranean Europe (Italy, Sicilia and Greece). The relationships of this taxon to *B. commutatus* and *B. racemosus* are clearly of interest, but experimental work must await new gatherings of the plant, which does not appear to have been collected for a long time.

3. *Bromus pseudosecalinus* P. M. Smith

Bromus pseudosecalinus P. M. Smith (Smith 1968b) was described from a roadside in Worcestershire. Material of the species is rare in herbaria. Collectors confuse it most often with *B. racemosus*. In K the plant has often been referred to *B. secalinus* L. f. *hirsutus* Kindberg (N.B. not var. *hirtus* (F. Schultz) Aschers. & Graebn.). The most obvious differences between this species and *B. secalinus* are the sizes of the florets and spikelets. Both species have the adaptations of tough rachilla, slow spikelet disarticulation and rolled caryopses which in *Bromus* are commonly associated with weeds contaminating sown cereals. Both have horny lemmas and glumes. Differences in the shape of the spikelets and florets are illustrated in Figs. 1 & 2, and Plate 2. More complete details of the morphological differences are given in Table 2.

Smith (1968b) commented on the apparent adaptations of *B. pseudosecalinus* to survival as a weed of small-grained pasture grasses, for instance *Lolium perenne* L. and various species of *Festuca*. The size and weight of caryopsis resemble those of the crop species sufficiently to frustrate efforts to separate mechanically the weed grains from those of the crop.

B. pseudosecalinus is a diploid species ($2n = 14$) unlike *B. secalinus* which is tetraploid ($2n = 28$). The saline-soluble seed proteins of *B. pseudosecalinus* are very different from those of *B. secalinus* (Smith 1972) and from those of *B. grossus*, *B. bromoideus*, *B. racemosus* and *B. commutatus*. *B. pseudosecalinus* hence appears serologically only distantly related to the other species considered to belong to Holmberg's Coriacei (Holmberg 1924), or to P. M. Smith's 'Group 2' (Smith 1972). Morphological similarities between *B. pseudosecalinus* and *B. secalinus* probably arise from convergent evolution.

The genetic relationships of *B. pseudosecalinus* are very incompletely known, but one possibly significant finding is that it will not hybridise with *B. arvensis* (Smith 1968b) – a diploid species thought to be a probable parent of *B. secalinus* and its close relatives (Wilson 1956, Smith 1972). The relationships of *B. pseudosecalinus* to other diploids, and to tetraploid species, are at present obscure.

Since the recognition of *B. pseudosecalinus* in 1968 it has been possible to investigate its distribution in a little more detail. Fig. 4 is a dot-map of the known distribution of the plant in the British Isles based on herbarium material and personal collection. All records known to date are listed in Appendix 1. The species resembles most other bromes with which it is sympatric in having a mainly southern distribution in the British Isles. It should be looked for in areas where small-seeded grasses or clovers are sown. It is likely to be commoner than its known distribution may suggest, and probably far commoner in the British Isles than *B. secalinus*.

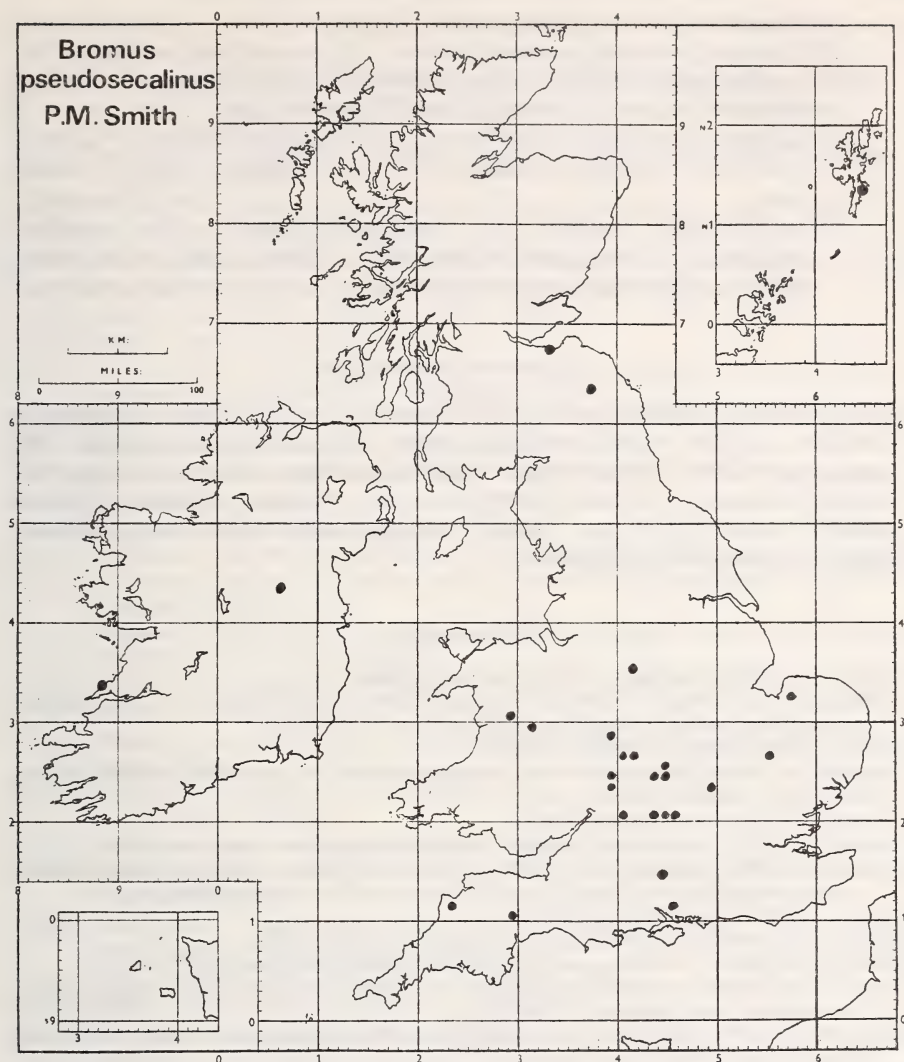


FIGURE 4. Distribution map showing records of *Bromus pseudosecalinus* in the British Isles.

KEY TO SPECIES

Measurements refer to basal florets in mature spikelets.

- | | |
|--|---|
| 1. Lemmas 5-6 mm, divaricate at maturity; lower sheaths hairy | 1 |
| <i>B. pseudosecalinus</i> P. M. Smith | |
| 1. Lemmas 6.5 mm or more, imbricate or divaricate at maturity; lower sheaths hairy or glabrous | 2 |
| 2. Mature lemmas divaricate, the margins longitudinally folded about the thick, deeply furrowed or rolled caryopsis; lower sheaths glabrous or very sparsely hairy | 3 |

3. Lemmas 6.5–9(–10) mm; anthers 1–2 mm *B. secalinus* L.
3. Lemmas 10–14 mm; anthers 2–3 mm *B. grossus* Desf. ex Lam. & DC.
2. Mature lemmas imbricate, with margins not infolded; caryopsis thin, flat, rarely feebly grooved; lower sheaths with retrorse hairs 4
4. Lemmas cucullate, 6.5–8 mm, with rounded margins; anthers 1.5–3 mm; rachilla internode 0.5–1 mm; panicle narrow, usually erect *B. racemosus* L.
4. Lemmas not cucullate, 8–11 mm, with bluntly angled margins; anthers to 1.5 mm; rachilla internode *c* 1.5 mm; panicle broad, rarely narrow, erect at first, eventually drooping *B. commutatus* Schrad.

ACKNOWLEDGMENTS

I thank Miss E. Randall and Mr W. Foster for technical and photographic assistance, and am grateful to the Curators of the herbaria at Berlin (B), Birmingham (BIRM), British Museum (BM), Cambridge (CGE), Edinburgh (E), National Museum of Ireland (DBN), Kew (K), National Museum of Wales (NMW), Oxford (OXF) and Trinity College, Dublin (TCD) for generously loaning specimens for examination.

REFERENCES

- BENTHAM, G. (1858). *Handbook of the British Flora*. Ashford.
- CUGNAC, A. DE & CAMUS, A. (1936). Sur quelques bromes et leurs hybrides, IV. Deux espèces messicoles menacées de disparition. *Bull. Soc. bot. Fr.*, **83**: 47–68.
- GROSE, D. (1957). *Flora of Wiltshire*. Devizes.
- HOLMBERG, O. (1924). Bromi molles – eine nomenklatorische und systematische Untersuchung. *Bot. Notiser*, **1924**: 313–328.
- HUDSON, W. (1762). *Flora Anglica*. London.
- MUNRO, W. (1861). The grasses of Linnaeus' herbarium. *Proc. Linn. Soc. Lond.*, **6**: 46.
- SMITH, J. E. (1798). Observations on the British species of *Bromus*, with introductory remarks on the composition of a Flora Britannica. *Trans. Linn. Soc. Lond.*, **4**: 276–302.
- SMITH, J. E. (1824). *English Flora*. London.
- SMITH, J. E. & SOWERBY, J. (1808). *English Botany*, **27**: t. 1584. London.
- SMITH, P. M. (1968a). The *Bromus mollis* aggregate in Britain. *Watsonia*, **6**: 327–344.
- SMITH, P. M. (1968b). Serological distinctness of *Bromus pseudosecalinus* P. Smith, sp. nov. *Reprium nov. Spec. Regni veg.*, **77**: 61–64.
- SMITH, P. M. (1970). Taxonomy and nomenclature of the brome-grasses. *Notes R. bot. Gdn Edinb.*, **30**: 361–375.
- SMITH, P. M. (1971). *Bromus* L. sect. *Bromus*, in CADBURY, D. A., HAWKES, J. G. & READETT, R. C. *A Computer-Mapped Flora*. London.
- SMITH, P. M. (1972). Serology and species relationships in annual bromes (*Bromus* L. sect. *Bromus*). *Ann. Bot.*, n.s., **36**: 1–30.
- TOURNAY, R. (1968). Le brome des Ardennes, '*B. arduennensis*', et ses proches, *B. secalinus* et *B. grossus*. *Bull. Jard. bot. État. Brux.*, **38**: 295–380.
- WILSON, D. (1956). *Cytogenetic studies in the genus Bromus*. Ph.D. thesis, University of Wales, Aberystwyth.

APPENDIX 1

Records of *Bromus pseudosecalinus* P. M. Smith in the British Isles

v.c.3, S. Devon: In clover fields at Cove, near Tiverton. Eleven collections from different parts of the Cove area were made in June 1943 by A. L. Still. K.

- v.c.3, S. Devon: Clover-field margin, Cobbacombe, near Tiverton. June 1943, *A. L. Still*. **K**.
- v.c.4, N. Devon: Hayfield, Woolfardisworthy. June 1945, *R. M. Payne*. **K**.
- v.c.12, N. Hants.: Andover. July 1890, *C. B. Clarke*. **K**.
- v.c.22, Berks.: South Hinksey. June 1892, *H. Baker*. **OXF**.
- v.c.22, Berks.: On roadside at Woodend, between Botley and Swinford. June 1941, *C. E. Hubbard* 10394. **K**.
- v.c.23, Oxford: In grassland on heavy soil by Oxford by-pass, near Wolvercote. July 1941, *C. E. Hubbard* 10290. **K**.
- v.c.28, W. Norfolk: Appleton, on roadside in partial shade, on sandy soil with *Bromus hordeaceus* agg. July 1936, *C. E. Hubbard* A.B.X. **K**.
- v.c.29, Cambs.: Wicken. June 1901, *A. H. (sic)*. **CGE**.
- v.c.30, Beds.: Tingrith. *J. G. Dony*. **K**.
- v.c.33, E. Gloucester: Around an old stack bottom, 1 mile north of Fairford, on the Hatherop road. June 1944, *C. E. Hubbard* 11919. **K**.
- v.c.33, E. Gloucester: Around an old stack bottom, 1-2 miles north of Fairford on the Quenington road. June 1944, *C. E. Hubbard* 11957. **K**.
- v.c.33, E. Gloucester: Rye-field at Ashchurch. June 1951 & June 1957, *C. W. Bannister* A/3-6. **K**.
- v.c.37, Worcester: Defford Common. July 1936. **K**.
- v.c.37, Worcester: Halesowen, growing among roadside population of *Bromus hordeaceus* agg. and *B. lepidus* on the verges of the new by-pass. July 1963, *P. M. Smith*. **E** (holotype).
- v.c.38, Warwick: Drayton Manor Farm, near Stratford-upon-Avon, by farm track. June 1945, *C. E. Hubbard* 12796. **K**.
- v.c.38, Warwick: In pasture, cultivated field and on roadside, near Upper Tysoe. **BIRM**.
- v.c.38, Warwick: in a mortuary (? cemetery) under trees, about half a mile east of Studley. **BIRM**.
- v.c.38, Warwick: Roadside near Hardwick Farm, south of Kineton. June 1958, *C. M. Goodman*. **BIRM**.
- v.c.38, Warwick: Pasture at Edge Hill. 1960, *B. M. Daulman*. **BIRM**.
- v.c.38, Warwick: Grove Park, near Warwick. Margin of cultivated field. June 1964, *P. M. Smith*. **BIRM**.
- v.c.47, Montgomery: Bettws, Lower Garth, in rye grass and clover ley, in upland pasture. July 1955, *E. Milne-Redhead* 6657. **K**.
- v.c.47, Montgomery: Carno. July 1956, *I. A. Williams*. **BM**.
- v.c.57, Derby: Ashbourne. July 1888, *W. R. Linton*. **E**.
- v.c.80, Roxburgh: Fields near Kelso. June 1870. **OXF**.
- v.c.83, Edinburgh: Field near Caroline Park, Edinburgh. July 1834. **E**.
- v.c.83, Edinburgh: Near Leith. July 1878, *D. Douglas*. **K**.
- v.c.112, Zetland: Ham, Isle of Bressay, in a meadow. July 1959, *R. C. Palmer*. **OXF**.
- v.c.H9, Clare: Near Glencolumkille House, north of Kilkee. July 1955, *D. A. Webb*. **TCD**.
- v.c.H23, Westmeath: meadows at Knock Drin, near Mullingar. June 1894, *H. C. L. Ewing*. **DBN**.

APPENDIX 2

Sources of material represented in Plates and Figures (Accession numbers refer to author's seed collection).

B. commutatus Schrad.

Spain, High Aragon, pathsides in Vallibierne, near Benasque. August 1961. Seed accession no. 42.

B. racemosus L.

Wales, Cardiganshire, roadside near Lampeter. July 1963. Seed accession no. 425.

B. pseudosecalinus P. M. Smith

England, Worcestershire, roadside at Halesowen. July 1963. Seed accession no. 489.

B. secalinus L.

Raised from seed received from Dijon Botanic Garden. Seed accession no. 336. (Plate 1).

B. secalinus L.

Raised from seed received from the State Botanic Garden, Brussels. Seed accession no. 330. (Plate 2).

B. grossus Desf. ex Lam. & DC.

Raised by Professor A. de Cugnac, Rumigny, Ardennes, France, 1970. Seed accession no. 1049.

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The distribution, habitat and status of *Hypericum canadense* L. in Ireland

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ABSTRACT

Details are given of the distribution of *Hypericum canadense* L. in western Ireland, including some records hitherto unpublished. The stations may be grouped into 5 distinct localities near Lough Mask and one near Glengarriff. Quadrat analyses from most of these localities show that it is very constantly associated with *Anagallis tenella*, *Carex demissa*, *C. echinata*, *C. panicea*, *Eleocharis multicaulis*, *Hydrocotyle vulgaris*, *Hypericum elodes* and *Ranunculus flammula*. It seems to require acidic, fairly base-poor, sandy or peaty soil with an abundance of water, at least for most of the year, and is most commonly found in flushes or by very small streams in moorland, heath or rough grassland. Grazing and disruption of the turf by cattle are probably of importance in reducing competition and providing open ground for establishment. There is no good reason to suppose, as has been suggested by Westhoff, that the necessary ecological conditions are realized in only a few localities. The claim of the species to native status in Ireland is re-iterated and recent suggestions that it is dispersed by human agency are shown to be based on a misunderstanding.

INTRODUCTION

Hypericum canadense is a predominantly North American species whose relatively recent discovery in north-western Europe has been the subject of some discussion. This paper attempts to summarize the known facts about its European distribution, to give more detailed information on its habitat than has hitherto been published, and to reconsider its status.

DISCOVERY IN EUROPE

The first published record for Europe was by Jonker (1935), who found it the previous year growing in abundance at several localities in the neighbourhood of Almelo, in eastern Holland. Subsequent herbarium investigations showed that unnamed specimens collected in the same region in 1909 were also referable to *Hypericum canadense* (Jonker 1959); it had also been collected a little further to the east in 1918.

More recently it was reported from eastern France by Bouchard (1955a, 1955b). It appears, however, that this identification was erroneous, as plants collected in the same region in 1958 and 1959 have been shown (Jonker 1960) to be *H. majus* (A. Gray) Britton, a related but distinct North American species with somewhat different ecological requirements. *H. majus* has also been found

in Germany by Merxmüller & Vollrath (1956). In both the French and German stations its introduction by American troops seems very plausible.

The occurrence of *H. canadense* in Ireland was first recorded by one of us (Webb 1957, 1958), who found a single plant in 1954 by the west shore of Lough Mask, Co. Mayo,* and on a later visit in 1956 found it in some abundance there in two stations about 1 km apart. Later visits by D. McClintock and J. E. Lousley (McClintock 1970 *in litt.*) in 1965, and by ourselves from 1965 to 1970, revealed a number of new stations in the same region. But in Ireland, as in Holland, the published records are antedated by a herbarium specimen, in this case misnamed as *H. linarifolium*, which was discovered in the herbarium of University College, Aberystwyth, by E. H. Chater (Webb 1969); it had been collected in Glensaul (a valley draining into the western side of Lough Mask) in 1906, apparently by H. H. Haines.

In 1968 *Hypericum canadense* was discovered at Glengarriff, Co. Cork (W. Cork, v.c. H3), by Mr & Mrs K. L. Butcher (Meikle 1969). This station is more than 200 km south of Lough Mask (Fig. 1).



FIGURE 1. Maps showing the location of Lough Mask and Glengarriff and the known sites for *Hypericum canadense* around Lough Mask. Stations C, D and E are now in Co. Mayo, but until 1898 they were in Co. Galway; they are therefore still in v.c. H16. The dashed line is the old comital and the present vice-comital boundary.

* See the legend to Fig. 1.

Finally, it should be mentioned that Lousley (1971) reported that a single plant had been seen in 1967 in a seed-bed in a nursery-garden in Hampshire in southern England (v.c. 12). It apparently did not persist.

THE IRISH STATIONS

In the Lough Mask area at least a dozen distinct stations are now known, but these may be grouped into five 'localities' (Fig. 1), within which the stations are separated by less than a kilometre. From north-east to south-west these localities are as follows:

A. The neighbourhood of Srah (Irish GR M 12.72). The stations extend from the western bank of the Cloon River, a few hundred metres above its entry into the lake, to a point near the lake-shore 1 km south of Srah.

B. A station, not precisely localized, near the Glensaul River, south-west of Toormakeady. This is the source of the Aberystwyth specimen, which is simply labelled 'Glensaul, Toormakeady'.

C. A stretch of some 1.5 km between the lake and the road, south and east of the hamlet of Killaleeun (GR M 05.63), a few plants being noted also on the other side of the road. This locality includes the station formerly referred to as Gortmore (Webb 1957, 1958), and is the locality in which the plant is most abundant.

D. A patch of moorland about 1.5 km east of Lough Nadirkmore (GR M 00.64 and over 3 km west of Lough Mask.

E. By the western arm of Lough Mask which extends to near the hamlet of Maumtrasna (GR M 00.60). The stations lie about two-thirds of the distance from Maumtrasna to the lake.

The total distance from A to E is 17 km. A, C and E are at 70–100 ft (20–30 m) above sea-level, B probably between 100 and 300 ft (30–90 m), and D at about 500–600 ft (c 175 m).

At Glengarriff we found the plant in six distinct stations in the course of an afternoon's search in August, 1970. All lie within a radius of 1 km, and may be regarded as constituting a single locality. One station is that discovered earlier by Mr & Mrs Butcher; it lies about 0.5 km north of Eccles' Hotel, close to a lane which runs up a steep hill from the main road immediately east of the hotel (GR V 94.57). The other stations lie a little further to the north-east, in the valley of a stream which rises in a lakelet near the county boundary and runs south-westwards to Glengarriff Harbour.

DETAILS OF THE HABITAT

All the localities and most of the individual stations have been visited by G. H. or both of us, and twelve quadrats of 50 cm square have been analysed, using the Domin scale of cover and abundance. In three other stations lists of associated species were made. The results are presented in Table 1, and the habitats briefly described below.

List 1. Margin of old, flooded peat-cutting just south of the Partry road, 0.5 km east of Srah (Locality A). This habitat is quite different from all the others, as the

TABLE 1. ASSOCIATES OF *HYPERICUM CANADENSE* IN WESTERN IRELAND

Quadrat and List Number	1*	2	3	4	5	6*	7	8	9	10	11	12	13	14	15*	Total
Total cover	10	9	9	9	8	—	9	8	10	10	9	9	8	9	—	
<i>Hypericum canadense</i>	+	4	3	4	4	+	4	4	2	4	4	X	3	4	+	15
<i>Juncus bulbosus</i>	+	4	4	5	3	+	4	4	4	.	a	X	4	3	+	14
<i>Carex panicea</i>	.	5	3	5	.	+	a	2	4	4	2	2	5	3	+	13
<i>Ranunculus flammula</i>	+	a	a	a	3	+	3	3	2	.	.	a	1	4	+	13
<i>Sphagnum</i> spp. ¹	+	1	X	3	.	+	.	4	3	1	.	6	4	1	+	12
<i>Anagallis tenella</i>	.	3	.	a	4	+	.	2	3	3	X	3	3	2	+	12
<i>Carex demissa</i>	+	5	3	5	X	+	3	a	.	4	5	a	4	4	+	12
<i>Hypericum elodes</i>	+	2	4	a	a	+	.	3	.	3	4	4	X	.	+	12
<i>Carex echinata</i>	.	4	5	a	X	+	.	a	.	3	a	2	.	a	+	11
<i>Eleocharis multicaulis</i>	.	.	1	3	a	+	X	5	a	4	4	.	4	1	+	11
<i>Molinia caerulea</i>	+	.	.	4	3	+	4	1	3	3	.	X	2	1	+	10
<i>Hydrocotyle vulgaris</i>	+	.	.	X	.	+	3	3	3	.	.	.	2	1	+	9
<i>Agrostis stolonifera</i> ²	.	4	.	.	a	.	a	2	a	2	.	3	.	.	+	7
<i>Eriophorum angustifolium</i>	+	.	1	X	4	+	.	3	4	.	.	.	1	.	+	7
<i>Juncus articulatus</i>	.	.	2	.	3	+	.	5	.	3	4	.	.	a	.	7
<i>Potamogeton polygonifolius</i>	+	.	1	.	X	+	.	.	.	X	1	X	.	.	.	7
<i>Riccardia pinguis</i>	+	.	2	.	X	+	.	.	.	2	a	2	a	.	+	6
<i>Drosera rotundifolia</i>	.	.	.	.	.	+	.	.	2	.	.	3	1	2	.	6
<i>Pellia epiphylla</i>	+	.	.	.	X	+	.	X	2	2	.	a	.	.	+	6
<i>Viola palustris</i>	+	.	.	.	.	+	.	.	5	.	.	.	1	2	.	5
<i>Acrocladium cuspidatum</i>	.	.	.	1	.	+	.	.	5	.	.	a	.	4	.	5
<i>Carex nigra</i>	.	.	.	a	.	+	.	.	3	.	.	X	1	.	.	5
<i>Drepanocladus exannulatus</i> ³	.	.	.	1	X	+	3	.	3	.	.	.	X	a	.	5
<i>Galium palustre</i>	.	.	.	.	.	+	.	.	3	4	.	6	X	4	+	5
<i>Juncus acutiflorus</i>	.	.	.	.	.	+	.	.	3	.	.	.	1	a	.	5
<i>Mentha aquatica</i>	.	.	.	.	.	+	.	.	3	3	.	a	1	3	+	5
<i>Potentilla erecta</i>	+	.	.	.	.	+	.	.	2	.	.	.	1	.	+	5
<i>Prunella vulgaris</i>	.	.	.	.	.	+	X	.	.	.	.	.	1	X	.	5
<i>Scutellaria minor</i>	.	.	.	.	a	+	a	.	.	.	.	.	.	.	+	5
<i>Acrocladium sarmentosum</i>	.	.	.	.	.	.	.	.	.	X	X	1	X	.	.	4
<i>Drosera intermedia</i>	+	.	.	.	X	.	.	X	.	.	.	.	3	.	.	4

Juncus effusus
Nardus stricta
Anthoxanthum odoratum
Drepanocladus revolbens
Erica tetralix
Holcus lanatus
Leontodon autumnalis
Narthecium ossifragum
Rhynchospora alba
Sieglingia decumbens
Carex hostiana
Eleocharis fluitans
Filipendula ulmaria
Hypochaeris radicata
Lotus uliginosus
Lythrum salicaria
Philonotis fontana
Rhytidadelphus squarrosus
Salix cinerea
Scorpidium scorpioides
Senecio aquaticus
Succisa pratensis
Trifolium repens
Triglochin palustris
Veronica scutellata

Present in only one quadrat: *Achillea ptarmica* 9, *Bellis perennis* 14, *Breutelia chrysozona* 10, *Bryum pseudotriquetrum* 14, *Callitriche stagnalis* 14, *Cardamine pratensis* 9, *Climacium dendroides* 9, *Cirsium dissectum* 4, *Dactylorhiza maculata* subsp. *erictorum* 12, *Deschampsia flexuosa* 14, *Equisetum palustre* 6, *Fossombronia* sp. 7, *Hypericum tetrapterum* 14, *Isolepis cernua* 14, *I. setacea* 2, *Luzula multiflora* 14, *Myosotis* sp. 9, *Myrica gale* 13, *Parnassia palustris* 14, *Pinguicula lusitanica* 10, *Polytrichum commune* 12, *Potentilla anserina* 7, *P. palustris* 6, *Radiola linoides* 7, *Ranunculus acris* 14, *R. repens* 9, *Sagina procumbens* 9, *Stellaria alsine* 9, *Thuidium delicatulum* 12.

* Cover not assessed.

a Additional species within 1m of quadrat and in the same habitat.

1 The species were only determined from quadrats 8, 9, 11, 12 and 13 (*S. subsecundum*) and 1 and 12 (*S. palustre*).

2 Some small specimens may have been *Agrostis tenuis*.

3 The species of *Drepanocladus* was not determined in quadrat 4.

plants of *Hypericum canadense* are scattered through a floating mat of vegetation (mainly *H. elodes*), which extends into the pool on its shallower side (Plate 1).

Quadrats 2, 3 and 4. Flushes in wet *Myrica-Calluna* heath on the west side of the Cloon River, just south of the road from Srah to Partry (Locality A). The river is here bordered by a belt of *Sparganium erectum*, beyond which is a zone of heavily grazed poor-fen, followed by a zone of *Alnus glutinosa*. A few isolated plants of *Hypericum canadense* were seen in the poor-fen zone, but these seem to have originated from small flushes a short distance away, between the *Alnus* zone and the road.

Quadrats 5 and 7 and list 6. By a small, sluggish stream trickling through rough, peaty grassland between the road and Lough Mask, 1 km south of Srah (Locality A).

Quadrats 8 and 9. Small flushes in grazed flats at Killaleeaun between the road and Lough Mask (Locality C). The flats are of sand, covered in most places with a thin layer of peat. The flushes percolate down towards the lake from the slightly higher sandy ground inland (Webb 1958, plate 11).

Quadrats 10 and 11. In peaty flushes and by a small stream in moorland on the eastern slopes of the Maumtrasna plateau (Locality D). The moorland is grazed by cattle and slopes gently to the east-north-east (Plate 2). The station lies about midway between the trigonometrical point 1703 ft and the Owenbrin R.

Quadrat 12. By the river-confluence 1 km south of Srahnaalong and the same distance east of Maumtrasna village (Locality E); the *Hypericum canadense* occurs by the side of a sluggish, peaty stream choked by *Juncus acutiflorus*. Only two plants were seen.

Quadrat 13. By the side of a small ditch 0.5 km south of Quadrat 7 (Locality E). The ditch, with *Carex rostrata*, *Equisetum fluviatile* and *Nymphaea alba*, separates a marshy meadow from an *Eriophorum angustifolium* bog. The *Hypericum canadense* grows in rather open ground on the meadow side of the ditch.

Quadrat 14. Hummocky, marshy pasture at c 300 ft (90 m), sloping gently to the south, about 0.5 km north of Eccles' Hotel, Glengarriff (Plates 3 & 4).

List 15. Small, hummocky flush near a path, about 0.5 km north of Quadrat 14.

In view of the relative floristic poverty of Ireland the total number of associated species (88, including bryophytes) is remarkably high. Only 11 species, however, occur in more than 8 of the 15 lists, and it is these which must be regarded as characterizing the community to which *Hypericum canadense* is restricted. Total plant cover ranges from 50% to 100%, the open ground consisting of bare mud or peat with varying amounts of standing or running water. With so many associated species it is not surprising that no species exceeds 20% of the cover, and only eight reach this figure (*Carex demissa*, *C. echinata*, *C. panicea*, *Eleocharis multicaulis*, *Hypericum elodes*, *Hydrocotyle vulgaris*, *Juncus bulbosus* and *Acrocladium cuspidatum*). *H. canadense* seldom shows a cover value of more than 5%, even at its most abundant.

Most of the species in Table 1 may be regarded, at least in western Ireland, as characteristic of wet, acidic grassland or of wet moorland, e.g. *Carex panicea*, *Juncus articulatus* and *Ranunculus flammula*, and *Eleocharis multicaulis*, *Eriophorum angustifolium* and *Narthecium ossifragum*. Occasional inundation, or the presence of surface water for a considerable part of the year, is suggested by the

presence of *Drepanocladus* spp., *Hypericum elodes*, *Potamogeton polygonifolius* and *Sphagnum* spp., The wet grassland component is especially strong in the Glengarriff station (Quadrat 14), with *Holcus lanatus*, *Hypochaeris radicata*, *Lotus uliginosus* and *Lythrum salicaria*. It is remarkable that List 1, although the plants are here floating on water instead of being rooted in soil, differs very little from those of the other lists and quadrats. The only species in Table 1 which can be said to be in any way remarkable, ecologically or geographically, are a few which have a decidedly western or south-western distribution within the British Isles. These comprise *Eleocharis multicaulis*, *Hypericum elodes* and *Scutellaria minor*; *Anagallis tenella* shows the same tendency, but less strongly. With the exception of the *Scutellaria* (rarely a common plant even in western Ireland), these species occur in 11 of the 15 lists. Of all the associated species *Hypericum elodes* seems to be closest to *H. canadense* in its ecological requirements, and it is certainly the best indicator-species to look for when searching for the latter.

In all the stations which we have examined the soil is normally waterlogged, and surface water is present for a large part of the year. Only in exceptionally dry seasons is the soil likely to dry out. In the flatter areas the water may be almost stagnant, and restricted to the deeper hollows, which are usually the result of cattle-treading. In other areas there is a slow percolation of water down a slope, and in a few cases it cuts itself a sufficiently well-marked channel to be called a stream. In such cases the *Hypericum canadense* is mainly restricted to the margins of the stream. Grazing by sheep and cattle (Plate 2) is a prominent feature of all the stations (except the flooded peat-cutting). This, at least as much as water-movement, is responsible for the patches of open ground which *H. canadense* seems to require for seedling establishment, and the grazing also keeps down the ranker growth with which even established plants would probably be unable to compete.

Soil analyses from six stations are presented in Table 2. These samples were not necessarily collected from the actual areas of the quadrats, but are from similar communities not more than a few metres distant.

TABLE 2. SOIL ANALYSES FROM *HYPERICUM CANADENSE* STATIONS IN WESTERN IRELAND

	pH ¹	Exchangeable bases ² (m.eq./100g)				% Organic carbon ³
		Na	K	Mg	Ca	
Killaleeun (Locality C)	4.2	0.3	0.2	1.3	1.6	7.7
Cloon River (Locality A)	4.5	0.5	0.3	1.8	5.9	17.5
Srah (Locality A)	4.25	0.4	0.3	1.4	4.1	22.9
Srahnalong (Locality E)	4.15	0.5	0.7	1.8	5.0	42.3
Owenbrin moorland (Locality D)	4.0	0.8	0.7	1.8	1.3	40.2
Glengarriff	4.85	0.3	0.2	1.6	5.5	14.0

1. Measured by glass electrode on 1:2.5 soil: water mixture.

2. Extract obtained using N ammonium acetate solution. Na⁺ and K⁺ determined using flame-photometer, Mg⁺⁺ and Ca⁺⁺ using atomic absorption spectrophotometer.

3. Determined by the Walkley-Black method.

The soils are distinctly acidic (that from Glengarriff least so), low in exchangeable bases, and mostly rich in organic matter. The lowest value for organic carbon is 7.7% from the Killaleeaun flats. Here the lacustrine sand is overlaid by a layer of peat of variable thickness; if the sample had been taken a few yards away a thicker layer of peat might have given a much higher value. Although we have referred to many of the sites as 'flushes', this is to be interpreted purely in a topographical sense as we have no soil analyses from the surrounding grassland or moorland for comparison. Presumably there is some base-enrichment in the flushes, but it may be very small.

WESTHOFF'S 'GRADIENTS'

The Dutch botanist, Professor V. Westhoff, visited the Killaleeaun locality in 1969 and in a recent paper (Westhoff 1971) has published data on four relevés which he made there. He concludes that his lists show the closest affinity with the *Eleocharetum multicaulis*. Fr J. J. Moore, who has seen our own lists in Table 1, considers that they belong to the *Potamogeton polygonifolius* - *Hypericum elodes* association. Both associations are in the order Littorelletalia.

Westhoff claims to recognise four ecological gradients. In order of decreasing magnitude these are:

1. a macro-gradient from the waterlogged, base-rich soil near the lake to the drier, acidic soil further up the shore.
2. a mesogradient from the sandy ridges to the boggy flats between them.
3. a minigradient from the more permanently waterlogged to the better-drained patches within the flats.
4. a microgradient of hollows and hummocks formed by cattle-treading.

He maintains that *H. canadense* requires a position on each gradient somewhere between its extremes and that the rarity of the plant is to be explained by the scarcity of terrain where this complete complex of gradients is realised.

As confirmatory evidence he adduces the presence in its Dutch stations of *Scutellaria minor* and *Wahlenbergia hederacea*, both very rare in Holland, and both, presumably, also dependent on complex and unusual 'milieu-gradients'.

We consider that such an analysis is needlessly complex, and we cannot agree with Westhoff's main conclusion. He is, in fact, asserting firstly that *H. canadense* requires a fairly base-poor, moderately acidic, slightly sandy soil, with ample water but not permanently water-logged, and secondly that the west shore of Lough Mask is one of the few places in Ireland where these conditions are realized. With the first assertion we are in partial agreement, but our analyses show that sand content of the soil is irrelevant. In most cases the soil lies very near the acidic end of the pH gradient since blanket bog peat in western Ireland usually has a pH of 4.0-4.2, so that many of our stations for *H. canadense* lie at the extreme end of his 'macrogradient', and some of them, perhaps, outside its range. In this connexion it may be pointed out that Westhoff's lists of associated species contain several which are not represented in Table 1. These include *Apium nodiflorum*, *Littorella uniflora*, *Montia fontana*, *Eleocharis quinqueflora* and *Samolus valerandi*. Of these, the last two are distinctly basiphilous in comparison with the majority of species in Table 1, and *Littorella* is seldom found far from a lake shore. It seems, therefore, that Westhoff's observations at Killaleeaun were made at the extreme lower limit of the *Hypericum canadense* zone. This, indeed,



PLATE 1. Edge of old peat-cutting near Srah showing floating mat of *Hypericum elodes*, in which *H. canadense* grows, and *Molinia* tussocks behind.



PLATE 2. Small flushes and runnels in grazed moorland between the Maumtrasna mountain plateau (left) and the Owenbrin River (right).



PLATE 3. General view of marshy meadow above Glengarriff looking towards Bantry Bay.



PLATE 4. Corner of the Glengarriff meadow showing the small wet depressions (dark areas) where *Hypericum canadense* grows.

is in the middle of his 'macrogradient', but the habitat is far from typical for *H. canadense* and represents one extreme of the plant's ecological tolerance.

For his second assertion – that the necessary ecological conditions are realized only in a few localities – we see no real evidence. There are surely hundreds of flushes in western Ireland where the conditions are very close to those of the sites we have studied, and where the list of species is (apart from the absence of *H. canadense*) very similar. Indeed, such habitats may also be found in south-western England. The vegetation of a pond at Burley, in the New Forest (Hampshire), includes within a few square metres 10 of the first 11 associates listed in Table 1 (*Carex echinata* alone is missing), and also the following.

<i>Acrocladium cuspidatum</i>	<i>Galium palustre</i>
<i>Agrostis setacea</i>	<i>Juncus articulatus</i>
<i>Apium inundatum</i>	<i>Littorella uniflora</i>
<i>Aulacomnium palustre</i>	<i>Nardus stricta</i>
<i>Drepanocladus exannulatus</i>	<i>Peplis portula</i>
<i>Drosera intermedia</i>	<i>Pilularia globulifera</i>
<i>Eleogiton fluitans</i>	<i>Potamogeton polygonifolius</i>
<i>Erica tetralix</i>	

Of the total of 25 species, 22 have been found associated with *H. canadense* in Ireland, the exceptions being *Apium inundatum*, *Aulacomnium palustre* and *Agrostis setacea*. The last is unknown in Ireland; the other two are common enough in wet, acid habitats in western Ireland, and a further search might well reveal them as associates of *H. canadense* by Lough Mask.

Mr A. O. Chater has kindly provided us with a similar list of species from a muddy, cow-trodden site at Rhostie in Cardiganshire. Of the 31 species recorded within a 2m square and 5 additional species within 20m, 28 species feature in Table 1, including the 15 most constant associates.

HABITATS OUTSIDE IRELAND

Jonker (1970 *in litt.*) finds considerable similarity between our species-lists and the associates of *H. canadense* in Holland. He also mentions it, however, as growing on sandy roads and paths with *Illecebrum verticillatum*; this probably implies a habitat which is seasonally drier than any of the Irish ones.

Westhoff (1971) has published two lists of species associated with *H. canadense* near Farnham, Quebec province, Canada. The only species common to these and the Irish lists is *Sphagnum subsecundum sensu lato* (listed by him as *S. auriculatum*), but a general similarity in the vegetation is suggested by the presence in the Canadian lists of two species of *Juncus* and one each of *Eleocharis*, *Eriophorum* and *Scirpus*. Westhoff concludes, from his admittedly limited observations, that in Canada *H. canadense* requires base-poor soil containing sand and organic material, which is inundated for part of the year. Information (derived from herbarium labels) supplied to us by Dr G. Brassard on its habitats in Newfoundland is in general agreement with this; he mentions 'sandy depressions', 'boggy barrens', 'borders of dried-up pool', 'wet fields', 'rocky bed of stream' and 'submerged rock-mud bottom'. Here, as in Holland, some degree of tolerance of seasonal drought is suggested. Apart from this, however, the ecological requirements of the species seem fairly constant and fairly precise throughout its range.

THE STATUS AND HISTORY OF *H. CANADENSE* IN EUROPE

Jonker (1935, 1959), Webb (1957, 1958) and Westhoff (1971) all conclude that *H. canadense* occurs in Europe as a native and has not been introduced by human agency; this does not of course exclude the possibility that its arrival in Europe by other means is of fairly recent date. Our own observations are entirely in accord with this view, but since Meikle (1970), Heine (1962), Robson (1968, 1970 *in litt.*) and Lousley (1971) have suggested that it is a recently introduced alien spread by human agency, it is necessary to review the evidence.

One misunderstanding should be cleared away at the start. Meikle's note refers to the Glengarriff station as 'a wet, sloping meadow close to the car-park of Eccles' Hotel'; and on the strength of this statement Lousley speculates that 'it is possible that the seeds of *Hypericum canadense* were conveyed [to Glengarriff] on footwear or the tyres of a car which had travelled from Lough Mask.' But in fact none of the stations is anywhere near a car-park. The sign (now vanished) for a minute car-park on the main road was used by Mr and Mrs Butcher merely for the purpose of identifying the lane, which ascends from this point up a steep hill for over 0.5 km until it passes close to one of the stations for *H. canadense*. Nowhere does the plant grow on the lane or on its verges (although such aliens as *Myrtus apiculata* Niedenzu seedlings are to be seen in the ditch); and several of the stations are some hundred metres from a track of any kind. In fact there is nothing in the distribution-pattern of the plant, either at Glengarriff or Lough Mask, to provide the smallest evidence of transport either by pedestrians or vehicles.

The evidence for native status is, as it always must be in the absence of a fossil record, mainly negative: it rests chiefly on the fact that none of the stations in which the plant has been seen are (or have been) the site of human activity which could account for the presence of an alien of any kind, let alone a species from North America which is unlikely to be associated with any cargo transported thence. No alien species grows with it in any of its stations; nor is the community in which it occurs one that has been colonised by an alien anywhere in Ireland. Before an alien status can be accepted some suggestions as to the means of introduction and dispersal are surely necessary.

The principal objections to the hypothesis of native status have already been discussed (Webb 1958). To the problems of periglacial survival and of changes in the level of Lough Mask we have nothing to add to what was said there, except that with the discovery of new stations the problems of the lake-level become less important. Three further notes may, however, be added:

1. Further observation has shown that it is a mistake to regard *H. canadense* as an annual. Numerous seedlings can be found, and some of the weaker plants appear to die after flowering, but the majority produce at ground-level more or less globular buds of a peculiar purplish-grey colour: these unfold in spring and produce the short, wide, crowded leaves which are found near the base of a flowering plant. It would appear that a large proportion of the seedlings do not come to maturity, being crowded out by other species. Doubtless the proportion of seedling-establishment to perennation varies from year to year, in accordance with the weather, but the plant is not exposed to the hazards which a true annual has to face.

2. There is no evidence that the species has spread in Ireland, at least during the past 15 years; certainly in the region of its main station at Killaleeun there

has been no perceptible change over this period. The argument that Praeger would have seen it if it had been there in 1933 is weakened by the knowledge that it was in Glensaul in 1906. Nor is the fact that only one plant was noticed in 1954 of any significance; no search was made for others.

3. Heine (1962) and Robson (1968) record the presence in Europe of four other species of the section *Brathys*, to which *H. canadense* belongs; all have their primary centre in North America. In the case of *H. majus*, to which reference has already been made, evidence for recent introduction by human agency is fairly strong. Opinion seems to be divided about the status of the others, and none of them has been studied in detail from this point of view. This is admittedly a curious situation and one which justifies a careful scrutiny of the claims of *H. canadense* to native status in Europe. But analogy, though often suggestive, is never decisive; even if all the other species were shown to be introductions, *H. canadense* might still be native. It is, after all, not the only amphi-Atlantic species with a predominantly American distribution; *Najas flexilis*, with a very similar distribution today, might have been the subject of a similar argument were it not for the abundance of its fruits in quaternary deposits in northern Europe. It is worth recording here that North American and Irish material of *H. canadense* have the same chromosome number, $2n = 16$.*

Dogmatism is particularly out of place in phytogeographical speculation, where we are, all too often, concerned with assessing improbabilities rather than probabilities. We shall merely say that we consider that a hypothesis of human introduction seems to raise much more difficult problems than one of native status. But if the latter is accepted, we must also say that between a theory of recent arrival by long-range dispersal (a phenomenon of which we know virtually nothing, except that it sometimes occurs) and of survival as a relic from a formerly wider distribution in north-western Europe, there appears to be no decisive evidence. For what it is worth, however, we may draw attention to the fact that in some of its Lough Mask stations *H. canadense* grows very close to *Lycopodium inundatum* and *Pilularia globulifera*, which have apparently relict distributions in Ireland.

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REFERENCES

- BOUCHARD, J. (1955a). Un *Hypericum* nouveau pour la flore de France. *Bull. Soc. Bot. Fr.*, **110**: 351–354.
 BOUCHARD, J. (1955b). Sur quelques plantes intéressantes de la Haute-Saône. *Bull. Soc. Hist. nat. Doubs*, **57**: 93–98.
 HEINE, H. (1962). Les millepertuis américains de la flore d'Europe. *Bauhinia*, **2**: 71–78.
 HOAR, C. S. & HAERTL, E. J. (1932). Meiosis in the genus *Hypericum*. *Bot. Gaz.*, **93**: 197–204.

* North American material has been counted by Hoar & Haertl (1932) and material from Lough Mask by Dr D. M. Moore (1972 *in litt.*). Voucher material of the latter is at LTR.

- JONKER, F. P. (1935). 15. *Hypericum canadense* L., in KLOOS, A. W. Jr. Aanwisten van de Nederlandse Flora in 1934. *Ned. kruidk. Archf.*, **45**: 138–140.
- JONKER, F. P. (1959). *Hypericum canadense* in Europe. *Acta bot. neerl.*, **8**: 185–186.
- JONKER, F. P. (1960). *Hypericum canadense* in Europe: an addition. *Acta bot. neerl.*, **9**: 343.
- LOUSLEY, J. E. (1971). *Hypericum canadense* L. in England. *Watsonia*, **8**: 293.
- MEIKLE, R. D. (1970). *Hypericum canadense* L. in the British Isles. *Watsonia*, **8**: 90.
- MERXMÜLLER, H. & VOLLRATH, H. (1956). Ein amerikanisches Neubürger in Europa. *Ber. bayer. bot. Ges.*, **31**: 130–131.
- ROBSON, N. K. B. (1968). *Hypericum*, in TUTIN, T. G., *et alii*, ed. *Flora Europaea*, **2**: 261–269. Cambridge.
- WEBB, D. A. (1957). *Hypericum canadense* L., a new American plant in western Ireland. *Ir. Nat. J.*, **12**: 113–116.
- WEBB, D. A. (1958). *Hypericum canadense* L. in western Ireland. *Watsonia*, **4**: 140–145.
- WEBB, D. A. (1969). An early gathering of *Hypericum canadense* L. *Ir. Nat. J.*, **16**: 209.
- WESTHOFF, V. (1971). Enkele gegevens over de standplaats von *Hypericum canadense* L. *Gorteria*, **5**: 239–248.

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Norfolk *Euphrasiae*

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ABSTRACT

In this paper an account is given of the history and ecology of the four species of *Euphrasia* occurring in Norfolk. The more important taxonomic characters are projected in the form of histograms and polygraphs and it is concluded that the present taxonomic treatment is valid.

INTRODUCTION

The purpose of this paper is to give a brief historical survey of the Norfolk *Euphrasiae*, to examine biometrically populations of the four species identified by Dr P. F. Yeo as occurring in the county, and to present further information on their ecology.

HISTORY

Following at intervals of approximately fifty years, the three Floras of Norfolk illustrate the phases through which the genus has passed. The first *Flora* (Trimmer 1866) lists one species only, *E. officinalis* L., 'Frequent on heaths, barren pastures, and in woods. Sometimes with white flowers'. This is obviously a blanket name covering all our taxa.

The publication of Wettstein's *Monograph* in 1896 undoubtedly gave impetus to more intensive studies but the early workers, in following Wettstein too closely, were attempting to match British species with those of the Continent, and were not aware that some of their plants were endemic to these islands; they denied or belittled the importance of variation and, all too frequently, described a species from one or two plants only. Just as salicologists were naturally averse to differ from Smith's work on the willows, so British workers adhered to Wettstein until the conflicting views gave rise to first one species enjoying a temporary bias and then another becoming more favoured. Townsend's *Monograph* (1897) was merely an abstract from Wettstein, covering those species which Wettstein considered to occur in the British Isles, though it was illustrated by photographs of British and other specimens, so that, as far as British work was concerned, these two monographs were one and the same. Bucknall's account (1917) similarly contained little original work and it fell to Pugsley (1930) to bring order out of chaos.

The second *Flora of Norfolk* (Nicholson 1914), published in the pre-Pugsley era, listed seven species:

E. officinalis L., sp. coll.

E. rostkoviana Hayne

E. kernerii Wettst.

E. stricta Host

E. nemorosa H. Mart.

E. gracilis Fr.

E. curta Wettst. var. *glabrescens* Wettst.

E. officinalis L. It is probable that both Trimmer's and Nicholson's plant includes, for the most part, the variable *E. nemorosa*, except where Breckland localities are given, when the widespread and abundant *E. confusa* is more likely.

E. rostkoviana. Norfolk material is now referred to *E. anglica*, our only glandular representative.

E. kernerii. This is not a British plant. The British material from Surrey, cited by Wettstein, was later recognised by Pugsley as a distinct species, *E. pseudokernerii*. Before this the name was liable to be applied in Britain to both *E. pseudokernerii* and *E. confusa*.

E. stricta. Salmon's gathering from Wells-next-the-Sea was recently named *E. pseudokernerii* by Yeo, but when Yeo subsequently found a *Euphrasia* there he considered it to be *E. nemorosa*, though, like the dune populations at Hunstanton and Holme, likewise recorded by Salmon, it shows some approach to *E. pseudokernerii*. The species at Salmon's Foulden locality are considered by Yeo to be *E. pseudokernerii*, perhaps *E. nemorosa*, and a dwarf form of *E. confusa*; the first of these is the most likely to have been assigned to *E. stricta*.

E. nemorosa. This species is currently accepted as occurring in Norfolk, though it is by no means as widespread as was thought at the time of the publication of the recent *Flora of Norfolk* (Petch & Swann 1968), and it tends to intergrade with *E. confusa*.

E. gracilis. Nicholson's sole record is of a plant found at Flordon by Glasspoole in 1835. The plant now there is considered by Yeo to be *E. pseudokernerii* f. *elongata* and presumably Glasspoole had the same thing. Robinson's later record from chalk heath at South Pickenham is regarded by Yeo as *E. confusa*.

E. curta var. *glabrescens*. This was the name applied around 1900 to the smaller forms of *E. nemorosa* and to *E. confusa*. The only definite record in the *Flora* is from Holkham. The plants on which this record is based are probably the same as those from Wells, Hunstanton and Holme discussed above under *E. stricta*.

The taxa listed in the recent *Flora* (Petch & Swann 1968) are:

E. nemorosa (Pers.) Wallr. including var. *calcareae* Pugsl. and var. *transiens* Pugsl.

E. confusa Pugsl. including forma *albida* Pugsl.

E. pseudokernerii Pugsl. including forma *elongata* Pugsl.

E. anglica Pugsl.

E. nemorosa. Field-work since 1968 has shown that the stated frequency of distribution, 'our commonest species on heaths, chalk grassland, and in pastures', is incorrect as *E. confusa* is far more abundant. It usually grows on deeper and damper soils where the vegetation is more lush, particularly in water-meadows and pastures, but occasionally on the basic soil of drying-up fens. The gatherings

from a chalky railway embankment in 1950 submitted to the Exchange Club as var. *calcareae* and Robinson's material of var. *transiens* from Gooderstone have both been referred to *E. confusa* by Yeo; it is doubtful whether any varietal distinction is merited in this taxon by reason of its considerable variation and apparent hybridisation with *E. confusa*.

E. confusa. Information about habitat was accidentally omitted from the *Flora*. It occurs in dry grassland with *Festuca ovina*, *Medicago lupulina* and *Thymus pulegioides*. The vegetation fails to form a complete cover, as in Watt's 'A' type of Breckland grassland, where it was first recorded by Pugsley in 1939; it is not, however, confined to Breckland. Although occurring in an area of very low rainfall, rarely exceeding 24 inches (608 mm), with highly permeable sandy soil, many Breckland specimens are tall with branches fairly high up the stem and lilac flowers with a rather long corolla-tube. Some populations consist of mixed white- and lilac-flowered plants, or sometimes entirely of white-flowered plants. In a wet season this plant may grow to a height of 35 cm but it nevertheless retains its characteristically small leaves. On the other hand, Yeo has found a few colonies in West Suffolk which match material of *E. confusa* from south-west England. He feels that it is best to retain the taller plants in *E. confusa* although such plants have probably been identified sometimes as *E. nemorosa*.

E. pseudokernerii. This is a beautiful species growing almost exclusively on undisturbed chalk where there is a closed sward. The typical plant is dwarf and bushy, with large, sometimes lilac, but more frequently white flowers (Petch & Swann 1968, Plate 71), The f. *elongata* occurs in many of our calcareous valley fens. This is described by Pugsley (1930) from Norfolk material as 'Of lax habit, with stems up to 40 cm high and internodes, except the upper floral, far longer than the leaves'. It is abundant on Flordon Common.

E. anglica. This grows on damp, less basic grassland overlying peat and it is usually associated with *Salix repens* and *Ulex europaeus*. It is the easiest species to determine as it is the only one in Norfolk with long glandular hairs.

TAXONOMIC STUDY

METHODS

With the exception of *E. anglica*, the Norfolk species of *Euphrasia* are far from easy to identify. There are no really good taxonomic characters and the taxa are very variable. This variation is partly genetic and partly environmental but locally hybridisation appears to be important. It is in fact very difficult to obtain a clear mental picture of the three species since they appear to differ only in a number of relatively minor characters. Field studies have shown that, although the eye may appreciate slight differences in scattered populations, such variation is difficult to formulate.

In an attempt to clarify the relationship between these three species, plants from populations identified by Dr Yeo have been scored for a number of characters which he considers to be significant. The resulting data of mean values for each population have been used to construct a series of histograms and polygraphs for each species. The characters used are as follows:

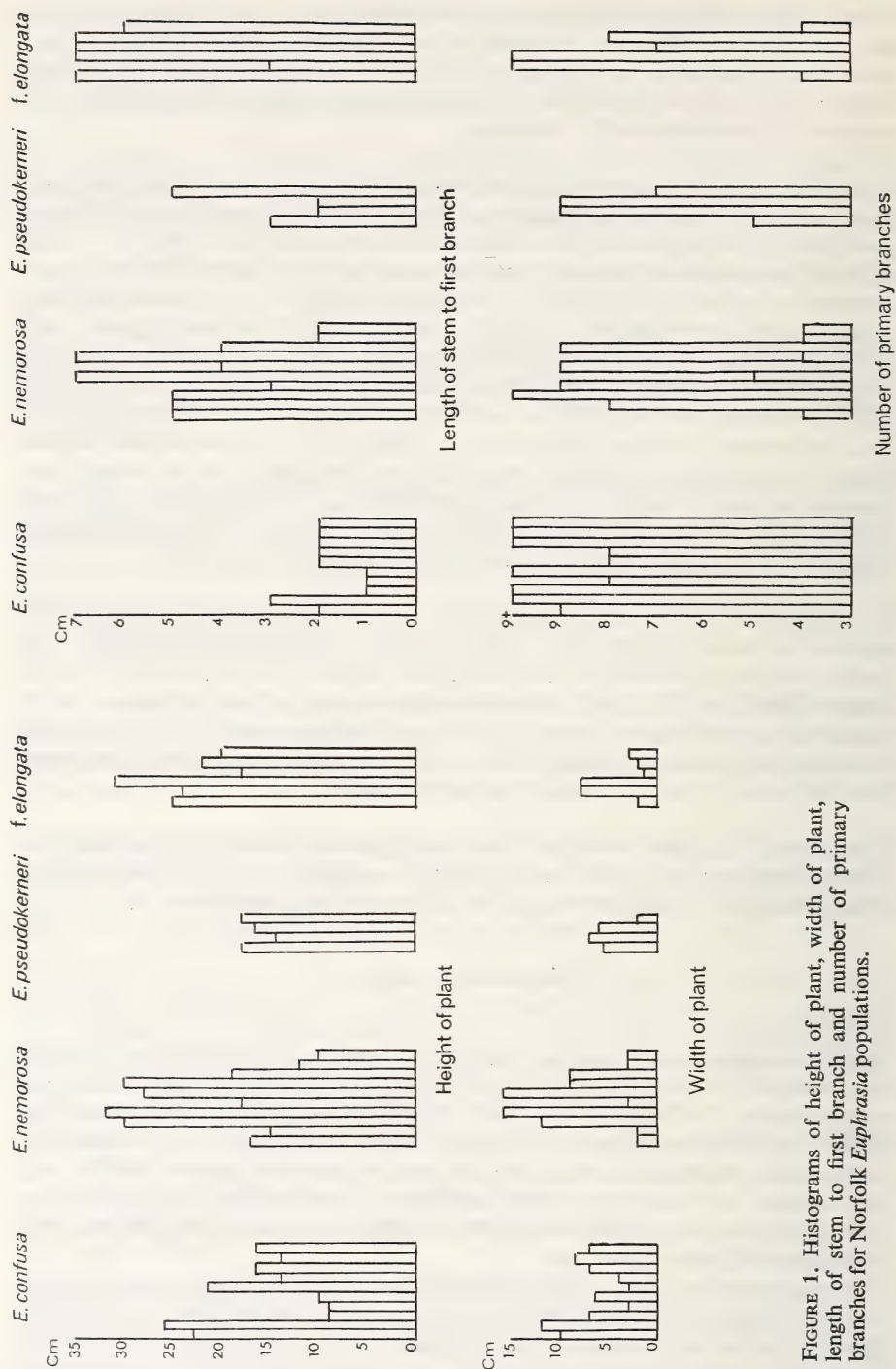


FIGURE 1. Histograms of height of plant, width of plant, length of stem to first branch and number of primary branches for Norfolk *Euphrasia* populations.



FIGURE 2. Histograms of leaf-length x leaf-width, length of corolla and length of capsule for Norfolk *Euphrasia* populations.

Height of plant
 Width of plant
 Length of stem to first branch
 Number of primary branches
 Leaf-length $\times$ leaf-width (to indicate leaf-area)
 Length of corolla
 Length of capsule

HISTOGRAMS

These have been constructed from ten populations each of *E. confusa* and *E. nemorosa*, four of *E. pseudokernerii*, and six of *E. pseudokernerii* f. *elongata*, taken from the localities listed below. The histograms are presented in Figs. 1 and 2.

E. confusa

1. Gooderstone Warren	GR 53/782.011	1969	Chalk grassland.
2. Scotch Covert, Cranwich	GR 52/779.925	1967	Forest ride, sand and chalk.
3. Weeting Heath	GR 52/762.897	1968	Chalk grassland.
4. Sturston Warren	GR 52/893.937	1968	Chalk pit.
5. Gayton Thorpe	GR 53/728.177	1950	Degenerate chalk grassland.
6. Crescent Wood, Brandon	GR 52/791.905	1969	Forest ride, sand and chalk.
7. Salthouse Heath	GR 63/071.426	1949	Heathland on glacial gravel.
8. Alderford Common	GR 53/128.186	1969	Chalk grassland.
9. Cockley Cley	GR 53/795.047	1969	Chalk pit.
10. West Harling	GR 52/965.844	1969	Chalk grassland.

E. nemorosa

1. Derby Fen	GR 53/705.208	1969	Drying-up fen.
2. Derby Fen	GR 53/701.206	1969	Drying-up fen.
3. Narborough	GR 53/745.106	1969	Calcareous grassland.
4. Narborough	GR 53/745.106	1969	Calcareous grassland.
5. Derby Fen	GR 53/705.208	1944	Wet fen.
6. Sugar Fen	GR 53/694.206	1950	Wet fen.
7. Derby Fen	GR 53/705.208	1944	Wet fen.
8. Sugar Fen	GR 53/694.206	1950	Wet fen.
9. Foulden Common	GR 53/758.001	1969	Calcareous grassland of fen.
10. Foulden Common	GR 53/755.000	1969	Wet fen.

E. pseudokernerii

1. Ringstead Downs	GR 53/692.401	1968	Chalk slopes.
2. Ringstead Downs	GR 53/692.401	1968	Chalk slopes.
3. Ringstead Downs	GR 53/692.401	1968	Chalk slopes.
4. North Pickenham	GR 53/866.075	1969	Chalk grassland.

E. pseudokernerii f. *elongata*

1. Buxton Heath	GR 63/178.218	1968	Calcareous valley fen.
2. Flordon Common	GR 62/188.976	1969	Calcareous fen.
3. Beeston Regis	GR 63/175.425	1969	Calcareous fen.

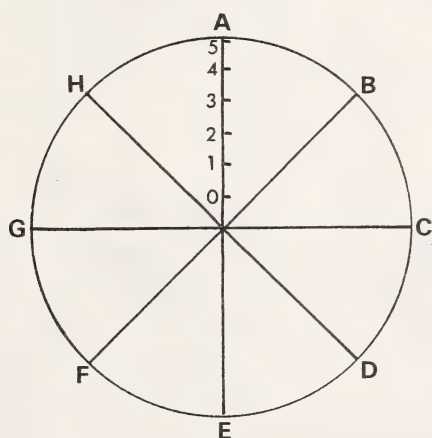
4. Scarning Fen GR 53/982.121 1969 Very calcareous fen.
 5. E. Walton Common GR 53/735.165 1967 Calcareous fen.
 6. Foulden Common GR 53/755.000 1969 Calcareous fen.

POLYGRAPHS

These have been constructed with 8 radii representing the 7 characters used for the histograms but treating leaf-width and leaf-length separately. The variation for each character is divided into six ranges for scoring as shown in Table 1. The polygraphs (Figs. 3 and 4) are of six of the ten populations of *E. confusa* and *E. nemorosa*, and all six and four respectively of *E. pseudokernerii* and its *f. elongata*.

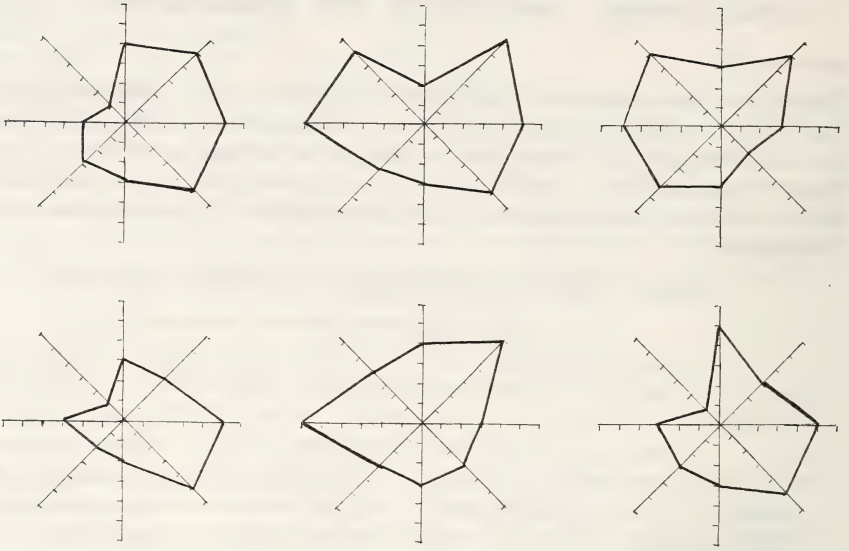
TABLE 1. METHOD OF SCORING FOR POLYGRAPHS

	0	1	2	3	4	5
A = height of plant (cm)	8-11	12-15	16-19	20-23	24-27	>27
B = width of plant (cm)	2-4	5-7	8-10	11-13	14-16	>16
C = length of stem to 1st branch (cm)	<2.5	2.5-3.0	3.5-4.0	4.5-6.0	6.5-7.0	>7
D = number of primary branches	0	2-3	4-5	6-7	8-9	>9
E = length of leaf (mm)	<5.0	5.0-5.5	6.0-7.5	8.0-9.5	10-11	>11
F = width of leaf (mm)	<3.5	3.5-4.5	5.0-6.5	7.0-7.5	8.0-9.5	>9.5
G = length of corolla (mm)	<6.5	6.5-7.5	8.0-9.0	9.5-10.0	10.5-11	>11
H = length of capsule (mm)	<4.5	4.5	5.0	5.5	6.0	>6



Key to polygraph
 Each radius has six divisions with values from 0-5

E. nemorosa



E. confusa

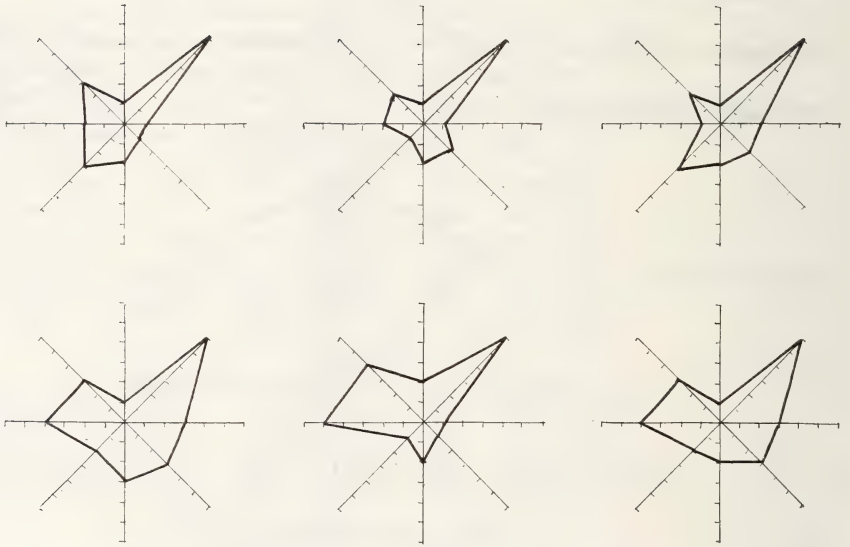
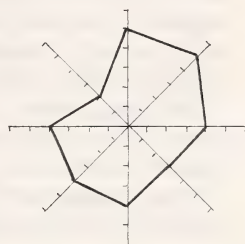
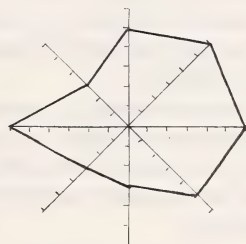
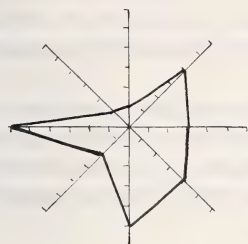
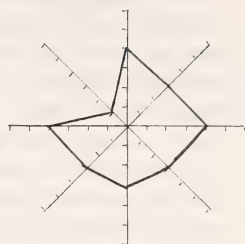
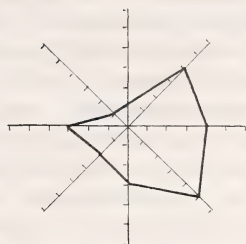
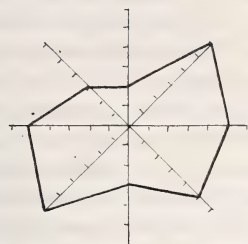
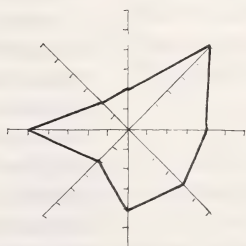
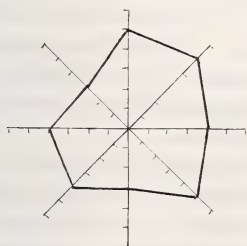


FIGURE 3. Polygraphs for Norfolk *Euphrasia confusa* and *E. nemorosa* populations.

E. pseudokeneri
f. *elongata*



E. pseudokeneri



E. confusa × *nemorosa*

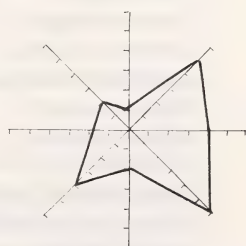


FIGURE 4. Polygraphs for Norfolk *Euphrasia pseudokeneri*, *E. confusa* × *nemorosa* and *E. pseudokeneri* f. *elongata* populations.

DISCUSSION

These three species, *E. confusa*, *E. nemorosa* and *E. pseudokernerii*, are all members of Pugsley's series *Nemorosae*. These are late-summer flowering species which are usually tall and richly branched. This is well shown by the histogram of the number of primary branches but that of length to the first branch shows that *E. confusa* is markedly smaller, and hence apparently more 'bushy', than *E. nemorosa*. *E. confusa* is also distinct in its small leaves.

E. nemorosa is shown to be a very variable plant and in my opinion the erection of varieties based on these characters is not justified. *E. pseudokernerii* varies in height much like *E. nemorosa* but there is here rather more suggestion of a division into medium-sized plants and taller ones (f. *elongata*). *E. pseudokernerii* is best recognised by its longer corollas and, to a lesser extent, the longer capsules. The range of corolla-length in *E. confusa*, 6–8.5 mm, is within the range given by Warburg (1962) (4.5–8(–9)mm) but considerably greater than that allowed for by Pugsley (1930).

The polygraphs of *E. nemorosa* and *E. pseudokernerii* are rather similar but that of *E. confusa* has a pronounced bias to the 'south-east', reflecting its large number of branches, small leaves and the short distance to the first branch.

These results do therefore suggest that the taxa recognised as occurring in Norfolk by Yeo are valid ones.

ASSOCIATED SPECIES

Species lists have been made of vascular plants occurring within a circle of approximately one metre radius in 15 stations for *E. confusa*, 8 for *E. nemorosa* and 11 for *E. pseudokernerii*. No fewer than 99 species were found to be present but the following lists apply only to those which were listed more than once.

E. confusa

Achillea millefolium
Agrostis stolonifera
A. tenuis
Anthoxanthum odoratum
Astragalus danicus
Briza media
Carex flacca
Centaurea nigra
Cirsium acaulon
Dactylis glomerata
Festuca ovina
Galium saxatile
G. verum
Helictotrichon pratense
Hieracium pilosella
Holcus lanatus
Koeleria gracilis
Leontodon taraxacoides

Linum catharticum
Lotus corniculatus
Medicago lupulina
Ononis spinosa
Pastinaca sativa
Phleum bertolonii
Plantago lanceolata
P. media
Poa pratensis
Potentilla reptans
Poterium sanguisorba
Pteridium aquilinum
Scabiosa columbaria
Senecio jacobaea
Succisa pratensis
Thymus pulegioides
Trifolium repens

E. nemorosa

<i>Achillea millefolium</i>	<i>Lychnis flos-cuculi</i>
<i>Agrostis stolonifera</i>	<i>Medicago lupulina</i>
<i>Anthoxanthum odoratum</i>	<i>Molinia caerulea</i>
<i>Briza media</i>	<i>Ononis spinosa</i>
<i>Carex flacca</i>	<i>Pastinaca sativa</i>
<i>Centaurea nigra</i>	<i>Phleum bertolonii</i>
<i>Cirsium acaulon</i>	<i>Plantago lanceolata</i>
<i>Conopodium majus</i>	<i>P. media</i>
<i>Dactylis glomerata</i>	<i>Poa pratensis</i>
<i>Equisetum fluviatile</i>	<i>Potentilla erecta</i>
<i>Galium verum</i>	<i>Poterium sanguisorba</i>
<i>Holcus lanatus</i>	<i>Prunella vulgaris</i>
<i>Juncus inflexus</i>	<i>Ranunculus flammula</i>
<i>J. subnodulosus</i>	<i>Rumex acetosa</i>
<i>Leontodon taraxacoides</i>	<i>Senecio jacobaea</i>
<i>Linum catharticum</i>	<i>Trifolium pratense</i>
<i>Lotus corniculatus</i>	<i>T. repens</i>
<i>L. pedunculatus</i>	

E. pseudokerneri

* species associated only with forma *elongata*

<i>Achillea millefolium</i>	<i>Lotus corniculatus</i>
* <i>Anagallis tenella</i>	* <i>L. pedunculatus</i>
* <i>Angelica sylvestris</i>	* <i>Lychnis flos-cuculi</i>
<i>Briza media</i>	<i>Medicago lupulina</i>
<i>Carex flacca</i>	* <i>Mentha aquatica</i>
<i>Centaurea nigra</i>	* <i>Molinia caerulea</i>
<i>Conopodium majus</i>	<i>Ononis spinosa</i>
<i>Dactylis glomerata</i>	* <i>Pedicularis palustris</i>
* <i>Epipactis palustris</i>	<i>Plantago lanceolata</i>
* <i>Equisetum fluviatile</i>	<i>Poa pratensis</i>
<i>Galium verum</i>	<i>Potentilla erecta</i>
<i>Helictotrichon pratense</i>	<i>Prunella vulgaris</i>
<i>Hieracium pilosella</i>	* <i>Ranunculus flammula</i>
<i>Holcus lanatus</i>	<i>Rhinanthus minor</i>
* <i>Hydrocotyle vulgaris</i>	<i>Rumex acetosa</i>
* <i>Juncus acutiflorus</i>	* <i>Succisa pratensis</i>
* <i>J. subnodulosus</i>	<i>Trifolium pratense</i>
<i>Koeleria gracilis</i>	

It is very difficult to detect the host plant in the field, not only because of the poorly developed root-system of *Euphrasiae* but also because the haustoria cease to function after a time, become detached, and then the *Euphrasia* becomes a saprophyte. On only one occasion was a plant pulled up complete with host. This was at Scarning in a very calcareous fen where *E. pseudokerneri* f. *elongata* was attached to *Drosera intermedia*; it must be unusual for a semi-parasite to parasitise an insectivorous plant.

Plantago lanceolata, which is a very common associate and is sometimes locally dominant on sheep-walks and forest-tracks, is probably the most frequent host-plant, particularly for *E. confusa*. The relatively high frequency of *Dactylis glomerata*, *Holcus lanatus* and *Poa pratensis* is in agreement with observations of other workers on host grasses.

ACKNOWLEDGMENT

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REFERENCES

- BUCKNALL, C. (1917). British Euphrasiae. *J. Bot., Lond.*, **55**, Suppl.
NICHOLSON, W. A., ed. (1914). *A Flora of Norfolk*. Norwich.
PETCH, C. P. & SWANN, E. L. (1968). *Flora of Norfolk*. London.
PUGSLEY, H. W. (1930). A revision of the British Euphrasiae. *J. Linn. Soc. (Bot.)*, **48**: 467–544.
TOWNSEND, F. (1897). Monograph of the British species of *Euphrasia*. *J. Bot., Lond.*, **35**: 321–336, 395–426, 465–477.
TRIMMER, K. (1866). *Flora of Norfolk*. London.
WARBURG, E. F. (1962). *Euphrasia*, in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*, 2nd ed., pp. 702–716. Cambridge.
WETTSTEIN, R. VON (1896). *Monographie der Gattung Euphrasia*. Leipzig.
YEO, P. F. (1962). A study of variation in *Euphrasia* by means of outdoor cultivation. *Watsonia*, **5**: 224–235.

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Observations on *Polypodium australe* Fée in Scotland

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ABSTRACT

Ecological and other data are given for *Polypodium australe* in ten Scottish sites where the taxon has recently been observed.

Evidence has been presented by Synnott (1970) and by Roberts & Synnott (1972) for the occurrence in Scotland of *Polypodium australe*, the diploid segregate of the *P. vulgare* complex, based on 19th century herbarium material. Recently we have reported the taxon from a number of Scottish localities (Rutherford & Stirling 1972) representing the most northern stations so far known for this southern species.

In all the localities under consideration (Table 2), the diploid grows in rocky situations, generally on slopes exceeding 60 degrees and with an aspect ranging from south-east to south-west. One site, however, faces north and two others more or less east. All the sites with two exceptions are coastal and lie within 100 m of the high tide mark, usually on sea-cliffs or cliffs of raised beaches. Site 1 is approximately six miles and site 7 two miles from the coast. The latter is the most easterly of the Scottish sites though some English localities lie even further to the east.

Polypodium australe is generally regarded as a calcicole in the British Isles and, with one exception, this is supported by the nature of its habitats in Scotland. We have found it on a wide range of rock types including sandstones and rocks of volcanic origin, but in only one instance on limestone, which is rather surprising considering its prevalence on the Carboniferous limestone of England, Wales and Ireland. The basic nature of the sites is evident from the species lists in Table 1 though site 1 is the notable exception. In addition to the species shown, *P. australe* is accompanied at site 1 by species more typical of neutral or acid habitats, including *Dryopteris dilatata*, *Luzula sylvatica* and *Deschampsia flexuosa*. In the other sites the frequent occurrence of the calcicolous or basiphilous species *Geranium sanguineum*, *Helianthemum nummularium* and *Saxifraga granulata* is significant. More or less constantly occurring species are *Asplenium trichomanes*, *Hedera helix*, *Thymus drucei*, *Teucrium scorodonia* and *Festuca rubra*. At site 2 *P. australe* grows epiphytically on ash (*Fraxinus excelsior*) and

TABLE 1. SOME ASSOCIATES OF *POLYPODIUM AUSTRALE* AT 10 SCOTTISH SITES (LISTED IN TABLE 2)

Site number	1	2	3	4	5	6	7	8	9	10
<i>Asplenium adiantum-nigrum</i>		+	+	+	+	+			+	
<i>A. trichomanes</i>	+	+	+	+	+	+	+	+	+	+
<i>Polypodium vulgare</i>				+	+	+			+	
<i>P. interjectum</i>	+	+	+	+		+				
<i>P. vulgare</i> × <i>interjectum</i>				+	+	+			+	
<i>P. australe</i> × <i>interjectum</i>		+	+							
<i>Helianthemum nummularium</i>			+		+		+	+		
<i>Silene maritima</i>			+	+					+	
<i>Linum catharticum</i>		+			+					
<i>Geranium sanguineum</i>		+			+	+	+			
<i>G. molle</i>					+	+	+			+
<i>Lotus corniculatus</i>					+	+	+			
<i>Rubus ulmifolius</i>			+	+	+				+	
<i>R. fruticosus</i> agg.		+	+	+	+	+	+			
<i>Sedum anglicum</i>		+	+	+					+	
<i>S. acre</i>						+	+	+		
<i>Umbilicus rupestris</i>				+		+			+	
<i>Saxifraga granulata</i>			+		+	+				
<i>Hedera helix</i>		+	+	+	+	+	+	+	+	
<i>Armeria maritima</i>			+						+	
<i>Veronica officinalis</i>		+			+					
<i>Thymus drucei</i>		+	+		+	+	+	+	+	+
<i>Teucrium scorodonia</i>		+	+	+	+	+	+	+	+	+
<i>Plantago lanceolata</i>						+	+	+		
<i>Campanula rotundifolia</i>	+		+		+			+	+	
<i>Festuca rubra</i>	+	+	+	+	+	+	+	+	+	+
<i>Dactylis glomerata</i>			+			+	+	+	+	
<i>Brachypodium sylvaticum</i>		+			+	+			+	
<i>Helictotrichon pratense</i>							+			
<i>H. pubescens</i>								+		
<i>Tortella nitida</i>			+		+		+	+		

elder (*Sambucus nigra*), and at site 5 on ash and hawthorn (*Crataegus monogyna*).

The site at Killinallan, Islay, calls for particular comment as the fern grows there on quartzite, a rock not usually notable for supporting a rich flora. Here, however, the rock crevices have become filled with sand blown from neighbouring dunes. A parallel example in North Wales is cited by Hughes (1969). It is noteworthy that *P. australe* has not yet been found on walls or similar man-made habitats in Scotland even though it is not uncommon in such sites elsewhere.

In all its Scottish localities *P. australe* is readily recognisable to the practised eye. The field characters generally found to be most useful are the relatively short, broad frond-shape, the rather narrow and often serrate pinnae, the marked tendency for at least the lower pinnae to be inflexed, and the very long rhizome-scales. Nevertheless a considerable degree of variation in frond morphology is evident in the Scottish plants. Some of this variation is undoubtedly due to environmental factors; for example, colonies growing in shade and in conditions of high soil moisture produce much larger fronds which often show a tendency to depart from the normal shape, exhibiting varying degrees of

crenation of the pinnae. Such plants were observed at sites 2 and 5 and at the latter fronds measuring up to 30 cm long (excluding the petiole) and 15 cm wide were not uncommon. The behaviour of some of these variants in cultivation is being observed.

Features frequently quoted as characteristic of the diploid but found to be unreliable are the degree of serration of the pinnae and the colour of the frond. Although many populations of *P. australe* have more or less serrate pinnae, forms are frequently encountered in which the pinnae are almost completely entire. The fronds of *P. australe* apparently never assume such a deep colour as in *P. vulgare sensu stricto* or *P. interjectum*, but these two commoner species can, especially when growing in full exposure, produce fronds of a much lighter, almost yellowish green.

Hybrids involving *P. australe* appear to be of rare occurrence, the tetraploid hybrid *P. × rothmaleri* Shivas (*P. australe* × *P. interjectum*) having been found only at sites 2 and 3 where both putative parents grow in close proximity. Despite diligent search in localities where *P. vulgare* is intermixed with *P. australe*, the rare triploid hybrid *P. × font-queri* Rothm. has not yet been discovered.* There are, as yet, no published records of this hybrid for the British Isles although it has been reported from the south of England and North Wales. Hybrids may often be recognised in the field by their intermediate frond characters but the degree of resemblance to one or other of the putative parents can be such that field recognition is virtually impossible. It should be emphasised that hybrids usually produce apparently normal sori though examination of the sporangia will reveal a high proportion of abortive spores. The idea that desiccated or partially developed sporangia are indicative of hybridity is erroneous as such abnormal features are almost certainly the result of arrested development due to unfavourable conditions.

Table 2 shows the number of indurated annulus cells in fourteen Scottish plants and, for comparison, six plants from English, Welsh and Irish localities. The data for the Scottish plants correspond closely with those of Roberts (1970) based on material from North Wales. Of the 700 sporangia counted for the Scottish material, 55% had 6 or 7 indurated cells and only 10% had less than 5 or more than 9. Of the 300 counts on the non-Scottish material, 58% were of 6 or 7 and only 6% exceeded 9; there was none less than 5.

The occurrence of *P. australe* in western Scotland* is scarcely surprising in view of the comparative mildness of parts of the western seaboard where plants of Lusitanian or Mediterranean-Atlantic distributions are known to occur. For example, the Mediterranean-Atlantic moss *Tortella nitida* has a remarkably similar distribution in the British Isles (Stirling 1971). The occurrence of *P. australe* in the Edinburgh area is less easily explained on climatic grounds and it would appear that it may be expected to occur where suitable basic conditions prevail almost anywhere in Scotland south of the Central Highlands and perhaps even further north than its present recorded limit (Islay) in the Western Isles. The present northern limit of *P. australe* is the island of Lismore, 56°30'N.

*Since this paper was written we have found the triploid hybrid (*P. × font-queri*) at Maidenbower Craigs, Dumfries, in 1972 and *P. australe* has been discovered in Kintyre (v.c.101) by Mr A. G. Kenneth.

TABLE 2. THE NUMBER OF INDURATED ANNULUS CELLS IN 20 PLANTS OF *POLYPODIUM AUSTRALE*

50 sporangia of each plant were examined

Site Number	Date of collection	Locality	Grid Reference	Range	Mode
1	July 1972	Maidenbower Craigs, Dumfries (Permian Sandstone breccia)	25/97	4-8	6
2	October 1971	Southwick, Kirkcudbrightshire (Silurian)	25/95	4-9	7
3	January 1972	Port Ling, Kirkcudbrightshire (Silurian)	25/85	6-10	7
4	January 1972	Lendalfoot, Ayrshire (Ultrabasic intrusion)	25/18	8-13	9
4	January 1972	Lendalfoot, Ayrshire (Ultrabasic intrusion)	25/18	4-9	6
5	January 1972	Heads of Ayr, Ayrshire (Volcanic agglomerate)	26/21	4-7	6
6	November 1971	Portencross, Ayrshire (Old Red Sandstone conglomerate)	26/14	5-9	7
7	May 1972	Arthur's Seat, Edinburgh (Basalt)	36/27	6-12	8
7	1855 (herbarium material)	Arthur's Seat, Edinburgh (Basalt)	36/27	6-9	7
8	September 1972	Isle of Lismore, Argyll (Limestone)	17/84	6-9	7
8	September 1972	Isle of Lismore, Argyll (Limestone)	17/84	3-7	5
9	June 1972	Bennan Head, Arran (Volcanic intrusion)	16/92	5-8	6
9	June 1972	Bennan Head, Arran (Volcanic intrusion)	16/92	6-10	8
10	June 1972	Killinallan, Islay (Quartzite with blown sand)	16/37	4-7	6
	herbarium	Brighstone, Isle of Wight		6-9	7
	cultivated	Somerset		6-13	8
	cultivated	Manorbier, Pembroke		6-11	7
	cultivated	Pembroke Castle		5-8	7
	cultivated	Pembroke Castle		5-10	7
	herbarium	Dingle Court, Co. Kerry		7-11	8

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REFERENCES

- HUGHES, W. E. (1969). The distribution of *Polypodium vulgare* L. subspecies *serratulum* Arcangeli in North Wales. *Nature Wales*, **11**: 194-198.
- PERRING, F. H. & SELL, P. D., ed. (1968). *Critical Supplement to the Atlas of the British Flora*, p. 3. London.

- ROBERTS, R. H. (1970). A revision of some of the taxonomic characters of *Polypodium australe* Fée. *Watsonia*, **8**: 121–134.
- ROBERTS, R. H. & SYNNOTT, D. M. (1972). *Polypodium australe* Fée in Scotland and North-East Ireland. *Watsonia*, **9**: 34–41.
- RUTHERFORD, A. & STIRLING, A. MCG. (1972). *Polypodium australe* Fée and the tetraploid hybrid in Scotland. *Brit. Fern Gaz.*, **10**: 233–235.
- STIRLING, A. MCG. (1971). Distribution maps of bryophytes in Britain – *Tortella nitida*. *Trans. Br. bryol. Soc.*, **6**: 333.
- STIRLING, A. MCG. (1972). *Polypodium australe* Fée in the Edinburgh area. *Trans. Proc. bot. Soc. Edinb.*, **41**: 549–551.
- SYNNOTT, D. M. (1970). Evidence of *Polypodium australe* Fée in Scotland. *Trans. Proc. bot. Soc. Edinb.*, **40**: 623–624.

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Chromosome numbers in the British species of *Calystegia* and *Convolvulus*

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ABSTRACT

British material of all 4 British species of *Calystegia* had $2n = 22$; it is believed that previous counts of $2n = 24$ are errors. British material of *Convolvulus arvensis* had $2n = 48$.

The chromosome number of all four British species of *Calystegia* has been determined as $2n = 22$, and that of *Convolvulus arvensis* as $2n = 48$. These counts are believed to be the first for Britain for *Calystegia pulchra* and *Convolvulus arvensis*, and, together with those reported by Brummitt (1973), the first British counts of any of the species to be published. Material of *Calystegia* from 2 sites in Sicilia also had $2n = 22$.

Root-tips were obtained from seeds grown on wet filter-paper in the light at 20°C. The germinated seeds were pre-treated for 6 hours with a 0.002M aqueous solution of 8-hydroxyquinoline at 15°C, and root-tip squashes made by the Feulgen method. The chromosomes were observed and photographed under negative phase-contrast with a microscope magnification of $\times 1,600$. This usually gave results superior to those obtained by positive phase-contrast and far superior to those with normal lighting.

Seed samples were obtained from the following 23 localities:

C. sepium (L.) R.Br. subsp. *sepium* $2n = 22$

- 1 Altcar, near Formby, S. Lancs., v.c.59, GR 34/32.06
- 2 Levenshulme, Manchester, S. Lancs., v.c.59, GR 33/87.94
- 3 Plymouth Grove, Manchester, S. Lancs., v.c.59, GR 33/85.96
- 4 Wellington Road North, Stockport, Cheshire, v.c.58, GR 33/88.80
- 5 Park Lane, Poynton, Cheshire, v.c.58, GR 33/92.83
- 6 Roadside near Bells Yew Green, near Tunbridge Wells, E. Sussex, v.c.14, GR 51/61.36

C. pulchra Brummitt & Heywood $2n = 22$

- 1 Reynolds Lane, Tunbridge Wells, W. Kent, v.c.16, GR 51/57.40

C. silvatica (Kit.) Griseb. $2n = 22$

- 1 Shrigley Road North, Higher Poynton, Cheshire, v.c.58, GR 33/94.83
- 2 Bramhall Moor Lane, Hazel Grove, Cheshire, v.c.58, GR 33/90.86
- 3 Between Altcar and Ormskirk, S. Lancs., v.c.59, GR 34/36.06
- 4 Carr Cross, Scarisbrook, S. Lancs., v.c.59, GR 34/37.13

- 5 Chorltonville, Manchester, S. Lancs., v.c.59, GR 33/81.93
- 6 On fixed dunes, Southport, S. Lancs., v.c.59, GR 34/32.16
- 7 Roadside, St Asaph, Flint, v.c.51, GR 33/03.74
- 8 Roadside west of St Asaph, Flint, v.c.50, GR 33/00.73
- 9 Roadside near Tarvin, Cheshire, v.c.58, GR 33/50.68
- 10 Brerton Road, Hartlepool, Durham, v.c.66, GR 45/49.33
- 11 By Cameron Hospital, Hartlepool, Durham, v.c.66, GR 45/49.32
- 12 North Farm Estate, High Brooms, near Tunbridge Wells, W. Kent, v.c.16, GR 51/59.41
- 13 Roadside on outskirts of Catánia, Sicilia

C. soldanella (L.) R.Br. $2n = 22$

- 1 Fine Shingle on Slapton Sands, Slapton, S. Devon, v.c.3, GR 20/83.44
- 2 Sandy foreshore just south of Catánia, Sicilia

Convolvulus arvensis L. $2n = 48$

- 1 High Brooms Gas-works, near Tunbridge Wells, W. Kent, v.c.16, GR 51/59.41

The karyotype morphology of all these samples was examined in some detail (Figs. 1 & 2); it was concluded that there was no significant variation among the 22 collections of *Calystegia* species. 10 of the 11 pairs of chromosomes are very short ($c\ 1.0\text{--}1.5\ \mu\text{m}$) and it is very difficult to define any structural details. It appears that about 8 may be best described as metacentrics and 2 as submetacentrics. The other chromosome pair is a longer metacentric with a well-defined satellite (total length $c\ 2.2\text{--}2.6\ \mu\text{m}$). In most cases the secondary constriction is fairly long, but in others it is very short and the satellite is not discernible. In *Convolvulus arvensis* all 24 pairs are short ($c\ 1.0\text{--}2.0\ \mu\text{m}$) and no satellites were clearly observable. As in *Calystegia* the chromosomes vary from submetacentrics to metacentrics.

Since earlier reports of the chromosome numbers of both *Calystegia sepium* and *Convolvulus arvensis* are conflicting, all previously-published chromosome counts of British species of these two genera were checked. This permitted counts based on material of unknown origin or from Botanic Gardens, and publications repeating earlier original counts, to be excluded.

There are about 5 published original counts of *C. soldanella*, all $2n = 22$, based upon material from Japan, North America and Portugal. No published counts of *C. silvatica* have been traced, and only one of *C. pulchra* (Holub *et alii* 1970). The latter, also $2n = 22$, was obtained from material collected from the Frýdlant district of northern Bohemia, Czechoslovakia.

In the case of *C. sepium*, 11* separate counts have been discovered; 7 of these are $2n = 22$, 3 are $2n = 24$, and 1 is $2n = 20$. Of the $2n = 22$ counts, 1 is based on Japanese material (Kano 1929) and is the earliest count for the genus; 2 are based on material from the U.S.A. (Jones 1968, from Virginia, and Lewis 1966, from Missouri); 3 are based on Czechoslovakian material (Murín & Váchová in

*Since writing this I have found that H. Weislo (*Acta biol. cracov., Bot.*, **14**: 73 (1971)) found $2n = 22$ in three separate collections of *C. sepium* from southern Poland.

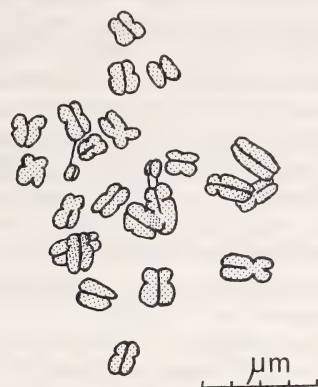


FIGURE 1. Karyotype of *Calystegia silvatica* (Kit.) Griseb. from Cameron Hospital, Hartlepool, Durham, v.c. 66.

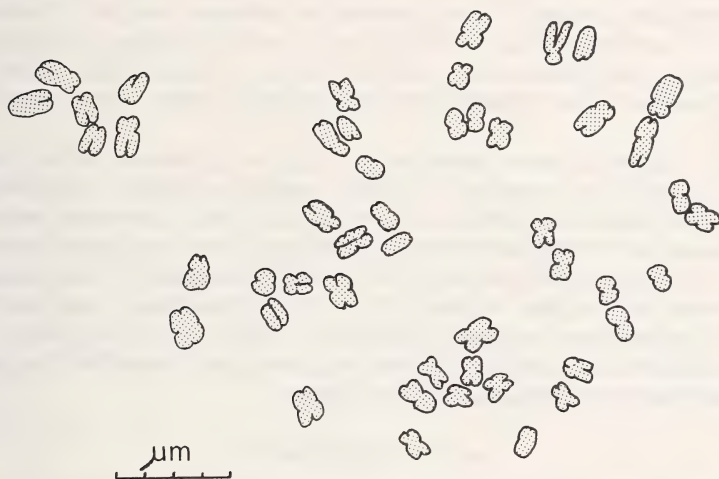


FIGURE 2. Karyotype of *Convolvulus arvensis* L. from High Brooms Gas-works, near Tunbridge Wells, W. Kent, v.c. 16.

Májovský *et alii* 1970, from south-western Slovakia, and Holub *et alii* 1970, 2 separate collections from central Bohemia); and 1 is based on Dutch material (Gadella & Kliphuis 1967). One of the $2n = 24$ counts (Wolcott 1937) refers to material from New Jersey, U.S.A., one (Feföldy 1947) to Hungarian material, and the other (Laane 1969) to Norwegian material; the last is the only published count in the genus based on meiotic rather than mitotic studies. The single $2n = 20$ count (Smith 1965) was made from a collection from Kansas, U.S.A.

Thus 13 of the 17 published counts of species of *Calystegia* agree with the 22 counts reported here for the first time. In the case of *C. sepium* the data based on American and Japanese specimens should be used with care, because they probably refer to a non-British taxon; *C. sepium* subsp. *sepium* is only a rare

alien in these countries. Further attention was paid to the remaining four counts. Smith (1965) gave no details of the karyotype morphology of his $2n = 20$ count, and did not comment that it was a number different from any previously published. The two mitotic counts of $2n = 24$ are accompanied by figures, and both show two chromosomes which are smaller than the rest and which, from their positions in the drawing, might well represent satellites. No morphological details are given for the $n = 12$ count, but in view of the small size of the chromosomes (particularly at meiosis) it would be easy to mistake satellites for an extra bivalent. Thus it is very likely that the counts of $2n = 24$ are errors, although it is of course not possible to exclude the possibilities that some strains might have 24 (or 20) chromosomes, or (as suggested by Holub *et alii* 1970) that the $2n = 24$ reports represent $2n = 22 + 2B$.

There are only 4 previous counts of *Convolvulus arvensis*, three of which are given as $2n = 50$ (Wolcott 1937, from Virginia, U.S.A.; Hagerup 1941, from Denmark; and Garajová in Májovský *et alii* 1970, from near Bratislava, Czechoslovakia). Khoshoo & Sachdeva (1961) made detailed observations on the chromosomes of *C. arvensis* from a number of sources in the Punjab Plains of northern India and also from various European samples, although the latter were from Botanic Garden material of unknown origin (Khoshoo 1972 *in litt.*) All samples had $2n = 48$ or $n = 24$, and the figures provided show a morphology closely comparable with that shown in Fig. 2. Thus in this species it is impossible to say whether the chromosome number varies or is always $2n = 48$.

Finally, a point of some interest concerning the appearance of the interphase nucleus is worthy of mention. In all the species examined it was found that during interphase the nucleus of meristematic cells possesses well-marked prochromosomes which, in favourable cases, and using negative phase-contrast, allow the chromosome number to be counted accurately. This feature was earlier noted in *C. sepium* by Persy (1935, 1936). During early prophase the rest of each chromosome becomes progressively visible from the position of the prochromosome outwards towards each telomere, and only after this process is completed are the chromosomes seen to shorten.

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REFERENCES

- BRUMMITT, R. K. (1973). *Calystegia* – some British chromosome counts. *Watsonia*, **9**: 369–370.
- FEFÖLDY, L. (1947). Chromosome numbers of certain Hungarian plants. *Archiva biol. hung.*, Ser. 2, **17**: 101–103.
- GADELLA, T. W. J. & KLIPHUIS, E. (1967). Chromosome numbers of flowering plants in the Netherlands, III. *Proc. K. ned. Akad. Wet.*, Ser. C, **70**: 7–20.
- HAGERUP, O. (1941). Nordiske Kromosom-Tal, 1. *Bot. Tidsskr.*, **45**: 385–395.
- HOLUB, J., MĚSÍČEK, J. & JAVŮRKOVÁ, V. (1970). Annotated chromosome counts of Czechoslovak plants, 1–15. *Folia geobot. & phytotax.*, **5**: 339–368.
- JONES, A. (1968). Chromosome numbers in *Ipomoea* and related genera. *J. Hered.*, **59**: 99–102.
- KANO, T. (1929). *Proc. Crop Sci. Soc. Japan*, **4**: 15–21. (Original article not seen).
- KHOSHOO, T. N. & SACHDEVA, V. (1961). Cytogenetics of Punjab weeds, 1. Causes of polymorphism in *Convolvulus arvensis*. *Indian J. Agric. Sci.*, **31**, *Genet. Supp.*: 13–17.

- LAANE, M. M. (1969). Meiosis og kromosomstrukturell hybriditet i en del norske plantearter. *Blyttia*, **27**: 141–173.
- LEWIS, W. H. (1966). Chromosome numbers of phanerogams, I. *Ann. Mo. bot. Gdn*, **53**: 100–103.
- MÁJOVSKÝ, J. & Co-workers (1970). Index of chromosome numbers of Slovakian Flora, 1. *Acta Fac. Rerum nat. Univ. comen., Bratisl., Bot.*, **16**: 1–26.
- PERSY, J. (1935). Observations sur le comportement du nucléole dans la caryocinèse somatique du *Calystegia sepium* R.Br. (*Convolvulus sepium* L.). *Bull. Soc. r. Bot. Belg.*, **67**: 193–195.
- PERSY, J. (1936). Nouvelles observations sur le comportement du nucléole dans la caryocinèse somatique du *Calystegia sepium* et sur sa néoformation. *Bull. Soc. r. Bot. Belg.*, **68**: 222–233.
- SMITH, E. B. (1965). Chromosome numbers of Kansas Flowering Plants, 2. *Trans. Kans. Acad. Sci.*, **68**: 463–464.
- WOLCOTT, G. B. (1937). Chromosome numbers in the Convolvulaceae. *Am. Nat.*, **71**: 190–192.

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Short Notes

100/b. ARABIS BOREALIS Andrz. ex Ledeb.—Not in Ireland.

Arabis borealis Andrz. ex Ledeb. is part of the *Arabis hirsuta* aggregate (Jones 1964, cf. Titz 1972). It is a native of northern Asia and northern Russia (Jalas 1949), but it was recently also reported from Ireland by Scannell (1965). This was based on the identification of a herbarium specimen in DBN (originally labelled '*Arabis* sp.? Kilrush, Co. Clare (Dock), 16/4/1930. R. A. Phillips') by B. M. G. Jones in 1965.

In the course of the revision of Irish herbarium material from DBN this plant has recently been investigated by me. Its habit is distinctly different from that of *Arabis hirsuta* agg., and a thorough examination of its flowers revealed a more or less pear-shaped ovary, which indicates that it is in fact a species of *Camelina*. Though there are no siliculae on the plant, which is rather immature, it seems probable that it is *Camelina sativa* (L.) Crantz var. *pilosa* DC. Thus the record of *Arabis borealis* for Ireland (being rather improbable from the first) should be deleted.

REFERENCES

- JALAS, J. (1949). Über *Arabis borealis* Andrz. ex Ledeb., eine im fennoskandischen Florengebiet bisher übersehene Art, nebst einigen Bemerkungen zur Systematik nordischer *Arabis hirsuta* (L.) Scop.-Formen. *Archiv Soc. zool.-bot. fenn. 'Vanamo'*, 2: 64-73.
 JONES, B. M. G. (1964). *Arabis*, in TUTIN, T. G., et alii, ed. *Flora Europaea*, 1: 290-294. Cambridge.
 SCANNELL, M. J. P. (1965). *Arabis borealis* Andrz. ex Ledeb. in Ireland. *Ir. Nat. J.*, 15: 113.
 TITZ, W. (1972). Evolution of the *Arabis hirsuta* group in Central Europe. *Taxon*, 21: 121-128.

W. TITZ

406. CALYSTEGIA—Some British chromosome counts.

Dr C. A. Stace has invited me to publish the following chromosome counts which were included in my thesis (Brummitt 1963). Voucher specimens are deposited in the herbarium of the University of Liverpool (LIVU). Anthers were obtained from buds in wild populations. Root-tips were obtained by growing rhizomes in gravel under a mist propagation unit for a few days. Material was fixed in Carnoy's fluid and stained in aceto-carmine.

Calystegia sepium (L.) R.Br. subsp. *sepium*

Burrows Lane, near St Helens, v.c.59, GR 33/474.947 $n = 11$

Cartbridge Lane, Halewood, near Liverpool, v.c.59, GR 33/448.864 $2n = 22$

Calystegia sepium subsp. *roseata* Brummitt

Salt marsh, Llandudno Junction, v.c.49, GR 23/280.773 $n = 11$

Calystegia silvatica (Kit.) Griseb.

Waste ground, Storeton Quarry, Bebington, v.c.58, GR 33/316.843 $n = 11$

Railway embankment, Thomas Lane, Broadgreen, Liverpool, v.c.59, GR 33/407.907 $2n = 22$

In all the preparations a pair of small satellites, as described by Stace (1973), was noticed. The above count of *C. sepium* subsp. *roseata* is, as far as is known, the only one to date of this taxon.

The opportunity is also taken to record a count made by Dr C. J. Marchant in 1966 on rhizomes supplied by me. A voucher specimen is deposited at Kew (K).

Calystegia soldanella (L.) R.Br.

Sand dunes, Deganwy, eastern side of mouth of R. Conway, v.c.49, GR 23/774.797
 $2n = 22$

REFERENCES

- BRUMMITT, R. K. (1963). *A taxonomic revision of the genus Calystegia*. Ph.D. thesis, University of Liverpool.
 STACE, C. A. (1973). Chromosome numbers in the British species of *Calystegia* and *Convolvulus*. *Watsonia*, 9:363–367.

R. K. BRUMMITT

506. CALYSTEGIA—Inheritance of the schizoflorous character.

Variants of various species of *Calystegia* and related genera in which the normally infundibuliform corolla is divided almost to the base into 5 separate segments have been known for a long time. Druce (1897) pointed out that the plant he later described as *Convolvulus arvensis* var. *stonestreetii* was first reported c 1690, and it has been found at fairly frequent intervals since.

Similar variants in the species of *Calystegia* are less common in Britain. Druce (1922) described *Volulus sepium* var. *schizoflorus* (= *Calystegia sepium* f. *schizoflora* (Druce) Stace), collected in S. Devon in 1921, and Hepper (1954) reported the analagous *C. silvatica* var. *quinquepartita* Terracciano from Dumbarton. At K there is a specimen of *C. sepium* f. *schizoflora* from Chichester, W. Sussex, collected in 1948 by H. D. Hewitt, and recently McClintock (1972) reported from Guernsey a schizoflorous pink-flowered plant.

In 1966 Mr F. J. Holroyde kindly showed me colour-slides of *C. silvatica* var. *quinquepartita* growing at Ruxley Gravel Pits, W. Kent, and at my request also sent seeds from this plant. Since this species is very highly if not completely self-sterile (Stace 1961) the seeds had almost certainly been the result of cross-pollination from another plant, which would have possessed a normal corolla, no other plants of var. *quinquepartita* then being known in the area. Thus it should be possible to determine whether the divided corolla is dominant or recessive to the undivided one. The 1966 seed failed to germinate, and although a similar batch collected in 1968 germinated well the plants failed to survive the winter of 1969–70. However a further batch collected in 1970 germinated successfully and three of the plants flowered at Manchester in 1972. The corollas were completely normal, suggesting that the divided corolla is genetically recessive, as would be expected from its rarity in nature.

The constancy of this character as recorded in the wild argues strongly against the possibility that its expression is governed by growth conditions. The Ruxley plant has appeared constant for at least 8 years, and there are records of *Convolvulus arvensis* var. *stonestreetii* persisting in one spot for 16 and 28 years respectively (Lousley 1937, Cruttwell 1944).

It is perhaps worth emphasising here that in a self-sterile species it is obviously not possible to determine by growing seed collected in the wild whether a characteristic is plastic or genetically-controlled, since the expression of the character in the offspring depends partly on the nature of the pollen parent. It seems very likely that some of the conflicting results reported by Allen (1966) are explicable on this basis, e.g. *Plantago lanceolata* varieties which have been variously reported as breeding true from seed or not so.

REFERENCES

- ALLEN, D. E. (1966). A list of intraspecific taxa of British phanerogams tested in cultivation. *Watsonia*, 6: 205–215.

- CRUTTWELL, N. E. G. (1944). *Convolvulus arvensis* L. var *Stonestreetii* Druce. *Rep. botl Soc. Exch. Club Br. Isl.*, **12**: 497.
- DRUCE, G. C. (1897). *The Flora of Berkshire*, p. 357. Oxford.
- DRUCE, G. C. (1922). *Volulus sepium* Junger. *Rep. botl Soc. Exch. Club Br. Isl.*, **6**: 297.
- HEPPER, F. N. (1954). Monstrous forms of *Calystegia sylvestris* and *Galium verum*. *Proc. bot. Soc. Br. Isl.*, **1**: 94-95.
- LOUSLEY, J. E. (1937). *Convolvulus arvensis* L. *Rep. botl Soc. Exch. Club Br. Isl.*, **11**: 268.
- MCCINTOCK, D. (1972). Field Meetings, 1971-Guernsey. *Watsonia*, **9**: 184-186.
- STACE, C. A. (1961). Some studies in *Calystegia*: Compatibility and hybridisation in *C. sepium* and *C. silvatica*. *Watsonia*, **5**: 88-105.

C. A. STACE

431/1. *HEBE* × *FRANCISCANA* (Eastwood) Souster, not *H.* × *lewisii*—Naturalized in Britain.

For some years a shrubby *Veronica* or *Hebe*, naturalized in a number of places in south-western Britain and the Channel Isles, has passed under the name *H.* × *lewisii* (Armstrong) Cockayne & Allan. Recently, Mr David McClintock noted its similarity to the plant known in horticultural circles as *H.* × *franciscana* and, knowing of my interest in the New Zealand flora, asked me to look into the question of the correct name for the naturalized plant.

Both names were coined to cover interspecific hybrids and in both cases the authors suggested that the parentage was *H. elliptica* (Forst. f.) Pennell × *H. speciosa* (R. Cunn. ex A. Cunn.) Andersen. In doing this, Armstrong (1881), who first described *H.* × *lewisii* (as *Veronica* × *lewisii* Armstrong), was evidently in error for, thanks to the help of Mr L. J. Metcalf of the Christchurch Botanic Garden, New Zealand, who kindly examined Armstrong's type material in CANTY for me, it is apparent that the parentage of this plant is really *H. elliptica* × *H. salicifolia* (Forst. f.) Pennell, as had been suggested by Allan (1961). Not only does the type indicate this but Mr Metcalf informs me that he raised progeny by selfing plants comparable with Armstrong's hybrid and obtained offspring ranging in appearance from ones approaching *H. elliptica* to others more like *H. salicifolia*.

There is, however, no doubt about the parentage of *H.* × *franciscana*. It first arose as an artificial hybrid raised in cultivation in Edinburgh by Mr Isaac Anderson-Henry about the middle of the last century, using as parent plants *Veronica decussata* (a synonym of *H. elliptica*) and *H. speciosa*. Anderson-Henry proposed the name *Veronica lobelioides* for the hybrid, but evidently this name was never validly published, although an inadequate unsigned description appeared in *The Garden*, **6**: 328 (1874). It is also interesting to note that the name *V. lobelioides* was used by Druce (1932), without description, for the plant naturalized in Devon and Cornwall.

A comparison of specimens of *H. elliptica*, *H. salicifolia* and *H. speciosa* from the wild with the plant naturalized in Britain shows that the last is quite unlikely to include *H. salicifolia* in its parentage, and that its appearance is consistent with its being a hybrid between the other two species. Furthermore, it exactly matches material in cultivation as *H.* × *franciscana* and without doubt has become naturalized by escaping from cultivation and by being planted as a hedge-plant resistant to sea-spray and wind. Evidently the use of the name *H.* × *lewisii* arose from an early misidentification of the cultivated plant (for example the name was used in this sense by Nicholson (1901)).

HEBE × *FRANCISCANA* (Eastwood) Souster, *Jl R. hort. Soc.*, **81**: 498 (1956)
H. elliptica (Forst. f.) Pennell × *H. speciosa* (R. Cunn. ex A. Cunn.) Andersen

Veronica lobelioides hort. ex Druce, *Rep. botl Soc. Exch. Club Br. Isl.*, **9**: 570 (1932), *nom. nud.*

V. × lewisii sensu auct. angl., non Armstrong

V. × franciscana Eastwood, Leaflet. West. Bot., 3: 221 (1943)

Hebe × lewisii sensu auct. angl., non (Armstrong) Cockayne & Allan

Naturalized in Devon, Cornwall (including the Isles of Scilly) and the Channel Islands.

Hebe salicifolia has also been recorded as naturalized in south-western England and Ireland, and *H. speciosa* in Ireland. The former is readily distinguished from *H. × franciscana* by its acute, narrowly lanceolate leaves, 4–15 × 1–3 cm. In *H. speciosa* they are obtuse, obovate-oblong and 5–10 × 2.5–4.5 cm, in contrast to those of *H. × franciscana* which are smaller, rounded-obtuse, oblong-elliptic and 2–5 × 1.3–2.3 cm.

REFERENCES

- ALLAN, H. H. (1961). *Flora of New Zealand*, 1: 950. Wellington.
 ARMSTRONG, J. B. (1881). *Veronica lewisii*. *Trans. N.Z. Inst.*, 13: 357–358.
 DRUCE, G. C. (1932). *Veronica lobelioides* Hort. *Rep. botl. Soc. Exch. Club Br. Isl.*, 9: 570.
 NICHOLSON, G. (1901). *Illustrated Dictionary of Gardening*, Suppl., p. 732. London.

P. S. GREEN

522. CONYZA—Taxa found in Britain.

As a result of the examination of numerous specimens of the genus *Conyza* in the herbaria at the British Museum (Natural History) and at Kew, the following analytical key has been devised and one new combination has proved to be desirable:

C. FLORIBUNDA Kunth var. *SUBLEIOTHECA* (Cuatr.) J. B. Marshall, **comb. et stat. nov.**
C. bonariensis var. *leiotheca* forma *subleiotheca* Cuatr., Webbia, 24: 222 (1969)

1. Leaf-margins ciliate *C. canadensis*
1. Leaf-margins smooth or with minute, hooked setulae
 2. Inflorescence a pyramidal panicle or sometimes with lateral (secondary) pyramidal panicles overtopping main axis; pappus dirty white or light russety-brown, becoming darker in older herbarium specimens; phyllaries greyish-green frequently tipped with reddish-purple *C. bonariensis*
 2. Inflorescence a cylindrical or sub-corymbose panicle; pappus drab straw-coloured or tawny-yellow; phyllaries greenish-brown
 3. Capitula 4–6 mm diam.; involucre sparsely to moderately pubescent; phyllaries light brown on mature heads; leaf-surfaces with evenly appressed hairs; leaf-margins smooth *C. floribunda* var. *subleiotheca*
 3. Capitula 3–4 mm diam.; involucre glabrescent; phyllaries dark chestnut-brown on mature heads; leaf-surfaces glabrescent or glabrous; leaf-margins with minute hooked setulae *C. floribunda* var. *floribunda*

Conyza canadensis seems to have been first described by John Parkinson in *Theatrum Botanicum* (1640) as *Eupatorium cannabinum americanum angustifolium* from material sent to him from New England. It is now an almost cosmopolitan weed, being recorded from many parts of the world. Although it is common and widespread in south-eastern and eastern England, and scattered in Wales, it seems to be unrecorded for Scotland and Ireland.

C. bonariensis was first described by Dillenius in *Hortus Elthamensis* (1732) as *Senecio bonariensis purpurascens foliis imis coronopi* and was based on material grown from seed originating, it is thought, from Buenos Aires. It now occurs as a weed in many tropical and sub-tropical regions of the world. In Europe it has a mainly Mediterranean distribution. In this country it is an infrequent alien, first recorded from Galashiels, Selkirk, in 1913. Since then it has been occasionally reported, usually as an introduction with wool shoddy.

C. floribunda var. *floribunda* is native of tropical South America and Brazil and has occurred as an alien in Spain. It has not yet been recorded in Britain. *C. floribunda* var. *subleiotheca*, a native of South America, is a widely distributed weed in the tropics and subtropics. It appeared in Spain and southern France during the early part of this century and has during recent years been observed and collected in Guernsey.

The following is a list of the known synonyms:

CONYZA CANADENSIS (L.) Cronq.
Eupatorium canadensis L.
Conyzella canadensis (L.) Rupr.
Leptilon canadense (L.) Britt. & Brown
Marsea canadensis (L.) Badillo

CONYZA BONARIENSIS (L.) Cronq.
Erigeron bonariensis L.
E. crispus Pourr.
E. undulatus Moench
E. linifolius Willd.
E. ambiguus (DC.) Schultz Bip.
Conyza ambigua DC.
Conyzella linifolia (Willd.) Greene
Leptilon bonariensis (L.) Small
L. linifolium (Willd.) Small

CONYZA FLORIBUNDA Kunth
Erigeron coronopifolius Sennen
E. gonzaloi Sennen
E. sumatrensis Retz.
Conyza altissima Naudin
C. barcinonense Sennen
C. capillipes Spencer Moore
C. daveauana Sennen
C. flahaultiana Sennen
C. naudini Bonnet
C. pappiflava Sennen
C. rouyana Sennen

J. B. MARSHALL

605/7f. JUNCUS FOLIOSUS Desf.—In Wales.

On 20th September 1971 I found a colony of *Juncus foliosus* growing in a shady, peaty part of the shore of the Mawddach estuary near Barmouth, Merioneth, v.c. 48 (GR 23/6.1). It was growing with *J. bufonius* L. *sensu stricto*, but I could find no morphological intermediates. Specimens have been deposited in NMW. To the best of my knowledge *J. foliosus* has not been previously reported from Wales, though Dr C. A. Stace tells me (1972 *in litt.*) that old specimens from Merioneth and elsewhere in Wales of *J. bufonius sensu lato* which are in fact *J. foliosus* do exist in some herbaria, e.g. BM, MANCH.

The characters of the two taxa in this district are here compared:

J. bufonius L. *sensu stricto*. Germinating in spring. Erect, scarcely rooting at the nodes, and proliferating only late in the season and in wet places. Flowers often cleistogamous. *Perianth* green, rarely slightly dark-tinged. *Anthers* shorter than the filaments, often adhering to the top of the developed capsule. Pollen scanty. *Seeds* with 54–72 *concolorous* ribs 13–27 μm apart, appearing nearly smooth through a hand-lens.

J. foliosus Desf. Germinating in autumn. Sprawling, rooting at the nodes, and freely proliferating from an early age. Flowers usually chasmogamous. *Perianth* strongly tinged with brownish-black. *Anthers* longer than the filaments, not adhering to the top of the capsule. Pollen abundant. *Seeds* with 22–30 *conspicuous* dark-brown ribs 35–55 μm apart, plus faint intermediate ribs, obviously ribbed even through a hand-lens.

Numerous searches of other apparently suitable places in Merioneth during 1972 failed to reveal any further colonies of *J. foliosus*.

P. M. BENOIT

Plant Records

Records for publication must be submitted in the form shown below to the appropriate vice-county Recorder (*Watsonia*, 8: 435-447 (1971)), and *not* to the Editors.

Records are arranged in the order given in the *List of British Vascular Plants* by J. E. Dandy (1958) and in his subsequent revision (*Watsonia*, 7: 157-178 (1969)) but *Taraxacum* is arranged according to Richards (*Watsonia*, 9, Suppl. (1972)). With the exception of collectors' initials, herbarium abbreviations are those used in *British Herbaria* by D. H. Kent (1958).

The following signs are used:

* before the record: to indicate a new vice-county record.

† before the species number: to indicate that the plant is not a native species of the British Isles.

‡ before the record: to indicate a species which, though native in some parts of the British Isles, is not so in the locality recorded.

[] enclosing a previously published record: to indicate that the record should be deleted.

1/4. LYCOPODIUM CLAVATUM L. **84**, Linlithgow: Carriden, GR 36/01.81. Among *Calluna* near the sea. E. P. Beattie, 1970, E. 2nd record.

7/1. HYMENOPHYLLUM TUNBRIGENSE (L.) Sm. **45**, Pembroke: 3 km south of Nevern, GR 22/09.36. On rocks in oak wood. F. Rose, 1965, field record. 2nd record. (*Nature Wales*, 13: 201 (1973)).

7/2. HYMENOPHYLLUM WILSONII Hook. **74**, Wigtown: Pularyan Burn, Main Water of Luce, GR 25/14.68. Rocks in ravine. H. Milne-Redhead, 1972, field record. 1st post-1930 record. **79**, Selkirk: Kirkhope Linns, Ettrick, GR 36/38.24. Damp rocks. R. W. M. Corner, 1972, *herb. R.W.M.C.* Confirmation of 1st record by A. R. Smith, 1927; the record in *Watsonia*, 8:53 (1970) is the 2nd record.

11/1. ADIANTUM CAPILLUS-VENERIS L. *†**35**, Monmouth: Monmouth, GR 32/50. 12. Wall of car-park. I. F. Gravestock, 1972, field record.

14/1. PHYLLITIS SCOLOPENDRIUM (L.) Newm. **84**, Linlithgow: Carriden, GR 36/01.81. Churchyard walls. E. P. Beattie, 1972, E. 2nd record.

21/3. DRYOPTERIS ABBREVIATA (DC.) Newm. ***79**, Selkirk: Bught Rig, Douglas Burn, Yarrow, GR 36/26.28. Scree slopes, 1100 ft. C.S.S.F. Party, 1972, *herb. R. W. M. Corner*, conf. R. H. Roberts.

21/6. DRYOPTERIS CARTHUSIANA (Vill.) H. P. Fuchs ***45**, Pembroke: Esgyrn Bottom, GR 12/97.34. Old peat cuttings. T. A. W. Davies, 1972, *BM,NMW*, det. A. C. Jermy. (*Nature Wales*, 13: 201 (1973)).

21/6 × 7. DRYOPTERIS CARTHUSIANA (Vill.) H. P. Fuchs × D. DILATATA (Hoffm.) A. Gray ***45**, Pembroke: Esgyrn Bottom, GR 12/97.34. Raised peat bog. J. W. Donovan, 1972, *BM*, det. A. C. Jermy. (*Nature Wales*, 13: 201 (1973)).

21/8. DRYOPTERIS AEMULA (Ait.) Kuntze ***45**, Pembroke: Llanychlwydog, GR 22/0.3. R. M. Payne, 1952, field record. 1 km N.W. of Amroth, GR 22/15.08. M. G. Collett, 1960, field record. 2nd record. (Both records *Nature Wales*, 13: 201 (1973)).

22/3. POLYSTICHUM LONCHITIS (L.) Roth **97**, Westernness: Coire an Lochain, Meall na Teanga, GR 27/22.92. Rock crevices, 700 m. A. McG. Stirling, 1971, field record. Range extension.

24/4. *GYMNOCARPIUM DRYOPTERIS* (L.) Newm. **74**, Wigtown: Pularyan Burn, Main Water of Luce, GR 25/14.68. Ravine. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

25/1/2. *POLYPODIUM AUSTRALE* Fée ***42**, Brecon: near Cwmdy, GR 32/1.2. Walls of Old Red Sandstone. M. Porter, 1972, NMW, det. S. G. Harrison, 3 miles north of Merthyr Tydfil, GR 32/01.10. Limestone cliffs. M. Porter, 1972, NMW. 2nd record. (Both records *Nature Wales*, **13**: 198 (1973)).

25/1/3. *POLYPODIUM INTERJECTUM* Shivas ***57**, Derby: Ticknall limeyards, GR 43/36.23. In deciduous woodland on limestone. A. Willmot, 1972, field record, det. A. C. Jermy. ***79**, Selkirk: by north tributary of Hawkshaw Burn, Kirkhope, Ettrick, GR 36/36.24. C.S.S.F. Meeting, 1972, herb. R.W.M. Corner, det. J. A. Crabbe & A. C. Jermy.

40/1/1. *ACONITUM ANGLICUM* Stapf **†82**, Haddington: Archerfield Estate, Dirleton, GR 36/50.84. Open woodland. E. P. Beattie, 1960, 1972, E. 2nd record. ***†83**, Edinburgh: Ravelston Dykes Quarry, Edinburgh, GR 36/21.73. E. P. Beattie, 1967, 1972, E.

†40/v. *ACONITUM VULPARIA* Reichb. ***57**, Derby: near Hassop Hall, GR 43/22.72. Well-established in woodland. Mr Strachan, 1971, field record.

46/7. *RANUNCULUS SARDOUS* Crantz ***42**, Brecon: 1 mile S.W. of Three Cocks, GR 32/16.36. Wheatfield and old railway line. M. Porter & H. Soan, 1972, NMW. 1 mile S.W. of Talgarth, GR 32/14.33. Wet pasture. M. Porter, 1972, field record. 2nd record. **45**, Pembroke: Marloes, GR 12/7.0. C. D. Pigott, 1955, field record. 2nd record. (All three records *Nature Wales*, **13**: 201 (1973)).

46/10. *RANUNCULUS AURICOMUS* L. **96**, Easternness: Falls of Foyers, GR 28/4.2. Woodland. A. J. & M. Souter & M. McC. Webster, 1971, E. 2nd record. ***97**, Westernness: Meall na Teanga, GR 27/22.92. Base-rich flushes, 600 m. A. McG. Stirling, 1971, field record.

46/17. *RANUNCULUS OMIOPHYLLUS* Ten. **74**, Wigtown: Knockquhassen, GR 25/02.59. Muddy track. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

46/22c. *RANUNCULUS PENICILLATUS* (Dumort.) Bab. ***82**, Haddington: Haddington, GR 36/51.73. E. P. Beattie, 1972, E.

†47/1. *ADONIS ANNUA* L. **96**, Easternness: Inverness, GR 28/66.44. Beet field. M. McC. Webster, 1971, E.

49/1. *AQUILEGIA VULGARIS* L. ***†96**, Easternness: Milton of Drumnadrochit, GR 28/49.30. River shingle. M. McC. Webster, 1964, E.

50/3. *THALICTRUM MINUS* L. **44**, Carmarthen: Crwbin, GR 22/46.12. Calcareous rubble. I. M. Vaughan, 1972, NMW. 2nd record. (*Nature Wales*, **13**: 200 (1973)).

57/1. *CERATOPHYLLUM DEMERSUM* L. ***95**, Moray: Gilston lochs, near Elgin, GR 38/20.66. M. McC. Webster, 1972, ABD, BM, CGE, E. 2nd and only extant record. ***H32**, Monaghan: Creevy Lough, GR 23/83.07. L. Farrell, 1972, DBN.

†58/8. *PAPAVER ATLANTICUM* (Ball) Coss. ***9**, Dorset: Cerne Abbas, GR 31/66.01. Wall-top. R. D. English, 1970, 1972, field record.

62/1. *CHELIDONIUM MAJUS* L. ***96b**, Nairn: Nairn, GR 28/89.56. Roadside verge. M. McC. Webster, 1972, field record.

66/2. *FUMARIA CAPREOLATA* L. ***96** Easternness: Ardesier, GR 28/78.55. Waste ground. M. McC. Webster, 1971, E.

†67/2. *BRASSICA NAPUS* L. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E.

67/4. *BRASSICA NIGRA* (L.) Koch *†96, Easternness: Inverness, GR 28/67.46. Distillery yard. M. McC. Webster, 1971, E.

†67/j. *BRASSICA JUNCEA* (L.) Czern. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E.

†69/3. *RHYNCHOSINAPIS CHEIRANTHOS* (Vill.) Dandy *95, Moray: Slochd, GR 28/8.2. Railway embankment. M. McC. Webster, 1971, field record. Long established. *96, Easternness: Daviot to Tomatin, GR 28/7.3., and Culloden to Daviot, GR 28/7.4. Railway embankments. M. McC. Webster, 1930, 1971, BM, CGE, E. 1st and 2nd records.

†70/2. *SINAPIS ALBA* L. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. 1970. Loch Ness, south of Dores, GR 28/55.29. Newly sown roadside verge. 1971. 2nd record. Both records M. McC. Webster, E.

†72/1. *DILOTAXIS MURALIS* (L.) DC. 82, Haddington: West Barns, Dunbar, GR 36/65.78. Waste ground. E. P. Beattie & U. K. Duncan, 1972, E. 2nd record.

†73/1. *ERUCA SATIVA* Mill. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1971, E.

†76/2. *RAPISTRUM RUGOSUM* (L.) All. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1971, E.

†79/p. *LEPIDIUM PERFOLIATUM* L. 29, Cambs.: Gog Magog Hills, Cambridge, GR 52/49.54. Newly sown grass on golf-course. N. Jardine & R. Hill, 1972, field record. 2nd record.

†84/2. *THLASPI ALLIACEUM* L. *29, Cambs.: between Ashwell and Steeple Morden, GR 52/27.40. Field margin. S. D. Garrett, 1972, field record, det. S. M. Walters. *50, Denbigh: between Llandulas and Pen-sarn, GR 23/92.78. Refuse tip. J. M. Brummitt, 1971, NMW. (*Nature Wales*, 13:48 (1972)).

85/1. *TEESDALIA NUDICAULIS* (L.) R.Br. 48, Merioneth: Morfa Harlech, GR 23/5.3. Acid sandy pasture. E. D. Pugh, 1965; rediscovered by O. H. Black & H. Handley, 1972, NMW, conf. P. M. Benoit. Only extant locality and only record from natural habitat.

88/5. *COCHLEARIA DANICA* L. *†57, Derby: Butterley, GR 43/40.51. Railway ballast. R. A. Frost, 1972, DBY. Millers Dale, GR 43/13.73. Railway ballast. B. S. Pendlebury, 1972, field record. 2nd record.

94/3. *DRABA MURALIS* L. *†97, Westernness: Fort William, GR 27/08.72. Rocks above the beach. Mrs C. Rowbottom, 1971, field record.

95/2. *EROPHILA SPATHULATA* Láng *95, Elgin: Culbin Sands, near Forres, GR 28/99.64. Dunes. M. McC. Webster, 1930, 1972, field record. Lossiemouth, GR 38/22.70. Dunes. M. McC. Webster, 1972, E, conf. P. D. Sell. 2nd record.

†97/7. *CARDAMINE RAPHANIFOLIA* Poir. *34, W. Gloucester: Clanna. Hewelsfield, GR 32/56.02. By Aylesmore brook. O. P. Clarkson Webb, 1971, 1972, field record, det. D. McClintock.

†100/3. *ARABIS CAUCASICA* Willd. *82, Haddington: walls by R. Tyne, Haddington, GR 36/86.74. E. P. Beattie, 1970, E. 84. Linlithgow: Carriden, GR 36/01.81. Waste ground. E. P. Beattie & K. M. Calver, 1970, E. 2nd record.

100/4. *ARABIS HIRSUTA* (L.) Scop. ***97**, Westernness: Aonach Beag, GR 27/45.73. Limestone outcrops. A. A. Slack, 1972, field record. 2nd record.

†102/6. *RORIPPA AUSTRIACA* (Crantz) Bess. ***42**, Brecon: near Llanfihangel Tal-y-llyn, GR 32/11.27. Rough grassland. S. I. Leitch & M. Porter, 1972, NMW. (*Nature Wales*, **13**: 198 (1973)).

†105/1. *ERYSIMUM CHEIRANTHOIDES* L. ***96**, Easternness: south of Nethybridge, GR 28/98.20. Waste ground. M. McC. Webster, 1971, E. 2nd record.

112/1. *RESEDA LUTEOLA* L. ***96**, Easternness: by Holm mill, Inverness, GR 28/65.42. M. McC. Webster, 1972, field record.

112/2. *RESEDA LUTEA* L. ***96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1971, field record.

113/12. *VIOLA TRICOLOR* L. subsp. *TRICOLOR* ***45**, Pembroke: 3 km north of St David's, GR 12/75.28. Potato field. T. Inskipp, 1972, field record. 2nd record. (*Nature Wales*, **13**: 201 (1973)).

122/1. *ELATINE HEXANDRA* (Lapierre) DC. ***97**, Westernness: pool in R. Garry near Loch Quoich dam, GR 28/10.01. R. Groom, 1971, field record. ***H32**, Monaghan: Creevy Lough, GR 23/83.07. L. Farrell, 1972, DBN.

123/12. *SILENE NOCTIFLORA* L. ***45**, Pembroke: Newport, GR 22/0.3. Weed in nursery. C. C. Townsend, 1956, herb. U.C. Swansea. 1 km south of Stackpole, GR 11/98.95. In field. F. H. Fremlin, 1965, field record. 2nd record. (Both records *Nature Wales*, **13**: 202 (1973)).

123/13 × 14. *SILENE DIOICA* (L.) Clairv. × *S. ALBA* (Mill.) E. H. L. Krause ***95**, Elgin: Grange Hall, Forbes, GR 38/06.59. Roadside verge. M. McC. Webster, 1972, field record. 2nd record. ***96**, Easternness: west of Lewiston, GR 28/49.28. By farm. M. McC. Webster, 1972, E. Groam, GR 28/51.43. M. McC. Webster, 1972, field record. 2nd record.

131/2. *CERASTIUM ARVENSE* L. ***42**, Brecon: Llangattock, GR 32/21.17. Garden weed. Mrs J. P. Sankey-Barker, 1972, NMW. (*Nature Wales*, **13**: 198 (1973)).

131/10. *CERASTIUM DIFFUSUM* Pers. ***42**, Brecon: near Craig-y-cilau, S. of Crickhowell, GR 32/19.15. Limestone rocks and grassland. M. Porter, 1972, NMW, det. E. Milne-Redhead. (*Nature Wales*, **13**: 199 (1973)). ***57**, Derby: between Temple Normanton and Heath, GR 43/43.67. Railway tracks. S. Band & J. Hodgson, 1972, field record.

131/11. *CERASTIUM PUMILUM* Curt. ***15**, E. Kent: near Margate, GR 61/35.69. Old railway line. C. C. Hare, 1971, MNE.

133/1. *STELLARIA NEMORUM* L. ***74**, Wigtown: Aldouran Glen, GR 25/01.63. H. Milne-Redhead, 1972, field record.

133/3. *STELLARIA PALLIDA* (Dumort.) Piré ***95**, Elgin: Findhorn, GR 38/04.64. ***96**, Easternness: Fort George, GR 28/77.56. Dunes. 1st post-1930 record. ***106**, E. Ross: Fortrose, GR 28/73.56. Caravan Park. 2nd record. All 3 records M. McC. Webster, 1972, E, conf. P. D. Sell.

135/1. *MOENCHIA ERECTA* (L.) Gaertn., Mey. & Scherb. ***47**, Montgomery: Ffridd Faldwyn, Montgomery, GR 32/21.96. V. J. Macnair & E. D. Pugh, 1972, field record, det. P. M. Benoit. 1st post-1930 record.

136/7. *SAGINA NORMANIANA* Lagerh. ***96**, Easternness: Sgurr na Lappaich, GR 28/16.35. M. McC. Webster, 1972, E, conf. P. D. Sell. 2nd record.

143/3 $\times$ 5. *SPERGULARIA RUPICOLA* Lebel ex Le Jolis $\times$ *S. MARINA* (L.) Griseb. *45, Pembroke: Stackpole Head, GR 11/99.94. Cliff-top. J. A. Ratter, 1971, E. (*Nature Wales*, 13: 202 (1973)).

143/5. *SPERGULARIA MARINA* (L.) Griseb. *84, Linlithgow: Bo'ness, GR 26/98.81. E. P. Beattie, 1971, E.

147/1. *ILLECEBRUM VERTICILLATUM* L. *56, Notts.: Langley Mill, GR 43/45.47. Railway ballast. S. Jackson, 1972, DBY.

†152/1. *CARPOBROTUS EDULIS* (L.) N.E.Br. *45, Pembroke: Tenby, GR 22/13.00. Limestone cliff. T. A. W. Davis, 1972, field record. 1st localised record. (*Nature Wales*, 13: 202 (1973)).

†153/1. *AMARANTHUS RETROFLEXUS* L. *95, Elgin: Forres tip, GR 38/02.59. M. McC. Webster, 1970, E.

154/11. *CHENOPODIUM MURALE* L. 45, Pembroke: Bentlass, GR 12/96.01. By shore. T. A. W. Davis, 1971, NMW, det. J. P. M. Brenan. 2nd record. (*Nature Wales*, 13: 202 (1973)).

156/3. *ATRIPLEX HASTATA* L. *84, Linlithgow: Bo'ness, GR 26/99.81. Shore. Carriden, GR 36/02.81. Shore. 2nd record. Both records E. P. Beattie, 1972, E.

159/1. *SALSOLA KALI* L. 107, E. Sutherland: Dornoch Point, GR 28/80.87. M. Barron, 1972, field record. 1st post-1930 record.

160/2. *SALICORNIA DOLICHOSTACHYA* Moss *84, Linlithgow: Bo'ness, GR 26/98.81. E. P. Beattie, 1971, E.

162/2. *TILIA CORDATA* Mill. *45, Pembroke: Cwmneifa, Clydau, GR 22/25.35. Wooded ravine. F. Rose, 1965, field record. (*Nature Wales*, 13: 202 (1973)).

163/2. *MALVA SYLVESTRIS* L. *96, Easternness: Longman Point, Inverness, GR 28/67.46. M. McC. Webster, 1971, E.

163/4. *MALVA NEGLECTA* Wallr. 80, Roxburgh: above Stichill Linn, GR 36/70.37. R. W. M. Corner, 1972, herb. R.W.M.C. 1st post-1930 record.

164/2. *LAVATERA CRETICA* L. 45, Pembroke: Nolton Haven, GR 12/85.18. Above the beach. C. C. Jones, 1970, field record. 2nd record. (*Nature Wales*, 13: 202 (1973)).

165/1. *ALTHAEA OFFICINALIS* L. 45, Pembroke: Pwllcrochan, GR 12/92.03. Top of salt-marsh. S. M. Coles, 1971, field record. 2nd record. (*Nature Wales*, 13: 202 (1973)).

166/1. *LINUM BIENNE* Mill. *H32, Monaghan: by Lough Naglack, GR 23/85.02. L. Farrell, 1972, DBN.

†166/2. *LINUM USITATISSIMUM* L. *84, Linlithgow: Carriden, GR 36/02.81. E. P. Beattie, 1972, E. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E.

†168/3. *GERANIUM ENDRESSII* Gay 83, Edinburgh: Ravelston, Edinburgh, GR 36/21.73. E. P. Beattie, 1972, E. 2nd record.

†168/6. *GERANIUM PHAEUM* L. 84, Linlithgow: Carriden, GR 36/02.81. E. P. Beattie, 1967, E. 2nd record. Still present 1972.

168/7. *GERANIUM SANGUINEUM* L. *84, Linlithgow: Carriden, GR 36/02.81. E. P. Beattie, 1972, E.

168/10. *GERANIUM COLUMBINUM* L. *H32, Monaghan: near Lugadadorris, Carr-ickmacross. Limestone quarry. L. Farrell, 1972, DBN.

168/15. *GERANIUM LUCIDUM* L. 96, Easternness: Kilmorack, GR 28/48.44. M. McC. Webster, 1963, E. 2nd record.

†171/3. *IMPATIENS PARVIFLORA* DC. *83, Edinburgh: Corstorphine Hill, Edinburgh, GR 36/20.74. M. MacKie, 1970, E.

†171/4. *IMPATIENS GLANDULIFERA* Royle *84, Linlithgow: Linlithgow, GR 26/98.76. Disused quarry. Near Nether Kinneil, Bo'ness, GR 26/96.79. Roadside verge. 2nd record. Both records E. P. Beattie, 1972, E. *96, Easternness: Ness Castle, GR 28/65.41. M. McC. Webster, 1970, field record.

†173/2. *ACER PLATANOIDES* L. *82, Haddington: Luffness, near Aberlady, GR 36/48.80. E. P. Beattie, 1971, E. 83, Edinburgh: Lady Victoria Wood, Newton-grange, GR 36/34.65. E. P. Beattie, 1967, E. 2nd record. Many young trees.

†183/2. *LUPINUS ARBOREUS* Sims *35, Monmouth: Portskewett, GR 31/49.88. T. G. Evans, 1972, NMW.

†191/2. *MELILOTUS OFFICINALIS* (L.) Pall. 84, Linlithgow: Bo'ness, GR 26/98.81. E. P. Beattie, 1967, field record. 2nd record.

192/10. *TRIFOLIUM STRIATUM* L. 35, Monmouth: Mathern, GR 31/52.89. T. G. Evans, 1971, field record. 1st post-1930 record. 80, Roxburgh: above Stichill Linn, GR 36/70.37. R. W. M. Corner, 1972, herb. R.W.M.C. 1st post-1930 record.

206/2. *VICIA TETRASPERMA* (L.) Schreb. 44, Carmarthen: Green Castle, Carmarthen, GR 22/39.16. Farmyard. I. M. Vaughan, 1972, field record. 2nd record. (*Nature Wales*, 13: 200 (1973)).

†206/6. *VICIA VILLOSA* Roth *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1972, E.

207/2. *LATHYRUS NISSOLIA* L. 35, Monmouth: Uskmouth, GR 31/33.82. On boiler ash. T. G. Evans, 1972, NMW. 1st post-1930 record.

211/2. *RUBUS SAXATILIS* L. 74, Wigtown: Pularyan Burn, Main Water of Luce, GR 25/14.68. Shaded ravine. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

211/11/126. *RUBUS ERRABUNDUS* W. C. R. Wats. *80, Roxburgh: 1 mile south of Newcastleton, GR 35/4.8. C. W. Muirhead, 1969, E, det. E. S. Edees.

211/11/201. *RUBUS TAENIARUM* Lindeb. *80, Roxburgh: 1 mile south of Newcastleton, GR 35/4.8. C. W. Muirhead, 1969, E, det. E. S. Edees.

211/11/204. *RUBUS RADULA* Weihe ex Boenn. *80, Roxburgh: south of Hawick, GR 36/5.1. C. W. Muirhead, 1969, E, det. E. S. Edees. 1st localised record.

211/11/356. *RUBUS DASYPHYLLUS* (Rogers) Rogers *80, Roxburgh: 1 mile south of Newcastleton, GR 35/4.8. C. W. Muirhead, 1969, E, det. E. S. Edees.

212/6. *POTENTILLA ARGENTEA* L. 80, Roxburgh: Stichill Linn, GR 36/70.37. R. W. M. Corner, 1972, herb. R.W.M.C. 1st post-1930 record. 82, Haddington: Over Hailes, East Linton, GR 36/57.76. E. P. Beattie, 1962, field record. 2nd record.

212/11. *POTENTILLA TABERNAEMONTANI* Aschers. *52, Anglesey: Marian Dyrys, near Bwtrd Arthur, GR 23/59.81. Limestone outcrop. T. Thomas, 1971, field record, det. W. S. Lacey. 82, Haddington: near Hailes Castle, East Linton, GR 36/57.75. Rocks. E. P. Beattie, 1967, field record. 1st post-1930 record.

212/14. *POTENTILLA ANGLICA* Laichard. **97**, Westernness: Craigard, near Invergarry, GR 28/29.02. R. Groom, 1971, field record. 2nd record.

†215/3. *FRAGARIA ANANASSA* Duchesne ***84**, Linlithgow: Bo'ness, GR 26/98.80. E. P. Beattie, 1972, E.

218/2. *AGRIMONIA PROCERA* Wallr. **82**, Haddington: Tynninghame, GR 36/61.78. E. P. Beattie & U. K. Duncan, 1972, E. 2nd record.

220/3/3. *ALCHEMILLA FILICAULIS* Buser ***44**, Carmarthen: Carreg Ceuneu, GR 22/66.19. Limestone. I. M. Vaughan, 1970, NMW, det. M. E. Bradshaw. (*Nature Wales*, **13**: 200 (1973)).

†226/5. *PRUNUS CERASUS* L. ***95**, Elgin: Arthurs Bridge. S.E. of Lossiemouth, GR 38/25.67. E. Advie, GR 38/12.34. Field record. 2nd record. Both records M. McC. Webster, 1970.

†227/5. *COTONEASTER FRIGIDUS* Wall. ex Lindl. **83**, Edinburgh: Ravelston Dykes Quarry, Edinburgh, GR 36/21.73. E. P. Beattie, 1967, 1972, E. 2nd record.

232/5 × 1. *SORBUS ARIA* (L.) Crantz × *S. AUCUPARIA* L. ***35**, Monmouth: Piercefield Cliffs, near Chepstow, GR 31/53.95. Limestone cliffs. T. G. Evans & C. Titcombe, 1972, NMW, det. F. H. Perring. 1st Welsh record.

232/6. *SORBUS LATIFOLIA* (Lam.) Pers. ***44**, Carmarthen: near Carreg Cennen, GR 22/65.19. I. M. Vaughan, 1970, NMW, det. P. J. M. Nethercott. (*Nature Wales*, **13**: 200 (1973)).

†235/3. *SEDUM SPURIUM* Bieb. ***84**, Linlithgow: Carriden, GR 36/02.81. E. P. Beattie, 1972, E. ***95**, Elgin: Grantown on Spey, GR 38/02.26. River bank. M. McC. Webster, 1970, E. 2nd record.

†235/6. *SEDUM ALBUM* L. **84**, Linlithgow: Carriden, GR 36/02.81. E. P. Beattie, 1972, field record. 2nd record.

†235/11. *SEDUM REFLEXUM* L. **83**, Edinburgh: Lanark road, Balerno, GR 36/15.66. E. P. Beattie, 1972, E. 1st post-1930 record.

235/12. *SEDUM VILLOSUM* L. ***95**, Elgin: Cromdale, GR 38/1.2. Flush by burn. Mrs Christie, 1971, E. 1st post-1930 record.

246/2. *RIBES SPICATUM* Robson ***95**, Elgin: Grantown on Spey, GR 38/0.2. Riverbank. M. McC. Webster, 1972, E.

†246/4. *RIBES SANGUINEUM* Pursh ***82**, Haddington: Nunraw Abbey, Garvald, GR 36/59.60. E. P. Beattie, 1967, E. Well naturalised. ***83** Edinburgh: Dreghorn Woods, Edinburgh, GR 36/22.68. E. P. Beattie, 1956, E. Still present 1972. Near Upper Firth, Howgate, GR 36/27.59. E. P. Beattie, 1970, field record. 2nd record.

249/2. *LYTHRUM HYSSOPIFOLIA* L. **57**, Derby: Belper, GR 43/35.47. Garden weed. Mr Swindall, 1971, DBY, det. D. McClintock. 1st record for 50 years.

251/1. *DAPHNE MEZEREUM* L. ***44**, Carmarthen: Crwbin, GR 22/46.12. Calcareous woodland. I. M. Vaughan, 1971, NMW. (*Nature Wales*, **13**: 200 (1973)).

254/5. *EPILOBIUM ROSEUM* Schreb. **84**, Linlithgow: Linlithgow, GR 26/99.77. E. P. Beattie, 1972, field record. 1st post-1930 record.

†254/6. *EPILOBIUM ADENOCALON* Hausskn. ***82**, Haddington: Longniddry, GR 36/44.76. Railway sidings. E. Burnhead, near Spott, GR 36/65.73. Roadside verge. Field record. 2nd record. Both records E. P. Beattie & U. K. Duncan, 1972. ***84**,

Linlithgow: Bo'ness, GR 26/98.81. Waste ground. 1971. Carriden, GR 36/01.81. Waste ground. 1972. 2nd record. Both records E. P. Beattie, E.

†254/13. *EPILOBIUM BRUNNESCENS* (Cockayne) Raven & Engelhorn **44**, Carmarthen: near Brechfa. Edge of Forestry plantation. Mrs E. Grey, 1972, field record. 2nd record. Site since destroyed. (*Nature Wales*, **13**: 200 (1973)). *H32, Monaghan: Priestfield Lough, Rossmore Castle, GR 23/65.30. L. Farrell, 1972, DBN.

†257/1. *FUCHSIA MAGELLANICA* Lam. **74**, Wigtown: Aldouran Glen, GR 25/01.63. Woodland. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

258/3. *CIRCAEA ALPINA* L. *105, W. Ross: Inverpolly Forest, GR 29/0.1. M. McC. Webster, 1971, E, conf. J. Heslop-Harrison.

261/1. *HIPPURIS VULGARIS* L. **74**, Wigtown: White Loch of Ravenstone, GR 25/40.44. H. Milne-Redhead, 1972, field record. 1st post-1930 record. *84, Linlithgow: near Winchburgh, GR 36/08.76. E. P. Beattie, 1967, E. *96, Easternness: Auchnagairn, Kirkhill, GR 28/55.45. M. McC. Webster, 1954, field record. Essich, GR 28/65.38. M. Barron, 1972, field record. 2nd record.

265/1. *SWIDA SANGUINEA* (L.) Opiz *†74, Wigtown: Portpatrick – Leswalt road, GR 15/98.59. Established on roadside. H. Milne-Redhead, 1972, field record.

274/1. *ANTHRISCUS CAUCALIS* Bieb. *96, Easternness: the Longman, Inverness, GR 28/67.46. By the sea. M. McC. Webster, 1954, field record. Ardersier GR 28/78.55. By the sea. M. McC. Webster, 1964, field record. 2nd record.

285/1. *APIUM GRAVEOLENS* L. **50**, Denbigh: Furnace, Bodnant, Glen Conwy, GR 23/79.72. Saltmarsh. J. M. Brummitt, 1971, NMW. 2nd and only extant record. (*Nature Wales*, **13**: 48 (1972)).

285/4. *APIUM INUNDATUM* (L.) Reichb.f. **95**, Elgin: Millbuies Loch, south of Elgin, GR 38/24.57. M. McC. Webster, 1972, E. Probably 2nd record.

294/1. *PIMPINELLA SAXIFRAGA* L. *97, Westernness: Loch Ailort, GR 17/7.7. By the sea. A. J. Souter & M. McC. Webster, 1971, E. Ardverikie, Kinlochlaggan, GR 27/53.89. M. McC. Webster, 1972, field record. 2nd record.

297/1. *BERULA ERECTA* (Huds.) Coville *48, Merioneth: Morfa Harlech, GR 23/5.3. P. M. Benoit, 1972, NMW. 1st definite record.

298/1. *CRITHMUM MARITIMUM* L. *97, Westernness: Ardnamurchan Point, GR 17/42.64. R. Groom, 1971, field record.

300/3. *OENANTHE SILAIFOLIA* Bieb. *34, W. Gloucester: Ashleworth Ham Nature Reserve, GR 32/83.26. Water meadow. S. C. Holland, 1972, field record.

301/1. *AETHUSA CYNAPIUM* L. **96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, field record. 2nd record.

†309/3. *PEUCEDANUM OSTRUTHIUM* (L.) Koch **95**, Elgin: Grantown on Spey, GR 38/0.2. M. McC. Webster, 1972, field record. 2nd record.

310/1. *PASTINACA SATIVA* L. *†96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1972, E.

†320/20. *POLYGONUM SACHALINENSE* F. Schmidt **45**, Pembroke: 3 km N.N.E. of Mathry, GR 12/89.34. Woodland edge. P. S. H. Henry, 1971, field record. 2nd record. (*Nature Wales*, **13**: 202 (1973)). *57, Derby: between Cromford and Lea Hall, GR 43/31.56. Roadside. S. Band & J. Hodgson, 1972, field record.

325/1/3. *RUMEX TENUIFOLIUS* (Wallr.) Löve *96, Easternness: Spey Dam, Laggan, GR 27/58.93. Loch Killin, GR 28/53.08. 2nd record. Both records from river shingle, M. McC. Webster, 1972, E, conf. J. E. Lousley.

†325/5. *RUMEX ALPINUS* L. *96, Easternness: Dalcross, GR 28/75.49. Railway embankment. M. McC. Webster, 1968, field record.

325/18. *RUMEX MARITIMUS* L. 57, Derby: Langley Mill, GR 43/45.47. G. C. Steele, 1972, DBY. 1st post-1930 record.

†325/21. *RUMEX TRIANGULIVALVIS* (Danser) Reching.f. *16, W. Kent: Dartford, GR 51/56.74. Rubbish tip. J. Mason & J. R. Palmer, 1968, field record. Not seen since. Stone, GR 51/57.74. Disused quarry. J. R. Palmer, 1971, 1972, MNE. 2nd record. 1972 specimen.

329/1. *HUMULUS LUPULUS* L. *†82, Haddington: Scougall, North Berwick, GR 36/61.83. Roadside verge. E. P. Beattie, 1969, E. Gullane, GR 36/48.82. Railway embankment. E. P. Beattie, 1972, E. 2nd record.

†336/2. *ALNUS INCANA* (L.) Moench *96, Easternness: Aigas, GR 28/4.4. 1950. Glen Doe, GR 28/41.08. 1972. 2nd record. Both records M. McC. Webster, field records. *97, Westernness: Loch Treig, GR 27/34.77. Self-sown on railway embankment. E. Leanachan, GR 27/21.89. Field record. 2nd record. Both records M. McC. Webster, 1972.

†341/1. *QUERCUS CERRIS* L. *84, Linlithgow: Linlithgow Castle, GR 36/00.77. E. P. Beattie, 1972, E.

343/13 × 11. *SALIX AURITA* L. × *S. CAPREA* L. 57, Derby: Manystones quarry, Brassington, GR 43/23.55. H. Lucking, 1971, field record, det. R. C. L. Howitt. 1st post-1930 record.

358/5. *VACCINIUM MICROCARPUM* (Rupr.) Hook.f. *106, E. Ross: Eileanach Lodge, Kiltarn, GR 28/52.68. K. Butler & M. McC. Webster, 1972, E.

359/3. *PYROLA ROTUNDIFOLIA* L. 44, Carmarthen: Laugharne Burrows, GR 22/28.07. Dunes. D. Davies *et alii*, 1972, field record. (*Nature Wales*, 13: 200 (1973)). 2nd record.

364/1. *EMPETRUM NIGRUM* L. *84, Linlithgow: Winchburgh, GR 36/00.63. Shale bing. R. W. M. Corner, 1967, field record. Blackridge, Blawhorn Moss, GR 26/88.68. E. P. Beattie, 1972, E. 2nd record.

†370/5. *LYSIMACHIA PUNCTATA* L. 83, Edinburgh: Ravelston Dykes Quarry, Edinburgh, GR 36/21.73. E. P. Beattie, 1967, 1972, E. 2nd record.

372/2. *ANAGALLIS ARVENSIS* L. 96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E. 2nd record.

†375/1. *BUDDLEJA DAVIDII* Franch. *57, Derby: by Swarkestone Bridge, GR 43/36.27. H. Lucking, 1970, field record. 82, Haddington: North Berwick, GR 36/57.84. Disused quarry. E. P. Beattie, 1972, E. 2nd record. 83, Edinburgh: Ravelston Dykes Quarry, Edinburgh, GR 36/21.73. E. P. Beattie, 1967, E. 2nd record. Still present 1972.

†378/2. *LIGUSTRUM OVALIFOLIUM* Hassk. *83, Edinburgh: Ravelston Dykes Quarry, GR 36/21.73. 1967. Hailes Quarry, Edinburgh, GR 36/20.70. 1972. 2nd record. Both records E. P. Beattie, E.

382/4. *CENTAURIUM ERYTHRAEA* Rafn 84, Linlithgow: Carriden, GR 36/0.8. E. P. Beattie. 1972, field record. 2nd record.

383/1. *BLACKSTONIA PERFOLIATA* (L.) Huds. *48, Merioneth: Morfa Harlech, GR 23/5.3. Mrs M. Newton, O. H. Black & H. Handley, 1972, NMW. 1st certain record.

385/3/1. *GENTIANELLA AMARELLA* (L.) Börner *79, Selkirk: N.E. side of Akermoor Loch, GR 36/40.21. R. W. M. Corner, 1972, herb. R.W.M.C. H32, Monaghan: Lugadadorris, Carrickmacross, GR 23/81.05. L. Farrell, 1972, field record.

†392/2. *SYMPHYTUM ASPERUM* Lepech. 96, Easternness: Beaufort Castle, GR 28/50.42. M. McC. Webster, 1972, CGE,E. 2nd record.

†392/2 × 1. *SYMPHYTUM* × *UPLANDICUM* Nyman 82, Haddington: Samuelston, Haddington, GR 36/48.70. Banks of R. Tyne. E. P. Beattie, 1969, field record. 2nd record.

†393/1. *BORAGO OFFICINALIS* L. *96b, Nairn: Nairn tip, GR 28/90.54. M. McC. Webster, 1970, E.

400/3. *MYOSOTIS STOLONIFERA* (DC.) Gay ex Leresche & Levier *79, Selkirk: Flesh Cleuch Burn, Douglas Burn, Yarrow, GR 36/26.24. C.S.S.F. Meeting, 1972, herb. R. W. M. Corner, det. A. E. Wade.

403/1. *ECHIUUM VULGARE* L. 84, Linlithgow: Carriden, GR 36/01.81. E. P. Beattie, 1972, field record. 2nd record.

†406/2. *CALYSTEGIA PULCHRA* Brummitt & Heywood 82, Haddington: Longniddry station, GR 36/44.76. E. P. Beattie, 1972, field record. 2nd record. 84, Linlithgow: below Stacks Farm, Carriden, GR 36/03.80. E. P. Beattie, 1970, E. 2nd record.

†408/1. *NICANDRA PHYSALODES* (L.) Gaertn. *95, Elgin: Brodie Castle gardens, GR 28/98.57. 1971. Elgin tip, GR 38/22.63. 1972. 2nd record. Both records M. McC. Webster, E. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1971, E.

†413/4. *SOLANUM SARRACHOIDES* Sendtn. 29, Cambs.: near Great Heath Wood, Gamlingay, GR 52/22.51. Sandy fields. R. J. Pankhurst, 1972, field record, det. S. M. Walters. 2nd record.

416/7. *VERBASCUM NIGRUM* L. *35, Monmouth: Newport Docks, GR 31/30.86. T. G. Evans & C. Titcombe, 1972, field record. *†82, Haddington: Garleton Hills, GR 36/86.76. Quarry. E. P. Beattie & U. K. Duncan, 1972, field record.

417/1. *MISOPATES ORONTIUM* (L.) Raf. *†95, Elgin: Dyke, GR 28/98.58. Garden weed. M. McC. Webster, 1970, E.

†418/1. *ANTIRRHINUM MAJUS* L. *45, Pembroke: Dinas Cross, GR 22/0.3. M. S. Johnson, 1954, field record. Between Fishguard and Goodwick, GR 12/9.3. D. McClintock, 1956, field record. 2nd record (Both records *Nature Wales*, 13: 203 (1973)). 84, Linlithgow: Carriden, GR 36/01.81. E. P. Beattie, 1972, field record. 1st post-1930 record.

420/3. *LINARIA REPENS* (L.) Mill. *84, Linlithgow: Carriden, GR 36/02.81. E. P. Beattie, 1972, E.

420/3 × 4. *LINARIA REPENS* (L.) Mill. × *L. VULGARIS* Mill. 42, Brecon: near Dyfynnog, GR 22/92.27. Old railway line. M. Massey & M. Porter, 1972, NMW. 2nd record. (*Nature Wales*, 13: 199(1973)).

422/1. *KICKXIA SPURIA* (L.) Dumort. 45, Pembroke: Marloes, GR 12/7.0. C.D. Pigott, 1955, field record. 2nd record. (*Nature Wales*, 13: 203 (1973)).

†423/2. *CYMBALARIA PALLIDA* (Ten.) Wettst. *82, Haddington: Haddington, GR

36/51.73. *E. P. Beattie*, 1972, **E**. *84, Linlithgow: Linlithgow, GR 36/00.77. *E. P. Beattie*, 1967, **E**. Still present 1972.

424/3. *SCROPHULARIA UMBROSA* Dumort. *47, Montgomery: Lymore, Montgomery, GR 30/23.96. By ditch. *V. J. Macnair & D. Pugh*, 1972, field record. Near Devil's Hole, Montgomery, GR 30/22.98. By ditch. *V. J. Macnair*, 1972, **NMW**. 2nd record. (Both records *Nature Wales*, **13**: 204 (1973)).

†424/5. *SCROPHULARIA VERNALIS* L. *96, Easternness: Ardersier, GR 28/77.55. *M. McC. Webster*, 1971, **E**.

†425/1 × 2. *MIMULUS GUTTATUS* DC. × *M. LUTEUS* L. *109, Caithness: near Thurso Castle, GR 39/1.6. *W. S. Lacey*, 1972, **UCNW**, det. *R. H. Roberts*.

†425/2. *MIMULUS LUTEUS* L. *74, Wigtown: Mochrum Loch, GR 25/30.52. Roadside. *H. Milne-Redhead*, 1972, field record.

†428/1. *ERINUS ALPINUS* L. 82, Haddington: Gifford, GR 36/53.68. *E. P. Beattie*, 1969, **E**. 2nd record.

430/3. *VERONICA CATENATA* Pennell *H32, Monaghan: east of Lough Fea demesne, GR 23/83.02. *L. Farrell*, 1972, field record.

439/1. *LATHRAEA SQUAMARIA* L. 46, Cardigan: Llannerch Aeron, GR 22/47.60. *A. O. Chater*, 1971, **NMW**. 1st record for 60 years. (*Nature Wales*, **13**: 204 (1973)).

440/3. *OROBANCHE RAPUM-GENISTAE* Thuill. 44, Carmarthen: near Cais, GR 22/68.39. *I. M. Vaughan*, 1972, **NMW**. 1st record for 60 years.

440/8. *OROBANCHE MINOR* Sm. *H32, Monaghan: near Lugadadorris, Carrickmacross, GR 23/81.05. *L. Farrell*, 1972, **DBN**.

442/2. *ULTRICULARIA NEGLECTA* Lehm. *96b, Nairn: Loch Loy, GR 28/92.57. Forest pool. *M. McC. Webster*, 1969, 1971, **E, K**, det. *P. Taylor*.

†445/4 × 5. *MENTHA AQUATICA* L. × *M. SPICATA* L. 57, Derby: Norbury, GR 43/12.42. *K. Hollick*, 1972, **DBY**. 1st localised record and 1st for 50 years.

453/1. *CLINOPODIUM VULGARE* L. 95, Elgin: Grantown on Spey, GR 38/0.2. Riverbank. *M. McC. Webster*, 1970, **E**. 2nd record.

459/3. *STACHYS ARVENSIS* (L.) L. 96, Easternness: the Longman tip, Inverness, GR 28/67.46. *M. McC. Webster*, 1970, **E**. 2nd record.

469/2. *SCUTELLARIA MINOR* Huds. 74, Wigtown: Garheugh, GR 25/26.50. *H. Milne-Redhead*, 1972, field record. 1st post-1930 record.

472/4. *PLANTAGO MARITIMA* L. 83, Edinburgh: Granton, Edinburgh, GR 36/22.77. Waste ground by sea. *E. P. Beattie*, 1972, **E**. 2nd record.

485/3. *GALIUM MOLLUGO* L. 84, Linlithgow: Carriden, GR 36/01.81. *E. P. Beattie*, 1972, field record. 2nd record.

485/7. *GALIUM STERNERI* Ehrend. 96, Easternness: Glen Markie, GR 27/59.99. *M. McC. Webster*, 1972, **E**. 2nd record.

485/10. *GALIUM ULIGINOSUM* L. 95, Elgin: Cromdale Hills, GR 38/1.2. *M. McC. Webster*, 1971, **E**. 1st post-1930 record.

497/1. *DIPSACUS FULLONUM* L. 84, Linlithgow: Carriden, GR 36/01.81. *E. P. Beattie*, 1972, field record. 2nd record. Subsp. *SATIVUS* (L.) Theil. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. *M. McC. Webster*, 1970, **E**.

506/11. *SENECIO PALUDOSUS* L. **29**, Cambs.: fen ditch, GR 52/—.—. D. Dupree, 1972, field record, det. S. M. Walters. 1st record this century.

†507/2. *DORONICUM PLANTAGINEUM* L. ***96**, Easternness: Ardersier, GR 28/78.54. 1971. Newton of Budgate, Cawdor, GR 28/82.49. 1972. 2nd record. Both records M. McC. Webster, E. **96b**, Nairn: Easter Milton, GR 28/95.53. M. McC. Webster, 1970, E.

†509/4. *PETASITES FRAGRANS* (Vill.) C. Presl **96**, Easternness: Dochfour, GR 28/61.39. M. McC. Webster, 1972, field record. 2nd record.

514/1. *FILAGO GERMANICA* (L.) L. **80**, Roxburgh: above Stichill Linn, GR 36/70.37. R. W. M. Corner, 1972, **herb. R.W.M.C.** 1st post-1930 record.

†516/1. *ANAPHALIS MARGARITACEA* (L.) Benth. ***97**, Westernness: Spean Bridge, GR 27/15.80. M. McC. Webster, 1972, E.

525/1. *EUPATORIUM CANNABINUM* L. **97**, Westernness: Kinlochmoidart, GR 17/6.7. M. McC. Webster, 1970, E. 2nd record.

†533/3. *LEUCANTHEMUM MAXIMUM* (Ramond) DC. ***82**, Haddington: North Berwick, GR 36/57.85. Gullane, GR 36/47.83. 2nd record. Both records E. P. Beattie, 1972, E. ***83**, Edinburgh: Ravelston Dykes Quarry, Edinburgh, GR 36/21.73. E. P. Beattie, 1967, 1972, E. Blackhall, Edinburgh. GR 36/22.74. E. P. Beattie, 1972, field record. 2nd record.

†544/2. *CENTAUREA MONTANA* L. ***96**, Easternness: Connage, Ardersier, GR 28/77.53. Roadside. M. McC. Webster, 1972, E.

550/3. *LEONTODON TARAXACOIDES* (Vill.) Mérat ***97**, Westernness: Loch Ailort, GR 17/7.7. Roadside verge. M. McC. Webster, 1971, E.

551/2. *PICRIS HIERACIOIDES* L. †**82**, Haddington: Kingston, North Berwick, GR 36/52.82. E. P. Beattie, 1971, E. 2nd record. †**84**, Linlithgow: Carriden, GR 36/01.81. E. P. Beattie, 1972, E.

†557/3. *CICERBITA MACROPHYLLA* (Willd.) Wallr. ***47**, Montgomery: Montgomery, GR 32/22.96. Roadside. V. J. Macnair & E. D. Pugh, 1972, field record. Montgomery, GR 32/21.93. Roadside. Mrs A. Walton, 1972, field record. 2nd record. (Both records *Nature Wales*, **13**: 205 (1973)). **84**, Linlithgow: Linlithgow, GR 26/99.77. Waste ground. E. P. Beattie, 1972, field record. 2nd record.

558/1/39. *HIERACIUM PETROCHARIS* (E. F. Linton) W. R. Linton ***95**, Elgin: Findhorn gorge, Relugas, GR 38/00.50. M. McC. Webster, 1970, CGE, det. P. D. Sell & C. West.

558/1/47. *HIERACIUM SCHMIDTII* Tausch ***80**, Roxburgh: north bank of R. Tweed at Trows Craggs, Makerstoun, GR 36/66.31. R. W. M. Corner, 1972, CGE, det. P. D. Sell & C. West.

558/1/58. *HIERACIUM CHLORANTHUM* Pugsf. ***96b**, Nairn: Drynachan, GR 28/86.35. Cliff by R. Findhorn. M. McC. Webster, 1970, CGE, det. P. D. Sell & C. West.

558/1/94. *HIERACIUM DURICEPS* F. J. Hanb. ***96b**, Nairn: Drynachan, GR 28/86.38. Rocky cliff. M. McC. Webster, 1970, CGE, det. P. D. Sell & C. West.

558/1/98. *HIERACIUM EXOTERICUM* Jord. ex Bor. ***15**, E. Kent: Maidstone, GR 51/76.53. Cemetery wall. E. G. Philp, 1972, MNE, det. C. West. ***83**, Edinburgh: Carberry Tower, Musselburgh, GR 36/36.69. E. P. Beattie & V. Leather, 1968, E, det. P. D. Sell.

558/1/204. *HIERACIUM CALCARICOLA* (F. J. Hanb.) Roffey *15, E. Kent: Maidstone, GR 51/75.56. Railway yard. E. G. Philp, 1971, MNE, det. C. West.

558/219. *HIERACIUM PERPROPINQUUM* (Zahn) Druce *80. Roxburgh: north end of Newcastleton, GR 35/48.88. Railway cutting. R. W. M. Corner, 1972, CGE, det. P. D. Sell & C. West.

559/5. *CREPIS BIENNIS* L. 50, Denbigh: entrance to Coed Accas, Nantglyn, Denbigh, GR 33/03.64. J. M. Brummitt, 1971, BM, NMW, det. J. B. Marshall. 2nd and only extant record.

560/3. *TARAXACUM LACISTOPHYLLUM* (Dahlst.) Raunk. *96b, Nairn: Nairn, GR 28/90.57. Dunes. M. McC. Webster, 1972, E, det. A. J. Richards.

560/4. *TARAXACUM RUBICUNDUM* (Dahlst.) Dahlst. *90, Forfar: Montrose Links, GR 37/7.5. U. K. Duncan, 1970, herb. U.K.D., det. A. J. Richards.

560/7. *TARAXACUM COMMIXTUM* Hagl. *15, E. Kent: Greatstone, GR 61/08.23. Sand-dunes. E. G. Philp, 1971, MNE, det. A. J. Richards.

560/12. *TARAXACUM LAETUM* (Dahlst.) Dahlst. *15, E. Kent: Hothfield, GR 51/97.45. Sandy grassland. E. G. Philp, 1971, MNE, det. A. J. Richards. *95, Elgin: Lossiemouth, GR 38/22.70. Dunes. M. McC. Webster, 1972, E, det. A. J. Richards.

560/17. *TARAXACUM OXONIENSE* Dahlst. *16, W. Kent: Stansted, GR 51/61.61. Downland. Mrs P. White, 1971, MNE, det. A. J. Richards.

560/18. *TARAXACUM RETZII* van Soest *16, W. Kent: Kemsing, GR 51/55.59. Downland. E. G. Philp, 1971, MNE, det. A. J. Richards.

560/20. *TARAXACUM PROXIMUM* (Dahlst.) Dahlst. *15, E. Kent: Greatstone, GR 61/08.23. Dunes. E. G. Philp, 1971, MNE, det., A. J. Richards.

560/21. *TARAXACUM SIMILE* Raunk. *15, E. Kent: Greatstone, GR 61/08.23. Dunes. E. G. Philp, 1971, MNE, det. A. J. Richards.

560/33. *TARAXACUM UNGUILOBUM* Dahlst. *106, E. Ross: Amat Lodge, Strath Carron, GR 28/4.9. River bank. U. K. Duncan, 1971, herb. U.K.D., det. A. J. Richards.

560/35. *TARAXACUM LANDMARKII* Dahlst. *95, Elgin: Clashdhu, GR 38/03.52. Railway cutting. M. McC. Webster, 1972, E, det. A. J. Richards.

560/37. *TARAXACUM SPECTABILE* Dahlst. *47, Montgomery: Llanfihangel-yng-Ngwynfa, GR 33/08.16. V. J. Macnair, 1972, field record, det. A. J. Richards. *64, Mid-W. Yorks.: Ingleborough, GR 34/7.7. Limestone pavement. M. McC. Webster, 1972, E, det. A. J. Richards. *97, Westernness: Loch Treig, Fersit, GR 27/35.76. M. McC. Webster, 1972, E, det. A. J. Richards.

560/42. *TARAXACUM EURYPHYLLUM* (Dahlst.) M.P. Chr. *65, N. W. Yorks.: Hawes, GR 34/8.9. Roadside. M. McC. Webster, 1972, E, det. A. J. Richards. *69, Westmorland: 1.5 km west of Kirkby Lonsdale, GR 34/59.78. Roadside. G. Halliday, 1972, LANC, det. A. J. Richards. *95, Elgin: Grantown on Spey, GR 38/04.26. M. McC. Webster, 1972, E, det. A. J. Richards.

560/44. *TARAXACUM PRAESTANS* H. Lindb.f. *64, Mid-W. Yorks.: Ingleborough, GR 34/7.7. Limestone pavement. M. McC. Webster, 1972, E, det. A. J. Richards. *91, Kincardine: Bogmuir, near Fettercairn, GR 37/6.7. Roadside. U. K. Duncan, 1972, herb. U.K.D., det. A. J. Richards.

560/50. *TARAXACUM NAEVOSUM* Dahlst. *65, N. W. Yorks.: Hawes, GR 34/8.9. Roadside. M. McC. Webster, 1972, E, det. A. J. Richards.

560/51. *TARAXACUM LAETIFRONS* Dahlst. *96, Easternness: Kirkhill, GR 28/54.45. M. McC. Webster, 1972, E, det. A. J. Richards.

560/58. *TARAXACUM STICTOPHYLLUM* Dahlst. *95, Elgin: Fochabers, GR 38/33.58. By R. Spey. M. McC. Webster, 1972, E, det. A. J. Richards.

560/61. *TARAXACUM NORDSTEDTII* Dahlst. *89, E. Perth: Loch of Lowes, near Dunkeld, GR 37/0.4. U. K. Duncan, 1970, herb. A. Robson, det. A. J. Richards.

560/64. *TARAXACUM ADAMII* Claire *96, Easternness: Glenmoriston, GR 28/40.17. Roadside. M. McC. Webster, 1972, CGE,E, det. A. J. Richards.

560/67. *TARAXACUM SUBCYANOLEPIS* M.P. Chr. *90, Forfar: north end of Lunan Bay, near Montrose, GR 37/6.5. Railway embankment. U. K. Duncan, 1970, herb. U.K.D., det. A. J. Richards.

560/68. *TARAXACUM CYANOLEPIS* Dahlst. *95, Elgin: Forres, GR 38/03.58. Old railway line. M. McC. Webster, 1972, E, det. A. J. Richards. *96, Easternness: Inchnacardoch, Fort Augustus, GR 28/37.09. Roadside. M. McC. Webster, 1972, CGE,E, det. A. J. Richards.

560/75. *TARAXACUM PANNUCIUM* Dahlst. *15, E. Kent: Folkestone, GR 61/21.35. Waste land. A. Ford, 1971, MNE, det. A. J. Richards.

560/78. *TARAXACUM ALATUM* H.Lindb.f. *95, Elgin: Dyke, GR 28/98.58. Garden. M. McC. Webster, 1972, CGE,E, det. A. J. Richards.

560/79. *TARAXACUM LINGULATUM* Markl. *15, E. Kent: Hothfield, GR 51/97.45. Roadside. E. G. Philp, 1971, MNE, det. A. J. Richards. *16, W. Kent: Harvel, GR 51/65.63, Mrs P. White, 1971, MNE, det. A. J. Richards.

560/94. *TARAXACUM EKMANNII* Dahlst. *15, E. Kent: Ashford, GR 61/01.43. Roadside. E. G. Philp, 1971, MNE, det. A. J. Richards.

560/103. *TARAXACUM CORDATUM* Palmgr. *95, Elgin: Burghead, GR 38/11.68. Sandy ground. M. McC. Webster, 1972, E, det. A. J. Richards. *96b, Nairn: Nairn Dunbar golf-course, GR 28/90.57. M. McC. Webster, 1972, CGE,E, det. A. J. Richards.

560/104. *TARAXACUM ADSIMILE* Dahlst. *15, E. Kent: Acol, GR 61/30.67. Roadside. C. C. Hare, 1971, MNE, det. A. J. Richards.

560/105. *TARAXACUM LONGISQUAMEUM* H.Lindb.f. *65, N. W. Yorks.: Hawes, GR 34/8.9. Roadside. M. McC. Webster, 1972, E, det. A. J. Richards. *90, Forfar: R. South Esk above Cortachy, near Kirriemuir, GR 37/3.6. River bank. U. K. Duncan, 1972, herb. U.K.D., det. A. J. Richards. *96, Easternness: Viewhill, Kirkhill, GR 28/55.46. Gravel drive. M. McC. Webster, 1972, E, det. A. J. Richards.

560/106. *TARAXACUM DAHLSTEDTII* H.Lindb.f. *90, Forfar: Needle's Eye, Arbroath, GR 37/6.4. Sandstone sea-cliff. U. K. Duncan, 1970, herb.U.K.D., det. A. J. Richards. *91, Kincardine: 'The Burn', foot of Glenesk, GR 37/5.7. Wall-top. U. K. Duncan, 1970, ABD, det. A. J. Richards.

560/107. *TARAXACUM DUPLIDENS* H.Lindb.f. *90, Forfar: Boddin Point, near Montrose, GR 37/7.5. U. K. Duncan, 1972, herb.U.K.D., det. A. J. Richards. *96, Easternness: Kilmorack, GR 28/48.44. Waste ground. M. McC. Webster, 1972, E, det. A. J. Richards.

560/113. *TARAXACUM BRACTEATUM* Dahlst. *95, Elgin: Glenernerney, GR 38/00.46. Stream-bank. M. McC. Webster, 1972, E, det. A. J. Richards.

560/115. *TARAXACUM HAMATIFORME* Dahlst. *95, Elgin: Relugas, GR 28/99.48. Roadside. M. McC. Webster, 1972, E, det. A. J. Richards.

560/116. *TARAXACUM MARKLUNDII* Palmgr. *15, E. Kent: Hythe, GR 61/18.35. Mrs J. M. Long, 1971, MNE, det. A. J. Richards. *16, W. Kent: Tunbridge Wells, GR 51/59.40. Roadside. W. E. Coultrup, 1971, MNE, det. A. J. Richards. *90, Forfar: R. South Esk, above Shielhillbridge, near Forfar, GR 37/4.5. River bank. U. K. Duncan, 1971, herb.U.K.D., det. A. J. Richards.

560/118. *TARAXACUM OBLONGATUM* Dahlst. *15, E. Kent: Folkestone, GR 61/20.35. Edge of wood. A. Ford, 1971, MNE, det. A. J. Richards.

560/119. *TARAXACUM MACULATUM* Jordan *15, E. Kent: Hythe, GR 61/16.35. Roadside. Mrs J. M. Long, 1971, MNE, det. A. J. Richards.

560/121. *TARAXACUM DUPLIDENTIFRONS* Dahlst. *15, E. Kent: Hythe, GR 61/18.35. Roadside. Mrs J. M. Long, 1971, MNE, det. A. J. Richards. *90, Forfar: Boddin Point, near Montrose, GR 37/7.5. U. K. Duncan, 1972, herb.U.K.D., det. A. J. Richards.

560/123. *TARAXACUM OBSCURATUM* Dahlst. *90, Forfar: Seymour Street, Dundee, GR 37/3.3. U. K. Duncan, 1970, herb. U.K.D., det. A. J. Richards. New to Scotland.

560/124. *TARAXACUM PARVULICEPS* H.Lindb.f. *95, Elgin: Grantown on Spey, GR 38/04.26. M. McC. Webster, 1972, E, det. A. J. Richards.

560/125. *TARAXACUM POLYODON* Dahlst. *69b, Furness: Kents Bank, GR 34/7.3. W. L. Smith, 1939, LANC, det. A. J. Richards. *90, Forfar, South Street, Arbroath, GR 37/6.4. Stony sea shore. U. K. Duncan, 1970, herb. U.K.D., det. A. J. Richards. *96b, Nairn: Trades Park, Nairn, GR 28/85.55. Wall. M: McC. Webster, 1972, CGE, E, det. A. J. Richards.

560/127. *TARAXACUM CRISPIFOLIUM* H.Lindb.f. *96, Easternness: Glen Strathfarrer, GR 28/39.40. M. McC. Webster, 1972, E, det. A. J. Richards.

563/3. *ALISMA GRAMINEUM* Lejeune *29, Cambs.: near Welches Dam, Manea, GR 52/46.85. Fen-drain. R. P. Libbey, 1972, field record, det. S. M. Walters.

576/2. *ZOSTERA ANGUSTIFOLIA* (Hornem.) Reichb. *35, Monmouth: Black Bedwins, R. Severn, GR 31/48.86. On inter-tidal gravel. T. G. Evans & C. Titcombe, 1971, 1972, NMW, det. T. G. Tutin.

577/20. *POTAMOGETON FILIFORMIS* Pers. *79, Selkirk: east end of Akersmoor Loch, GR 36/40.21. R. W. M. Corner, 1972, BM, herb.R.W.M.C., det. J. E. Dandy.

579/2. *RUPPIA MARITIMA* L. 74, Wigtown: near St Helena Island, mouth of Water of Luce, GR 25/19.56. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

†605/2. *JUNCUS TENUIS* Willd. 35, Monmouth: Newport Docks, GR 31/30.86. T. G. Evans, 1972, NMW. 2nd record. *83, Edinburgh: Edinburgh, GR 36/22.72. Railway track. E. P. Beattie, 1967, 1972, E. *84, Linlithgow: Linlithgow, GR 36/98.76. Canal tow-path. E. P. Beattie, 1967, 1972, E. 96, Easternness: Cannich, GR 28/34.32. Roadside. C.S.S.F. Meeting, 1971, E. 2nd record.

605/4. *JUNCUS COMPRESSUS* Jacq. *80, Roxburgh: north bank of R. Tweed, Trows Crags, Makerstoun, GR 36/66.31. Clefts in rock. R. W. M. Corner, 1972, BM, herb.R.W.M.C., det. A. Melderis.

605/25. *JUNCUS BIGLUMIS* L. *96, Easternness: Sgurr na Lappaich, Glen Strathfarrer, GR 28/16.35. M. McC. Webster, 1971, field record.

†605/p. *JUNCUS PLANIFOLIUS* R.Br. *H16, W. Galway: Lough Truscan, S.E. of Carna, GR 84/8.0. Wet grassy track by lake. M. Scannell, 1971, DBN. 1st record from British Isles. (See Exhibition Meeting, 1972, pp. 431–432.)

†606/4. *LUZULA LUZULOIDES* (Lam.) Dandy & Wilmott *97, Westernness: Ardverikie, Kinlochlaggan, GR 27/53.89. By drive to house. M. McC. Webster, 1972, E.

607/6. *ALLIUM OLERACEUM* L. 29, Cambs.: Little Abington, GR 52/53.49. Roadside. Mrs B. A. Jackson, 1972, field record, det. S. M. Walters. 1st record since 1905.

625/2. *EPIACTIS HELLEBORINE* (L.) Crantz *94, Banff: Tomintoul, GR 38/1.1. T. M. Groucher, 1917, GLA. Subsequently seen at Craighalkie, Tomintoul by A. J. Souter, 1952, and Miss Raeburn *et alii*, 1972.

631/1. *HAMMARBYA PALUDOSA* (L.) Kuntze 96, Easternness: Loch A' Chlachain, GR 28/65.31. M. Barron, 1972, field record. 2nd record.

643/1 × 5. *DACTYLORHIZA FUCHSII* (Druce) Soó × *D. PURPURELLA* (T. & T. A. Stephenson) Soó *105, W. Ross: Inverpolly Forest, GR 29/0.1. Moorland bog. M. McC. Webster, 1971, E, det. J. Heslop-Harrison.

649/1. *ARUM MACULATUM* L. †96, Easternness: Ness Castle, GR 28/65.41. M. McC. Webster, 1971, E. 2nd record.

652/2. *SPARGANIUM EMERSUM* Rehm. *96b, Nairn: Nairn Dunbar golf-course, GR 28/89 57. Ditch. M. McC. Webster, 1971, E.

652/3. *SPARGANIUM ANGUSTIFOLIUM* Michx. 44, Carmarthen: Llyn y Gwaith, GR 22/67.50. D. Davies & I. M. Vaughan, 1972, field record. 1st record since 1935. (*Nature Wales*, 13: 201 (1973)).

653/2. *TYPHA ANGUSTIFOLIA* L. *H32, Monaghan: Priestfield Lake, Rossmore Castle, GR 23/65.30. L. Farrell, 1972, DBN. Probably introduced.

655/5. *SCIRPUS HOLOSCHOENUS* L. *†15, E. Kent: GR 51/9.6. M. J. Newcombe, 1971, MNE.

656/4. *ELEOCHARIS MULTICAULIS* (Sm.) Sm. 42, Brecon: 2 miles west of Cilmerly, GR 22/98.51. Boggy flushes. M. Massey & M. Porter, 1972, NMW. 2nd record. (*Nature Wales*, 13: 199 (1973)).

663/3. *CAREX PUNCTATA* Gaudin 74, Wigtown: Garheugh, GR 25/26.50. Cliff. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

663/4. *CAREX HOSTIANA* DC. 82, Haddington: Bothwell Water, GR 86/67.66. E. P. Beattie & U. K. Duncan, 1972, field record. 2nd record.

663/8 × 4. *CAREX DEMISSA* Hornem. × *C. HOSTIANA* DC. *44, Carmarthen: near Temple Bar, GR 22/57.17. K. Lewis, 1971, field record, det. A. C. Jermy. (*Nature Wales*, 13: 201 (1973)).

663/10. *CAREX SEROTINA* Mérat 74, Wigtown: Loch Dernaglar, GR 25/26.57. Stony shore. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

663/43. *CAREX ATRATA* L. 97, Westernness: Coire an Lochain, Meall na Teanga, GR 27/22.92. A. McG. Stirling, 1971, field record. Range extension.

663/47. *CAREX ACUTA* L. 74, Wigtown: Prestrie Loch, Whithorn, GR 25/46.38. H. Milne-Redhead, 1972, field record, 1st post-1930 record.

663/52. *CAREX BIGELOWII* Torr. ex Schwein. **80**, Roxburgh: N.W. summit of Peel Fell, GR 35/62.99. R. W. M. Corner, 1972, *herb. R.W.M.C.* Confirmation of doubtful 1st record.

663/56. *CAREX DIANDRA* Schrank **74**, Wigtown: Prestrie Loch, Whithorn, GR 25/46.38. H. Milne-Redhead, 1972, field record. 1st post-1930 record. ***96**, Easternness: Essich, GR 28/65.38. By lochan. M. Barron, 1972, field record.

663/67. *CAREX SPICATA* Huds. ***47**, Montgomery: 2 km south of Arddleen, GR 33/25.13. By canal. T. A. W. Davis, 1970, NMW, det. A. O. Chater. (*Nature Wales*, 13: 205 (1973)).

663/72. *CAREX CURTA* Gooden. **45**, Pembroke: Esgryn Bottom, GR 12/97.34. T. A. W. Davis & S. B. Evans, 1972, NMW. 2nd record. (*Nature Wales*, 13: 203 (1973)).

663/81. *CAREX DIOICA* L. **82**, Haddington: Faseny Water, S.E. of Garvald, GR 36/64.62. E. P. Beattie & U. K. Duncan, 1972, field record. 2nd record.

669/1 × 2. *GLYCERIA* × *PEDICELLATA* Townsend **45**, Pembroke: 3 km north of St David's, GR 12/76.28. T. Inskip, 1972, field record. 2nd record. (*Nature Wales*, 13:203 (1973)).

669/3. *GLYCERIA DECLINATA* Bréb. **74**, Wigtown: Prestrie Loch, Whithorn, GR 25/46.38. H. Milne-Redhead, 1972, field record. 1st post-1930 record.

†671/2 × 3. *LOLIUM MULTIFLORUM* Lam. × *L. TEMULENTUM* L. ***96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E, det. C. E. Hubbard. 1st record for British Isles.

†671/3. *LOLIUM TEMULENTUM* L. ***96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E.

672/3. *VULPIA MYUROS* (L.) C. C. Gmel. ***†84**, Linlithgow: Carriden, GR 36/01.81. E. P. Beattie, 1972, E. **†96**, Easternness: Bunchrew, GR 28/61.45. M. McC. Webster, 1971, E, det. C. E. Hubbard. 2nd record.

673/1. *PUCCINELLIA MARITIMA* (Huds.) Parl. **84**, Linlithgow: Bo'ness, GR 26/98.81. E. P. Beattie, 1971, field record. 2nd record.

673/2. *PUCCINELLIA DISTANS* (L.) Parl. ***84**, Linlithgow: Bo'ness, GR 26/98.81. E. P. Beattie, 1971, E.

675/1. *NARDURUS MARITIMUS* (L.) Murb. **33**, E. Gloucester: Daneway Banks Nature Reserve, Sapperton, GR 32/94.03. Lady Ricketts, 1972, field record, det. C. A. Stace. 2nd record.

676/11. *POA ANGUSTIFOLIA* L. ***42**, Brecon: near Llanfihangel Tal-y-llyn, GR 32/11.27. Wall-top. M. Porter, 1972, field record, det. C. E. Hubbard. (*Nature Wales*, 13: 199 (1973)).

676/12. *POA SUBCAERULEA* Sm. **82**, Haddington: Scoughall, GR 36/61.83. Dunes. E. P. Beattie & U. K. Duncan, 1972, field record. 2nd record.

681/1. *MELICA UNIFLORA* Retz. **80**, Roxburgh: Jed Water below Ferniehurst Bridge, GR 36/64.18. Shady bank. R. W. M. Corner, 1972, *herb. R.W.M.C.* 1st post-1930 record.

683/1. *BROMUS ERECTUS* Huds. ***H32**, Monaghan: east of Lough Fea demesne, GR 23/83.02. L. Farrell, 1972, field record.

†683/4. *BROMUS INERMIS* Leyss. **95**, Elgin: Roseisle, GR 38/14.65, Verge. M. McC. Webster, 1971, E. 2nd record.

683/5. *BROMUS STERILIS* L. **96**, Easternness: Kirkhill, GR 28/58.45. Gravel drive. M. McC. Webster, 1972, field record. 2nd record.

†683/18. *BROMUS SECALINUS* L. ***42**, Brecon: 2 miles north of Llangorse, GR 32/13.30. Wheatfield. M. Porter, 1972, NMW. 1st definite record. Llangynidr, GR 32/15.19. Garden weed. M. Porter, 1972, field record. 2nd record. (Both records *Nature Wales*, **13**: 199 (1973)).

†683/20. *BROMUS WILLDENOWII* Kunth ***95**, Elgin: Elgin tip, GR 38/22.63. M. McC. Webster, 1972, E. ***96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E, det. C. E. Hubbard.

685/5. *AGROPYRON JUNCEIFORME* (A. & D. Löve) A. & D. Löve **84**, Linlithgow: Carriden, GR 36/02.81. Shore. E. P. Beattie, 1968, E. 1st post-1930 record.

687/2. *HORDEUM MURINUM* L. **96**, Easternness: Longman Point, Inverness, GR 28/66.47. M. McC. Webster, 1964, E. 2nd record.

689/1. *KOELERIA CRISTATA* (L.) Pers. ***84**, Linlithgow: Carriden, GR 36/01.81. E. P. Beattie, 1972, E.

†692/3. *AVENA STRIGOSA* Schreb. ***45**, Pembroke: 1.5 km N.E. of St David's, GR 12/76.26. Arable field. A. J. Silverside, 1970, NMW, conf. A. Melderis. (*Nature Wales*, **13**: 203 (1973)). **94**, Banff: Craigellachie, GR 38/28.44. Disturbed roadside verge. M. McC. Webster, 1971, field record. 1st post-1930 record. ***96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E, conf. C. E. Hubbard.

699/1. *AMMOPHILA ARENARIA* (L.) Link ***†57**, Derby: near Cowley Bottom, near Dronfield, GR 43/34.77. Site of old coal-shaft. M. C. Hewitt, 1972, DBY.

700/1. *CALAMAGROSTIS EPIGEJOS* (L.) Roth. [***48**, Merioneth: *Watsonia*, **8**: 311 (1971). The material on which this record is based has been redetermined as *C. canescens* (see below).] ***84**, Linlithgow: Carriden, GR 36/01.81. E. P. Beattie, 1972, E.

700/2. *CALAMAGROSTIS CANESCENS* (Weber) Roth ***48**, Merioneth: between Towyn and Aberdovey, GR 22/5.9. Mrs K. M. Stevens, 1969, 1972, BM, NMW, det. A. Melderis. 1st definite Welsh record. This record was originally published as *C. epigejos* (see above).

701/4. *AGROSTIS GIGANTEA* Roth ***96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1964, E, det. C. E. Hubbard.

†701/7. *AGROSTIS SCABRA* Willd. ***16**, W. Kent: Blackheath, GR 51/39.75. Railway siding. R. C. Palmer, 1971, OXF, det. C. E. Hubbard.

702/1. *APERA SPICA-VENTI* (L.) Beauv. **57**, Derby: Whitwell Wood, GR 43/52.78. S. Band & J. Hodgson, 1972, field record. 1st record for over 50 years.

707/1. *PHLEUM BERTOLONII* DC. ***84**, Linlithgow: Bo'ness, GR 36/98.80. Waste ground. E. P. Beattie, 1972, E.

708/1. *ALOPECURUS MYOSUROIDES* Huds. **96**, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1971, E. 2nd record.

709/1. *MILIUM EFFUSUM* L. **97**, Westernness: by R. Garry, near Iron Bridge, GR 28/27.02. A. A. Slack, 1971, field record. 2nd record.

†713/2. *PHALARIS CANARIENSIS* L. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1972, E.

†718/1. *ECHINOCHLOA CRUS-GALLI* (L.) Beauv. *96, Easternness: the Longman tip, Inverness, GR 28/67.46. M. McC. Webster, 1970, E, conf. C. E. Hubbard.

Book Reviews

Phytochemical Ecology. Edited by J. B. Harborne. Pp. 272. Academic Press, London, New York. 1972. Price £5.00.

This volume is a report of the eighth annual symposium of the Phytochemical Society, and consists of 14 reviews spanning this field of work. The intensive study of chemical compounds occurring in plants leads, at first sight, to a bewildering complexity. However, the studies reported here mostly confirm the hypothesis that few of these compounds lack a biological function. Many of the naturally occurring alkaloids, phenolics and terpenes function as attractants, repellents or toxins towards insects or higher animals, and some may also be important in stimulating or inhibiting the germination of seeds. Such observations are likely to have important repercussions in the applied biological sciences, as in the case of plants palatability to stock, and in the control of insects and parasitic weeds.

British botanists will not learn of many new facts concerning their own flora from this book, nor should they wish to purchase it unless they have a fair grasp of organic chemistry. Most field workers know that toxic alkaloids occur in *Senecio* species; but how many are aware that other alkaloids occur in 'palatable' species such as *Lolium perenne* and *Phalaris arundinacea*, while poisons in the form of cyanogenic glucosides may lurk in *Trifolium repens* and *Lotus corniculatus* (though not in *L. uliginosus*)?

The report has been promptly produced by the editor, there is very little overlap between individual reviewers, and the book production is of that high quality one has come to expect from Academic Press.

H. J. M. BOWEN

Flowers of Iona. Jean M. Millar. Pp. 32. The Iona Community. 1972. Price 25p.

This unpretentious little book is an example of a kind of publication that is sorely needed at this present time. It is a simple direct account of the flowers of a small area intended for the interested layman, who would never think of referring to himself as an 'amateur botanist' or even perhaps as a 'naturalist'. Mrs Millar has provided a short introductory account of the most obvious plant communities, and these are accompanied by simple sketches that would probably enable the complete novice to recognise most of the plants mentioned in the text. This is followed by a systematic list with scientific and vernacular names, flower colours and times of flowering. Spaces are provided so that users can fill in dates as the various species are observed for the first time. Alternate pages are left blank to allow for the addition of new records and other notes. The floristic list is very incomplete, the rushes, sedges and grasses being completely omitted together with many other less obscure species. However, it will be noted that in the introduction Mrs Millar has expressly stated that she is providing a list of plants with recognisable 'flowers'. I understand that she is already working on a second edition which, along with additional records, will include the families omitted in the present volume. It is often easy at the professional level to point to defects and deficiencies in works of this kind, but sometimes, as in this case, it is possible to take a much more positive view and to note with pleasure the generally high standard of the material that has been included. It is greatly to be hoped that many botanists will follow the present example and provide simple, cheap booklets on the plants of the many areas of our country where holiday-makers tend to congregate. In this way contact could be made

with many well-intentioned people who are completely untouched by the more formal range of natural history publications. Such contacts can only serve the best interests of conservation in Britain.

J. F. M. CANNON

Morphologie des Végétaux Vasculaires – Cytologie, Anatomie, Adaptations. H. Camefort. 2nd edition. Pp. 407 + 44 plates + 261 figs. Doin, Editeurs, Paris. 1972. Price Fr. 78·00.

This book gives the impression of a text which students are likely to have to learn as a job of work, rather than to read as an instructive pleasure. It is apparently aimed at levels less advanced than the University. The text presents its facts tersely; it is illustrated chiefly by line drawings (261) and there are 44 plates including a few electron micrographs. Reproduction of the plates is of indifferent to poor quality and the line drawings are not inspiring. Attractiveness of presentation as a whole seems not to have been considered important.

The range of content and coverage is not exactly what one might expect from the title. There are seven major section headings: the plant cell; plant tissues; the stem (la tige); the leaf; the root; adaptation of vegetative organs to storage function; adaptations in relation to an environmental factor – water. Reproductive structures, apparently covered by a sister text in the series, are not specifically included. The plant cell is treated at length under the first heading, at levels ranging from cytochemistry through electron microscopy to unsophisticated light microscopy. Yet structure and function of specialised cells are not considered in this section. Xylem and phloem cells, for instance, are considered in the section on plant tissues, where their structure is dealt with only down to the level of light microscopy and function receives only a brief introductory mention.

Throughout the major part of the book morphology and anatomy are dealt with as essentially static factual subjects. There is little consideration of developmental aspects, either from structural or physiological points of view. The section on adaptations in relation to water is also low in physiological content.

In conclusion, this is not a book that one would choose to read. I doubt that students given it as a text will be stimulated by it. Any who are stimulated, and wish to explore the subjects further, will immediately find a further shortcoming of the book: there is no bibliography and there are no suggestions for further reading apart from a rare reference to another text of the same series.

W. A. CHARLTON

Three-dimensional Structure of Wood. B. A. Meylan & B. G. Butterfield. Pp. 80 + 61 plates. Chapman & Hall, London. 1972. Price £2·00.

This is a most valuable book. It provides a good balance of text and illustrations that cannot fail to give a clear picture of wood structure to the student. The light microscope has been the traditional tool for the study of wood anatomy for many generations of students. They have laboured to visualise the relationship between thin flat sections of wood and the real three-dimensional substance itself. Now they can obtain a ready understanding with the minimum of effort. What a saving of mental energy!

The pictures have reproduced well, on the whole. The degree of enlargement means that, for the best effect, they should be held at arm's length. There are 61 plates in all, grouped in 14 sections. Starting with the cell wall, the reader is taken through pitting and other wall sculpturing to tissue systems, and then the complex structure of angiosperm and gymnosperm wood; there is also a brief account of reaction wood.

D. F. CUTLER

Probing Plant Structure. J. Troughton & L. A. Donaldson. Pp. 116+105 S.E.M. photographs. Chapman & Hall, London. 1972. Price £1.75.

Many people will welcome this book as a very useful source of illustrations for teaching. It will be of particular value to those who have no access to a scanning electron microscope. The non-botanist might also have his interest aroused by the clear way in which the photographs illustrate details of plant structure, particularly because of the great depth of focus achieved by the S.E.M. The text to the illustrations is brief, sometimes to the extent of making over-generalisations. The student would need supplementary anatomy and physiology reference- and text-books to derive the maximum benefit from the photographs. Most of the criticisms of factual statements are small, but the keen reader will notice some statements that are misleading.

Some of the original quality of the illustrations seems to have been lost in reproduction or over-enlargement. Graininess is obtrusive in some pictures: however, others are good, particularly those showing apical meristems. Lettering on the plates is sometimes difficult to see and would have been more useful if arrows had been used to pin-point the cells or tissues concerned (see plate 58).

There are a few misprints – the Latin name for Dandelion, for example, is given as *Taraxacum officiales*, instead of *T. officinale*.

In summary, this book will undoubtedly be widely used and it provides a useful and easily understood supplement to other anatomy and morphology texts.

D. F. CUTLER

A Gardener's Dictionary of Plant Names. A. W. Smith. Revised and enlarged by W. T. Stearn and I. L. L. Smith. Pp. 371. Cassell, London. 1972. Price £3.25.

It is indeed fortunate that the revision of the late Colonel A. W. Smith's work has been largely undertaken by Dr W. T. Stearn, a scholar whose publications are inevitably both thorough and stimulating. This revised publication cannot fail, I believe, to arouse a continuing and lasting interest, both to the gardener and botanist alike – an attitude that many do not normally associate with a Dictionary!

The book is divided into two main sections, each section being preceded by an explanatory introduction by Dr Stearn. A lucid explanation entitled 'An Introduction to Botanical Names' precedes the main bulk of the work, which is devoted to the origin and meanings of some 6,000 botanical names. Within this section we learn, for example, that the Reverend Stephen Hales (1677–1761), a curate of Teddington (after whom the genus *Halesia* was named), was, in addition to his ecclesiastical profession, an ingenious inventor. It is probable that he undertook the first measurement of blood pressure, the experiment being 'performed one Sunday on a white mare, thrown and tied to a gate, whose blood, transferred through a goose's windpipe (an effective medium before the invention of rubber tubing) rose in a glass tube to a height of 8 feet 3 inches.'! Another fascinating account of the Scottish horticulturalist William Forsyth (whose surname is perpetuated in one of the most widely cultivated genera of garden shrubs) indicates that this gentleman had a keen eye for business. He formulated and manufactured a concoction known as 'Forsyth's plaster', consisting of lime, dung, woodashes, soap-suds, sand, urine, etc., which, he claimed, 'was capable of curing defects in growing trees' and would restore oak trees 'where nothing remained but the bark' and 'brought to such a degree of soundness that no one can know the new wood from the old'. In desperate need of timber for ships to fight Napoleon, the British Government paid Forsyth a generous gratuity of £1,500, but he fortunately died before his 'plaster was finally discredited'.

The second section, with its enlightening introduction, consists of an index of some 3,000 vernacular names, together with their botanical equivalents, an explanation and classification of which may be obtained by reference to the first section, while another

most useful addition to each section is a comprehensive bibliography. After browsing through this most fascinating and readable publication, I felt that, in many ways, it could be considered as a companion volume to Dr Stearn's classic publication on Botanical Latin.

J. E. ELSLEY

Arctic Adaptations in Plants. D. B. O. Savile. Pp. 81. Monograph No. 6, Canada Department of Agriculture. 1972. Obtainable (free) from Information Division, Canada Department of Agriculture, Ottawa, Canada, K14 OC7.

This is the only publication I have seen on this subject. It is a very useful and informative booklet, drawing on material from a wide variety of sources; but, as will become apparent, I do have a number of criticisms.

The author begins with a brief consideration of the arctic environment. He then discusses the various morphological and physiological adaptations shown by the vascular plants in relation to such factors as winter hardiness, snow abrasion, low summer temperature and short growing season. There follows a short section dealing with what little we know of adaptations in cryptogams, but excluding the fungi which have a section of their own, reflecting the author's particular interest.

The book makes refreshing reading, as a number of current views on the arctic flora and its environment are challenged. The author is very sceptical about the importance of low soil-nitrogen in relation to stunting and he emphasises the important role, at least in some species, of insect pollinators. He is a passionate advocate of long-distance dispersal: while stressing the role of dispersal by birds, he is convinced that the most important agent in the arctic is wind dispersal in winter over the ice. He would have us believe that the east Greenland enclave of *Saxifraga tricuspidata* on the basalt of the Blossville Kyst has originated by long-distance dispersal 700 km over the ice-cap from west Greenland, and that the recent discovery of this species in Peary Land in an area well studied by botanists must therefore be the result of long-distance dispersal during the last 50 to 100 years!

A further controversial issue is the age of the arctic flora, which Savile contends is of recent origin. He is impressed by the occurrence of spruce in the late Tertiary/early Pleistocene deposits on Meighen Island (80°N) in the Canadian arctic and concludes that the present-day arctic land masses must then have been largely tree-covered, allowing only two, or at the most three million years for the arctic flora to evolve. This view runs counter to those of Bøcher, Dahl and, more especially, of Löve. Löve considers that the flora evolved during the mid-Tertiary, when in the north Atlantic sector there was still a land connection between Greenland, Spitsbergen and Scandinavia.

The brief section on the arctic environment surprisingly does not include any reference to such vital physical factors as solifluction, gelifluction and the effects of needle-ice. Neither is there any mention of the delicate relationship between snow protection and the effect of prolonged snow-lie on the growing season.

The author doesn't discuss what he understands by a successfully adapted species. I would suggest that it is any species which can grow and reproduce itself successfully over wide areas of the arctic. He says that *Salix arctica* is one of the best-adapted species of the high-arctic. Yet, from the fact that it grows appreciably better in east Greenland than on the bleakest outpost of the Canadian arctic, he deduces that 'it is far from completely adapted to high-arctic temperatures'. The terms high- and low-arctic are used misleadingly throughout without reference to precipitation.

The book is obviously aimed at North American botanists (Canadian place-names are rarely localised) and the author is apparently less familiar with other areas of the arctic. *Triglochin palustris* (p. 46) and dioecious sedges (p. 36) are not limited to the

periphery of the arctic. The former reaches 76°N in east Greenland, *Carex parallela* nearly 80°N in Spitsbergen and *C. scirpoidea* 76°N in west Greenland and 80°N on Ellesmere Island, where it has recently been discovered (Waterston unpub.). There are several dubious statements: the strongly caespitose *Carex misandra* can hardly be said (p. 32) to show 'vigorous... vegetative propagation'; the *Phippsia concinna* on Meighen Island (p. 56) is almost certainly a form of *P. algida*; and *Antennaria* is far from being the only genus in the arctic with obligate agamospermy (p. 36), *Hieracium* and *Taraxacum* being other obvious examples. The only misprint I noticed was of Jan Mayen (p. 40).

The inevitable and over-brief discussion on the relationship between polyploidy and latitude is not helped by a failure to distinguish between the various types of polyploids.

Despite these criticisms I recommend the booklet. It is very well produced and illustrated with clear line-drawings; and I am pleased not to have to conclude with the all-too-familiar complaint about the price – the book appears to be available free on request.

G. HALLIDAY

Flora of Staffordshire. E. S. Edees. Pp. viii + 280 + 15 half-tone plates. David & Charles, Newton Abbot. 1972. Price £4.20.

When, on a spring outing in the early 1930's, the writer of this appreciation met the author and he mentioned that he hoped to publish a Flora of Staffordshire about the year 1960, the young imagination boggled: then, 1960 seemed aeons distant. But here, in 1972, it is: the first full-scale Staffordshire Flora, the life work of one man. The book may be likened to an iceberg in that there is much more there than meets the eye. Records, all of which are post-1929, are presented by means of an economical system of lettering on a 10 km grid-square basis: only rarities are given localities, map-references for which may be found in a gazetteer at the end of the book. The lettering system is adequate for common plants, but one would have liked more information about the less frequent and local species. There are 200 distribution maps based on 2 × 2 km tetrads, or, as the author prefers to call them, minor squares. Similar maps for each species are in his possession, as are species-lists for each of the 800 tetrads which make up the area of the county. Each tetrad (except for a few in built-up areas) was visited *personally* three times, at different seasons of the year, a degree of coverage which might well make some other producers of county Floras blush.

The book has, admirably, a strong historical bias, and one can sometimes learn at least as much about a plant's occurrences in the 18th and 19th centuries as its distribution in the 20th: just occasionally one is left guessing as to the present position, e.g. of *Vinca major* and *Mentha arvensis*. The genera are all printed together under their families with nothing, not even heavier type for the first member of each genus, to separate them. This is tiresome, especially in the case of the larger groups. The book is illustrated by 15 (plus one on the jacket) good black-and-white photographs, aesthetically so much more satisfying than coloured ones. These are, appropriately, mostly of habitats. Critical groups receive due attention, though *Sorbus rupicola*, as a local speciality, is dismissed rather summarily. The *Rubi* in particular very properly benefit from the attention of a national authority. Few aliens of the casual type are included, possibly a wise decision in view of the large numbers of species which have occurred locally in industrial sites such as the Burton-on-Trent maltings, though the persistence there of *Herniaria cinerea* is noted. A list of these brewery aliens, nowadays less numerous owing to different methods of unloading the barley, would have been an interesting addition. Colonising newcomers like *Impatiens capensis* and *Bidens frondosa* are well documented: both are spreading via waterways.

Of the introductory chapters, there is an excellent account of the history of field botany in Staffordshire, but the section on the vegetation occupies scarcely six pages of

text. There are indeed relief, solid geology and soil maps, but little concerning rainfall and no habitat samples. There is no county map. One feels that the work may have received Procrustean treatment in the cause of economy, yet the result is an expensive book, surprisingly bulky for less than 300 pages, owing to the thick paper. Nothing, however, is so dull as uniformity, and it would indeed be sad if all our county Floras were written from the same angle, with no scope for individuality. The shortness of the book, as a whole, is disappointing. There are a few misprints (and, alas, an error in the brief errata slip!).

Mr Edees has earned our gratitude in giving us not only the first Flora of his county, thus satisfactorily filling a gap in the literature, but also a book for the botanical bedside to induce dreams of the pools, mosses and moorlands of Staffordshire.

K. M. HOLLICK

The Concise Flowers of Europe. Oleg Polunin (assisted by Robin S. Wright). Pp. xix + 92 + 192 colour plates. Oxford University Press, London. 1972. Price £1.95.

The author's earlier work *Flowers of Europe* (reviewed in *Watsonia*, 8(3): 321 (1971)) contained, besides descriptions, keys and line drawings, a set of 192 plates in colour of over 1100 common European plants. These excellent colour photographs have been reproduced, with English names added, to form the basis for this handy-sized soft-back. The text which precedes them is new and consists simply of brief 3-4-line descriptions of each of the plants photographed, with months of flowering and, alongside each, three symbols representing one of 16 flower- or inflorescence-types, one of nine habitat types and one of eight generalised European distribution patterns. These symbols are conveniently defined on the front cover. The sequence of the descriptions is not that of the photographs but is subject to a logical hierarchical grouping based on easily observed superficial characters. Thus all the medium-sized herbaceous plants with small white flowers will be found together by choosing appropriate headings in sequence. Within this group the symbols referred to allow rapid selection of a final small number of descriptions sharing one flower type, habitat and distribution pattern. This is clearly intended for the layman—English names only are used (with some compromises like Soft Urospermum, Common Andryala, Hacquetia), the descriptions are nontechnical and the arrangement of the text forms a simple type of key. Thus the disadvantages of literal and metaphorical weightiness possessed by the parent work have been eliminated and an attractive, reasonably priced pocket, or at least glove-box, book, emerges at an appropriate time for 'going into Europe'.

Reduction has meant, of course, some loss, and the 1100-odd species now covered are even more select than the 2600 of *Flowers of Europe*. Thus, for example, Volume 2 of *Flora Europaea* has 433 numbered species in the *Umbelliferae* and 842 in the *Leguminosae*, of which 20 and 76 respectively are pictured here. The British reader may wish the space taken up by such familiars as primrose, snowdrop and mistletoe had been less mundanely allocated; but perhaps they are there to counter the danger of thinking that the yellow primrose by an alien river's brim must necessarily be something more. The preface claims that the user will in almost every case find in this book at least a closely related species to the one he has in his hand, but it seems to me that, if he has unluckily chosen a plant outside the 1100 to search for, he will need a fair degree of systematic knowledge or an unusually discriminating eye before the chances that he will light upon the right related species are high. So long as no-one buys this book under the impression that it will provide an easy way of finding the name of any plant they come across in Europe, only pleasure and profit will result from acquiring it.

S. S. HOOPER

The Flora of the Isles of Scilly. J. E. Lousley. Pp. 326. David & Charles, Newton Abbot. 1972. Price £4.75.

The easiest way to find a plant new to the British list is to go to the Isles of Scilly. Whether it be *Certomium falcatum* under the shore line boulders, *Phormium colensoi* at the back of St Martins or one of the myriad weeds of the bulb fields, these exotic plants will appear as an integral part of the enchanted landscape of the Islands, not as the ephemeral of shoddy field or corporation rubbish tip. It is this element in the vegetation which has made the writing of this scholarly book a task different from and beyond that of the normal regional Flora, and requires it to be judged by wider standards.

The introduction paints a wonderfully complete picture of past and present conditions on the Islands and shows how they have interacted to produce the unique flora which gives Scilly so much of its character. Mr Lousley deals with the geology and soil and with the particularly mild and equable climate. These, combined with many other factors, in an area isolated from the mainland for at least 300,000 years, have favoured a flora of predominantly Mediterranean and South European species which can take advantage of the mild winter growing season, and rest in the summer on the shallow soils. Man's activities have also taken advantage of these physical conditions and thus reinforced their effect on the flora. The earlier vegetable immigrants followed the same route round the Atlantic coasts of Europe as did Bronze Age Man, even where the plants were not imported by him unintentionally. Later, alien plants were obtained from ships calling at the Islands, and with the establishment of Tresco Gardens the trickle became a flood of new species. Finally, in the bulb fields the Mediterranean weeds found a perfect home, where the growing season of the crop coincided with their own and the ground could not be disturbed for several years. So we have the Isles of Scilly as we know them today, with their sharp contrasts of wind-bitten backbones and promontories, where diminutive rarities hide in the heather, sheltering the unbelievably lush vegetation of cove or bulb field.

Our understanding is further increased by contrasting the flora with that of Cornwall, the Channel Islands and the Mediterranean. We notice how many flowers common on the mainland are absent from Scilly. Some of these, like *Anthyllis vulneraria*, are inexplicable absentees; with others the habitats are just not there.

With the exotics the first task is to decide which to include. The Tree Echiums do not merit more than a mention. *Fascicularia pitcairniifolia*, with a horrid prophecy, ranks fully. In making these decisions Mr Lousley has considered the historical side – the seafaring tradition, the part played by Tresco – then evaluated the place of the individual species, whether as escaped and naturalised ornamental plants, as weeds of the bulb fields spreading to unstable natural habitats, or as planted windbreaks, firstly becoming part of the general scenery of the Islands and then establishing themselves in more natural ways. It is easy to see why these weeds have flourished; it would be interesting to be given more speculations as to why they should ever have turned up. In this way Mr Lousley has rendered immense service to the botanical visitor, and to those non-botanists who are merely intelligently interested, by explaining the landscape produced by years of bulb cultivation on windswept islands, and by providing for the first time an accessible means of identifying the plants without recourse to a whole library of foreign Floras.

The section on the Aizoaceae fills a big gap in British botanical literature and will enable people who have never before had the means to do so to try to understand the Mesembryanthemums. Barbara Everard's clear drawings are an immense help in identifying other miscellaneous unusual species. With all these plants the author gives notes on the country of origin and some description of their habitats, the associated species on the Islands and their rate of increase. With some, such as *Allium triquetrum* and *Oxalis articulata*, he has been able to ferret out the exact date of introduction.

'First Records' are of importance in a community including so many aliens. These are, always given, but with some inconsistency in their format. The more frequent form quoting both the first published and first field record, might appear contradictory to the general reader, though useful to the professional botanist. I wish that we had been told how often a record is the first record for Britain.

The plan of the Flora, abbreviations and so on, are clearly explained in a 4-page guide, there is a very full Bibliography and the Index, besides plants, includes customs, places and people. It is pleasing to find old friends like Miss Knox juxtaposed with Knotted Hedge Parsley.

The individual islands have been used as the natural and obvious units of recording, the smaller islands and rocks being grouped together to make ten divisions in all. This system makes for easy comparison in the study, and will be extremely usable in the field. Neither the map showing the divisions nor the geological map are worthy of the work. They are too small and are divided across two pages so as to make Bryher, Sampson and St Agnes totally unrecognisable. They have far too little detail. They are, however, better than those which have been inflicted on us in most recent local Floras. It is odd that the standards of cartography of a generation imbued with dot maps and grid lines should be so far below those of their predecessors. The type-face and running headings are clear and admirable and, though the buyer may boggle at the price, he will find it very well worth paying for a first-class production. Mr Lousley is to be congratulated on distilling the accumulated knowledge of so many years in so readable and instructive a book.

R. C. L. HOWITT

Conifers in the British Isles, A Descriptive Handbook. A. F. Mitchell. Pp. 322 + 24 plates, and with 203 drawings by C. Darter. Forestry Commission Booklet No. 33. H.M.S.O., London. 1972. Price £2.25.

Those in the know had been eagerly awaiting this exposition of Mr Mitchell's knowledge of the Conifers cultivated in Great Britain. They will not have been disappointed; here are 322 pages in large format (275 × 215 mm) almost entirely freshly written by him. In a field where secondhand opinions are common, here is a significant exception. The descriptions are cast in useful comparative paragraphs and the information they give is almost all newly observed 'from living specimens'; there are new keys to the difficult genera, *Abies*, *Picea* and *Tsuga*; colours are strongly featured and even smells are often described. The most novel part of the text is that on *Cupressocyparis*, with its three species. The emphasis throughout on growth and cultivation is a characteristic feature of the book.

This is a personal account including 'every species the author has found growing' and, for varieties and cultivars, all those reaching about 20 feet tall: a total of 587 descriptions. Also included are summaries of the thousands of statistics collected by the author during the last decade or so from 526 estates and forests. These complement the same author's lists in the latest Conifer Conference Report. The records are given here in feet and inches under species; in the Report they are in metric measure under localities. Perhaps there are other ways to make use of this vast quantity of data but its collection and listing alone is a tremendous service to science. A glossary and an index to estates completes the text.

The drawings are an important part of the work. Miss Darter has drawn from fresh specimens and the results set a new standard for the representation of conifer foliage; one wishes they had been reproduced at natural size. 24 full-page half-tone plates come as a bonus: they are studies of the individual trees impressive for their size or history.

The author avers that his keys are 'not strictly botanical', but who will wish them to be, so long as they work? He includes no synonyms, few references and no index, but who

will miss them? Perhaps his 'reversed system' used in describing branching (see p. 92) is not a good idea, and one must criticise the incorrect use of 'recurved'. Another unfortunate feature is the title, being exactly the same as that of the Conifer Conference Report published in the same year. But in such a splendid work these things are merely shortcomings. Anyone with the slightest interest in Conifers will enjoy this book, to read as well as to consult, for here a master arboriculturist conducts us species by species through the gardens and forests of Great Britain. At the price, this must easily be the book bargain of its year.

J. LEWIS

Thomas Johnson – Botanical Journeys in Kent & Hampstead. Edited by J. S. L. Gilmour. Pp. ix + 167 + 2 folded maps. The Hunt Botanical Library, Pittsburgh, Pennsylvania. 1972. Obtainable from Wheldon & Wesley Ltd., Codicote, Herts. Price £5.25 post free.

There are few botanical works which can rival Thomas Johnson's *Iter Plantarum* of 1629 and his *Descriptio Itineris Plantarum* of 1632 for rarity and interest. Of the first, only two copies are known to exist, of the second five. They were included in a reprint of Johnson's shorter works in 1847, and the *Descriptio* reprint was reissued in 1849, but even these are rare. Thus, relatively few botanists have seen the full wording, which is wholly in Latin, though most know of them as the source of a large number of first records of plants from Kent and Middlesex or from references in writings on the history of botany in Britain.

The great importance of these books rests on their value as early accounts of the journeys of apothecaries in search of plants, as a source of early records and for the section on Hampstead Heath in the *Descriptio*, which is the first Flora of a small district printed in England. Followed by Ray's Cambridge *Catalogus* in 1660, this is claimed as the first of our long series of local Floras. There has been a need for easily available facsimiles, and Mr Gilmour is to be congratulated on his enterprise and on recruiting so much talent for their interpretation.

The copies at the British Museum have been used for the facsimiles, which take up about a quarter of the book. The rest is devoted to full translations by C. E. Raven and R. E. Latham, to which modern names have been added by F. Rose and others, and papers on the flora of N. Kent 1629–1971, by F. Rose, and Hampstead Heath, by P. W. Richards (to which D. H. Kent has made important contributions), and shorter notes on other aspects. There are two pairs of maps, an old map with the conjectured route marked and a modern map for comparison. For the first time Johnson's accounts of these journeys can be read in English in full, the adventures he shared with his companions, where they stayed, and the hazards of 17th century travel. It is grand reading and yet I was just a little disappointed by this accurate and precise translation. It lacks something of the enthusiasm and inspiration of the looser account which appeared in *The Phytologist*, 1848, as part of their review of the 1847 reprint.

Finding the modern equivalents of Johnson's pre-Linnaean names is an exceedingly difficult task, calling for a wide knowledge of early botanical literature and detailed knowledge of the past and present flora along the routes. It has been undertaken by Dr Francis Rose for flowering plants, and by Dr P. W. Richards and Dr W. D. Margadant for bryophytes and lichens and James H. Price for marine algae. For flowering plants and ferns each determination has to be done in two stages – first to find the modern equivalent of the name used, then to decide by comparison with other records and knowledge of the present flora whether Johnson applied it correctly. For example, given that *Orchis myodes prima* of Lobel was *Ophrys insectifera* L. (*O. muscifera* Huds.), did Johnson's party really find it in July, let alone on their second journey in August, or did he misapply the name to some other plant, perhaps a late-flowering *Ophrys*

apifera? The occasional notes that rarer species still grow in the same neighbourhood are of tremendous interest, but it would be good to have more of these, and especially to know if more of the common plants are still there.

The reproduction of the facsimiles is good, but the background is too grey. Comparison of the title page and illustrations of the *Descriptio* with Plates III and IV in Kew & Powell's *Thomas Johnson* shows that a somewhat more pleasing reproduction is possible from the same copy of the book. The printer's device on p. 99 on a white background should be compared with the same in the facsimile on p. 71.

This is a delightful and botanically valuable book for which we have waited a long time. Mr Gilmour and his team, and the Cambridge University Press who printed it, are to be congratulated on a first-class production. I hope it will inspire someone to walk the routes again and produce a free and spirited account of Johnson's journeys, combined with a description of the modern flora and indicating the changes. He could still stay at The Bull at Dartford and The Bull at Rochester, find some of the places unspoilt, and explain the changes in the last 300 years. Thanks to the Hunt Botanical Library, the basic material for such a study is now freely available.

J. E. LOUSLEY

August Garcke. Illustrierte Flora – Deutschland und angrenzende Gebiete – Gefäßkryptogamen und Blütenpflanzen. 23rd edition. Edited by K. von Weihe. Pp. xx + 1607. Paul Parey, Berlin. 1972. Price Dm 124.00.

The first edition of Garcke was in 1849, the 22nd in 1922. The manuscript of a 23rd was a lamentable casualty of the closing chaos of the last war. This, eventual, 23rd edition is about twice the size of the 22nd, with 2914 species, numbered throughout. The area covered is Grossdeutschland indeed, Germany and neighbouring districts, stretching as far as the Kurische Nehrung. Microspecies are usually lumped or grouped – *Hieracium* into 19 species – but there are 44 pages summarising *Rubus* subgenus *Rubus*. Adventives and escapes are only occasionally included, but there are three Forsythias. Hybrids are merely listed – 1½ pages of them for *Salix* – sometimes with binomials, practically never with any other data, and several are omitted e.g. *Polygonatum* and *Potentilla*.

Diagnoses are generally brief, 4–6 lines. Too rarely are any measurements given except for overall length, e.g. there is no indication that *Geranium* flowers are not all the same size. No dates are given for the first records of introduced plants such as *Veronica filiformis*. Telling characters are left out, such as that *Symphytum bulbosum* vanishes completely after flowering or the presence of rhizomes in *Rumex acetosella*; *Cynosurus echinatus* is said to be perennial. 2–3 lines are given on habitat and distribution. As is too often the case on the Continent, 'England' is used sometimes to mean England, sometimes instead of, or to include, some or all of the other countries of the United Kingdom, although Ireland and Scotland are, rarely, mentioned separately. Thus *Inula salicina* is credited to 'England' and *Galeopsis segetum* to 'S. England', while *Draba aizoides* and *Homogyne alpina* are ignored for our islands. Indeed the distribution of them is not always accurate, e.g. *Minuartia tenuifolia*, as it is called here, is given for S.E. England only: but how did they know that *Senecio paludosus* would reappear in England – or were they 120 years out of date? The habitats may differ interestingly from those we are used to, e.g. *Cornus suecica* (credited to 'N. England') from scrub and wood edges, *Viola kitaibeliana* from cornfields and waste places and *Ilex* from acid soils only. It is interesting to see *Vicia pannonica* noted as recently appearing by autobahns.

The taxa are regimented, in one place or another, into Phylum, Class, Subclass, Order, Suborder, Family, Subfamily, Genus, Subgenus, Tribe, Subtribe, Section, Subsection, Series, Chorus, Species, Subspecies, Convariety, Variety, Subvariety,

Formenkreis and Cultivar. But of only species and below are descriptions given. For the rest, families, genera, etc., the only indication of their characters (except for basic chromosome numbers) is to be found by turning back to the keys; and even for the species there are frequently important characters in the keys unmentioned in the later text. Not all the groupings in these grades are attributed to an author, owing to the difficulties of knowing the correct attribution. There is a muted lingering of the Middle Ages in the references to the official drugs prepared from certain of the plants.

The 460 drawings are all new: most cover several species and their details, and nearly all are good, but not that of *Gaudinia*. None have any sort of scale. Practically every species is given a vernacular name. Latin nomenclature is usually at best conservative – many genera now generally split being kept lumped, e. g. *Dactylorchis* (sic) is treated as only a subgenus of *Orchis*. But some are just not according to the Rules, however regrettable, such as the continued use of *Mentha rubra* or *M. rotundifolia*, *Phragmites communis* or *Ruppia spiralis*. Authorities may differ from those we use, e.g. for *Valerianella locusta* or *Sedum hispanicum*. Names differ too; for example, × *Festulolium ascendens* (no mention of *lohiaceum*), while *Potamogeton pusillus* is used for *P. berchtoldii* of Dandy & Taylor and *P. panormitanus* for their *P. pusillus*. Synonyms are few, or indications of taxa sunk, so that there is no clue to, for example, *Atriplex longipes*, *Polygonum nodosum*, *Veronica sublobata* or many others. Continental spellings persist – surely these should have been settled by now? – such as *Helodea*, *Heleogiton*, *Honckenya*, *Bartschia*, *Cobresia*, as does the use of classical Latin such as *Dipsacus sylvester* (Hudson wrote *D. sylvestris*) or *Sonchus paluster* (Linnaeus wrote *palustris*). *Bidens* is here masculine, *Cotoneaster* feminine and *Glechoma* neuter. *Flora Europaea* is not among the books listed. Misprints are remarkably few – I noted only one, plus *Hieracium peleteranum* being given an intrusive ‘i’ in the Key.

But all these are moles, not beams. There are new characters used, new thoughts, new groupings, new treatments, splits, aliens, and related species to look out for – I made ten pages of notes. It will often be worth seeing what ‘Garcke’ has to say.

D. McCLINTOCK

The Naturalist in the Isle of Man. Larch S. Garrad. Pp. 234 + 16 half-tone plates + 17 maps. David & Charles, Newton Abbot. 1972. Price £3.75.

It is difficult for one person to do justice to all aspects of natural history in an area even as limited as the Isle of Man; but this, the third in the Regional Naturalist Series, contains much to interest naturalists resident in or visiting the island. The first chapter is introductory, the other eight devoted to regions or types of habitat; but the treatment is very uneven. The old mining areas are virtually ignored and the wonderful sheltered glens, which are such a feature of the island, are not described in any detail. There are references to most of the more obvious groups of plants and animals, though there is some imbalance and liverworts are included only in the index. The author has made use of much of the bibliography listed, but some of her more extraordinary statements might have been avoided by consultation with specialists in certain groups. Much valuable space has been wasted by repetition and the inclusion of many irrelevant geological and historical details.

Despite the claim in the Author’s Note, unfamiliar names such as Danish milk-vetch, major Manx ladies tresses and willow moss have been used without the scientific names. There are clumsy lists of English names followed by all the Latin equivalents, and several ambiguities which could have been avoided by using capitals for vernacular names.

A list of areas of natural history interest with O.S. grid references would have been invaluable in the appendix, but this is devoted entirely to a list of birds without any

indication of the significance of the asterisks. The lack of lists for the other groups could have been compensated for by the inclusion of a really good index, but this one is most unsatisfactory. There are various omissions and one can locate *Rhynchosinapis monensis*, for example, only by looking under 'Mooragh, Ramsey' or 'Ray, John', neither of which leads to the second reference on p. 70. The value of the book is thus severely limited.

J. A. PATON

Atlas de la Flore Belge et Luxembourgeoise – Pteridophytes et Spermatophytes. E. van Rompaey & L. Delvosalle. Pp. 290. Jardin Botanique National de Belgique, Bruxelles. 1972. Price Belg. Fr. 350.00.

Biogeography has long been well served by Belgian botanists. Since before the second world war L'Institut Floristique Belge (I.F.B.), a very active group of amateurs, has been preparing distribution maps which have been published in successive volumes of *La Flore Generale de Belgique*. Now the two authors, who have been associated with the project from the beginning, with the help of L. Reichling from the Grand Duchy of Luxembourg, have gathered together maps of 1,626 species or subspecies and published them in a convenient format, 6 maps per page.

The maps show the presence or absence in 4×4 km squares and the territory covered includes not only Belgium and the Grand Duchy but considerable areas of overlap into Holland, Germany and Northern France. The total number of squares was 2,970, not far short of the c.3,650 10 km squares which cover the British Isles. The actual survey was done by making lists in particular 1 km squares. In 3% of the cases only a single 1 km square in a 4×4 km square was visited, in 30% two were visited, in 40% three or four and in the rest between five and eight. A total of 12,000 lists were made from a possible of c. 40,000. This would be almost equivalent in the work involved to making one list in every 2×2 km square. Whilst no major errors may have arisen, more reliance could be placed on the maps had the recording been more evenly spread using the 2×2 km rather than a random 1 km. As the authors themselves admit in the introduction, 'it was usually the richest areas floristically which were the most intensively surveyed', a temptation square-mapping was designed to resist.

Unfortunately no map is provided to indicate the extent of the unevenness, whether this is scattered at random, or whether perhaps there are underworked areas of considerable extent. A situation map showing the number of records per 4×4 km square or the number of 1 km squares/ 4×4 km square surveyed would have been most helpful.

Nine-tenths of the surveying was carried out between 1950 and 1970 but, to make the maps comparable with those in the *Atlas of the British Flora*, the authors have used 1930 as the major date line: pre-1930 records are shown with a circle, post-1930 with a cross. This gesture underlines the importance of coordinating mapping work on a European scale whenever possible: ornithologists are already planning a survey of the distribution of the Birds of Europe to be carried out simultaneously in all countries over a five-year period. Only in this way can a 'snap-shot' of distribution be obtained. The authors of this *Atlas* admit that the populations on which many records made before 1955 were based may well be extinct now, especially for species of damp habitats. Thus the *Atlas* reveals only declines in species which have been going on for over 40 years. But, from the first pages, we are made aware that the species which have declined in Belgium are those which have also declined in Britain: *Huperzia selago*, *Lycopodium inundatum*, *Equisetum hyemale*, *Botrychium lunaria*, *Dryopteris cristata* and *Pilularia globulifera*, to quote from the Pteridophyta alone.

Unfortunately the *Atlas* does not make it easy to interpret the distribution patterns of the species and their changes. No maps of physical feature or climatic gradients are

provided and the only detail on the base map, the rivers, is obscured by the heavy pattern of squares, all of which are shown.

The floras of Britain and the Low Countries have so many species in common that to glance through this *Atlas* produces the same interest and pleasure, and stimulates just as many lines of thought, as a modern County Flora. Perhaps, now that we are entering the European Economic Community, meetings of the B.S.B.I. will become as frequent in Brussels as they are now, for example, in Dublin. If so, then this *Atlas* will be an excellent and essential guide. I look forward with enthusiasm to the publication of the explanatory volume which is promised in a few years.

F. H. PERRING

Flora of Rutland. Guy Messenger. Pp. 184+56 map pages. Leicester Museums. 1971. Price £2.50.

This would best be described as a model Flora because it is so closely modelled on John Dony's excellent *Flora of Hertfordshire* published 5 years ago. In size, format and contents it closely follows the pattern established by Dr Dony, and what an excellent pattern it is! All the essential facts about the flora of the county are packed into only 128 pages of text, and 56 pages of maps which, with 15 maps on each page, illustrate the distribution of 845 species. Whilst we may wish it were still possible to indulge in Floras of the length of the previous work to cover the area, *Flora of Leicestershire and Rutland* by A. R. Horwood and Lord Gainsborough, which ran to 984 pages, printing and publishing costs are now so great that the product would be beyond the pocket of all but the wealthy collector.

But even if cost were no consideration it is surely above argument that modern county Floras ought to include as much information in map form as possible, not only to interpret distribution now but to make it possible to compare changes with maps to be made in the future. As the author says in his preface 'The rapidity with which the vegetation of England is changing. . . can only be fully appreciated by someone who is prepared to observe and record in laborious detail the Flora of a comparatively limited area over an extended period of time.' This the discipline of producing maps ensures and this Guy Messenger has done. Moreover, despite the length and apparent exhaustiveness of Horwood & Gainsborough, this is the first time that a thorough survey has been made of Rutland, our smallest English county.

For nearly 20 years Mr Messenger and a few friends studied intensively each of the 100 2 × 2 km tetrads which cover the area. Not only was this period long enough in which to do the work, but it spanned an era of extensive change in the land-use of the county, most significantly of all perhaps the change from a largely grassland county with 70% of agricultural land to a largely arable county with only about 30% under grass, so that, whilst the work proceeded, species like *Primula veris*, *Campanula rotundifolia* and *Conopodium majus* were becoming rare or local. A section on the Changing Flora of Rutland brings this out very effectively and shows how, even in this extremely rural county, the native flora is declining and being replaced by naturalised aliens and garden escapes, though to the botanist interested in species *per se* it must be some consolation that the number of species to be found, over 1000, remains approximately the same.

The value of a local Flora lies essentially in the local information it contains, which can be given only by the author who has an intimate knowledge of the behaviour of the plants in his own area. Thus it is refreshing that Mr Messenger has assessed the status of each species in Rutland and given in detail the range of habitats in which the species occur. He calls upon Sir Edward Salisbury to support his view that it is impossible to draw a distinction between natives and introductions, and he prefers to recognise

'Constituents', which are a normal species of a stable community, 'Intrusives', which may invade such a community from time to time, 'Residuals', which occur at some stage during plant succession but are likely to be eliminated, and 'arable weeds' and 'casuals'. In the account of each species the range of habitats is given under each status, and this is certainly an economical way of presenting the information. My only fear is that, unless I were using the *Flora* daily, I would be so mystified by the plethora of abbreviations that I would not have the patience to translate. When I came face to face under *Rumex acetosa* with: 'Constituent: Ef, Er, Ev, Gp, Gr. Intrusive: Ag, Gg, Gl, Sb', I turned with relief to the statement above: "Grassland, woodland rides, roadsides, railway banks, widespread and common; occasional garden weed."

Another useful feature of the *Flora* is that, despite the compact accounts and their telegraphic style, when a species is of especial interest it is given more leisurely treatment, if sadly only to record the last rites of one now extinct. The 'injudicious clearance of scrub' which put paid to *Linum perenne* at Great Casterton is a grisly warning to all slash-happy conservationists. It is interesting to learn that Holly sets seed satisfactorily and appears to be indigenous in some woods: it is never thus in adjacent Lincolnshire.

The *Flora* ends with a complete gazeteer of the County, with notes on plants of interest to be found in particular places and details of access. This last touch ought to persuade botanists that Rutland is more than ten minutes of rolling country on the A.1: that it is a county worth turning aside into to explore what are now, following the publication of this *Flora*, the four best-documented 10 km squares in Britain.

F. H. PERRING

Guide du Naturaliste dans les Alpes. J. P. Schear and others. Edited and published by Delachaux and Niestlé. S.A., Neuchâtel (Switzerland). Pp. 421, + 61 plates (colour and black and white). 1972. Price not stated.

Guides du Naturaliste are the equivalents in the French language of the familiar Field Guides published by Messrs Collins, and several volumes in translation, though not this one, are common to both series. The size of these books, their style and presentation with a profusion of illustrations will be recognised at once by anyone who has become addicted to the series.

The guide to the Alps has six authors and is divided into nine parts which deal in turn with geology, climate, flora, vegetation, insects, other invertebrates, mammals, birds and finally human settlement and economy. All the sections are profusely illustrated, though each has its own distinctive style. The immediate appeal of this book to botanists will be in the first four sections.

In few parts of Europe is geological structure so conspicuously interesting, so important to the botanist and yet so complicated, as in the Alps. Professor Schear begins with a child's guide to petrology and then, with the aid of numerous maps, sections, block-diagrams and photographs of outstanding quality, he describes the deposition of the great thickness of sediments, their uplift and folding, the intrusion of igneous complexes and the evolution of present land forms. The account is outstanding for giving both an appreciation of principles and a detailed description of practical value in the field.

Professor Veyret adopts the same method and combines a general outline of the processes controlling climate over the region with sufficient attention to local features which affect patterns of vegetation and human settlement.

The accounts of the flora and vegetation are both provided by Professor Favarger and illustrated with coloured plates which are water-colours of small pieces of vegetation composed of the most characteristic species. No attempt is made to include descriptions and pictures of all the common species of flowering plants, and such a

treatment would only duplicate what is already available in many popular illustrated Floras. Instead Prof. Favarger first discusses the ecology of the more significant species, grouped in their families, and then gives a brief but fascinating analysis of types of geographical distribution, paying special attention to the problems of vicariance and endemism.

The description of vegetation is both biological and sociological. The main types of vegetation are treated within the framework of plant sociology but without inclusion of either long lists of species or tables.

This is perhaps not the appropriate place to review the remaining sections in detail but they clearly provide the type of information which would enable a botanist to identify and appreciate many of the animals he is likely to encounter. He would need to be very deeply engrossed in his examination of plants not to notice the brilliant colours and noisy call of a rock-thrush or hear the whistle-like call of marmots. Even a wet day can be enjoyed in the company of black salamanders.

The emphasis of the whole guide is ecological and on conservation. The threat to the Alps is undoubtedly largely from tourism, which has brought in its train, not only the development of resorts and the opening up of remote summits by ski-lifts and railways, but also a more fundamental change in rural economy and the gradual abandoning of the alpine system of agriculture based on transhumance. No one who frequently visits the Alps can fail to notice the ever-accelerating change which has taken place since the end of the second world war.

C. D. PIGOTT

Obituaries

JOHN HUTCHINSON

(1884-1972)

Dr John Hutchinson, one of the best-known flowering plant taxonomists this century has produced, died suddenly at his Kew home on the 2nd September 1972, aged 88. All members of the B.S.B.I. will be familiar with his name, although he was never a member of the Society.

Throughout his botanical career Hutchinson spent an extremely busy life, beginning with his work on the *Flora of Tropical Africa* and his self-imposed task of writing the *Flora of West Tropical Africa* at the Royal Botanic Gardens, Kew, and ending with his work on the *Genera Plantarum*.

Except when drawing British plants for his Penguin Books, Hutchinson had little time for field work in Britain. All his drawings were done from living material while travelling around the countryside in a caravan during his holidays.

His best-known works on British botany were those published by Penguin Books, viz. *Common wild flowers* (1945), *More common wild flowers* (1948), *Uncommon wild flowers* (1950), and *British wild flowers* (1955), which has recently been reissued by David & Charles (1972).

Other books dealing with British plants written by him include: *A bouquet of wild flowers* with paintings by Hyacinth Abbott (1946), *The story of plants* in collaboration with Dr R. Melville (1948), *British flowering plants* (1948), and *Wild flowers in colour* with illustrations by E. Hahnewald (1958), as well as two *I Spy* books for the now defunct *News Chronicle*.

J. L. GILBERT

DENYS D. MUNRO SMITH

(1890-1971)

Dr Munro Smith died in the Bristol Royal Infirmary at the age of 81 on 1st December, 1971, after sustaining multiple injuries in a fall in the Avon Gorge three weeks earlier. On 12th November he was studying bryophytes in The Gully area of the Gorge when he slipped and fell from the cliff edge.

Denys Munro Smith was born in Bristol and educated at Clifton College. His father, Dr George Munro Smith, was a medical practitioner and President of the Bristol Naturalists' Society from 1910 to 1912. Like his father, Denys Munro Smith was also a medical practitioner with a keen interest in natural history. He served as a Captain in the R.A.M.C. during the First World War, in which he was wounded and taken prisoner.

At first his interest lay principally in birds and in photography, and it was not until later in life that he was attracted to flowering plants and joined (1955) the Botanical Society of the British Isles. Still later he developed a strong interest in bryophytes and joined the British Bryological Society.

Dr Munro Smith was an enthusiastic field botanist in the Bristol region, especially in the vicinity of Downend, to the east of the city, where he was in practice for 40 years. On retiring to Clifton in 1969, he concentrated his efforts on the flora of the Gorge area. Many of his finds are reported in articles on 'Bristol Botany' in the *Proceedings of the Bristol Naturalists' Society*, every account from 1955 to 1971 containing records made by him. He corresponded widely with experts of critical groups and reported on, for example, *Hieracium* and *Mentha*. Both native and alien plants commanded his

attention, and a substantial number of his records refer to unusual forms of flower colours, and to plants growing outside their normal habitat range. Among his finds in the Bristol area, which reflect his eye for detail and small differences, mention may be made of *Cirsium arvense* var. *integrifolium*, *Fumaria densiflora*, *Lathyrus palustris* var. *pilosus*, *Rosa canina* × *tomentosa* and *Sonchus arvensis* var. *glabrescens*.

His late-developing interest in bryophytes was rewarded by several new vice-county records (*Dicranum strictum*, v.c. 6; *Lejeunea lamacerina* var. *azorica* and *Polytrichum aurantiacum*, v.c. 34). Other records are included in his short article on the mosses of the Frome valley (*Proc. Bristol Nat. Soc.* for 1965). Of greatest note, however, was his discovery (in 1963) of *Pohlia lutescens*, new to Britain, in Oldbury Park, Bristol; this moss has been described by Dr E. V. Watson (*Trans. Br. bryol. Soc.*, 5: 443–447 (1968)), and is now known from a number of localities.

Dr Munro Smith will be remembered for his persistence in exploring the plant life of his favourite sites and for his capacity to alight on the unusual. He is survived by his widow and daughter, but he was predeceased by his son, P. G. Munro Smith, who also was interested in natural history.

A. J. WILLIS

Reports

FIELD MEETINGS, 1972

ENGLAND

WELLS, SOMERSET. 30th MARCH-3rd APRIL

HEREFORD. 12th-16th APRIL

Both these meetings were arranged to assist the Society's survey of the distribution of mistletoe, *Viscum album*, on different hosts, and the centres were chosen because they were known to be at the centre of areas where mistletoe would be abundant.

The survey technique used on both occasions was to divide the members attending into car loads of 3 or 4 people, each of which was given a 10 km square to cover during a day. The surveying was done almost entirely from roads because mistletoe is easy to recognise with binoculars from considerable distances before the buds burst on the trees. Every one of the 25 tetrads (2×2 km squares) in the 10 km square had to be visited and the hosts on which mistletoe was seen listed. Observers also noted the highest altitude in the whole 10 km square at which it occurred, and whether or not it was fruiting.

For both meetings there were about 15 members present and we were able to send 5 parties into the field each day. In this way 20 or more 10 km squares were listed in each area.

But recording mistletoe was not our only pleasure. During each meeting one day was devoted to seeing something of the other interesting plants of the neighbourhood, on show at Easter. From Hereford we visited Gt Doward and the woods along the Wye Valley. Three early-flowering and rare sedges were seen, *Carex digitata*, *C. humilis* and *C. montana* during the morning whilst, in the afternoon, by kind permission of Brig. R. P. Waller, we scrambled through scrub and over scree in the grounds of Wyeastone Lees to refine an old record of *Hornungia petraea*. From Wells we went east to Asham Wood, part of which is a reserve of the Somerset Trust. It is a superb wood threatened, however, with almost complete destruction over the coming years as it is being quarried away. *Lathraea squamaria* and the leaves of *Colchicum* were identifiable at this time of year.

We were fortunate that for both meetings we had the assistance of the appropriate County recorders. Capt. R. G. B. Roe kindly led the field meeting from Wells and gave much useful local advice. In Hereford, Mrs Whitehead not only gave us the benefit of her wide local knowledge, but entertained the party each evening in her magnificent drawing room, in which tea is perpetually hot. The Society is deeply indebted to them both.

F. H. PERRING

WARLEY PLACE GARDENS, ESSEX. 13TH MAY

By kind permission of the owner, Mr Norman Carter, 50 members attended this meeting after the Annual General Meeting of the Society to explore the site of what was once the great garden of Miss E. A. Willmott (1860-1934) with the object of seeing some of the many species which have persisted and even multiplied over years of competition with the native flora, the garden having received no attention since her death. In its heyday, around 1900, some 100,000 different kinds of plants, including varieties, are said to have been grown on the estate of 35 acres, with a staff of more than 50 gardeners to tend them.

The garden had almost entirely reverted to woodland, but much of interest remained. Trees and shrubs included a fine bay-like tree, *Umbellularia californica*. This caused some speculation: it was pinched for scent, and sampled by several noses which, after a few seconds, began to feel the effect of something like a mixture of ammonia and pepper, which lasted for five minutes or more. There were various forms of *Hedera helix*: *H. colchica* rooted up trees to become arborescent, producing ripe fruit (rarely developed in this country), a sample of which has since germinated. *Parthenocissus quinquefolia* was also holding its own. Bamboos flourishing in the lower woodland were *Arundinaria japonica*, *A. vagans* and *Sasa palmata*. Periwinkles, *Vinca major* with its subsp. *acutibola*, and *V. minor*, survived in strength. *Campanula latifolia*, *C. trachelium* and *C. rapunculoides* looked well. Among the smaller woodland species were *Tellima grandiflora*, *Geranium nodosum*, *Dentaria pinnata* and *Caulophyllum thalictroides*. Especially in the clearer conditions near the paths there were numerous small bulbs such as *Scilla italica* and *Allium triquetrum*. *Crocus purpureus*, which may antedate Miss Willmott, abounded in an adjoining field. Although we saw only one patch of the native toothwort, the purple *Lathraea clandestina* was plentifully naturalised.

The above necessarily brief account merely summarizes what was noticed in that part of the site that was visited. Miss Willmott's name, and that of her garden, are still with us: horticulturally they are the mark of a good plant. Her ghost (we are told) resides in *Eryngium giganteum*. We did not see this plant, but one hopes, on that wet but so enjoyable Saturday afternoon, that she slipped out to join us in her old garden: perhaps she did.

K. HOLLICK

INGLEBOROUGH AREA, YORKSHIRE. 11TH JUNE

The object of this well-attended meeting (34 members and friends) was to examine the flora of limestone pavements in Chapel-le-dale, then to investigate the summit cliffs of Ingleborough. On ungrazed pavements *Antennaria dioica*, *Convallaria*, *Melica nutans*, *Orchis mascula*, *Potentilla tabernaemontani*, *Primula farinosa*, *Saxifraga tridactylites* and *Trollius* were in full flower, but the presence of newly opened *Anemone nemorosa* and most of the *Lotus corniculatus* being only in bud indicated the lateness of the season. Grazed pavements had no emergent vegetation but in their grykes much *Actaea*, *Dryopteris villarii* and *Thelypteris robertiana* were found.

On the way up Ingleborough a flush-line full of *Chrysosplenium alternifolium* and *Adoxa* was discovered and *Carex bigelowii* appeared at 2,000 ft. *Salix herbacea* was not found despite a search.

The top Yoredale limestone, which outcrops at 2,100 ft, carries luxuriant stands of alpine vegetation. From the botanists' path along the base of the cliff, damp gullies and ledges covered with *Saxifraga aizoides*, *S. hypnoides*, *S. oppositifolia*, *Sedum roseum*, *Minuartia verna*, *Cochlearia officinalis* and *Poa alpina* were seen, while smaller outcrops yielded *Botrychium* and *Draba incana*.

During the day, special attention was paid to the *Alchemillas*: *A. glaucescens* and *A. wickhamiae* were seen near the pavements, whilst *A. minima* (confirmed by M. E. Bradshaw) was found in its typical habitat – ground subject to periodic flushing with calcareous ground-water – just above the lunch spot, a new site for this Craven endemic.

O. L. GILBERT

HUNTINGDONSHIRE. 16TH–18TH JUNE

The main purpose of this meeting, attended by 13 members, was to assist in the recording of the flora of Huntingdonshire on a tetrad basis. By kind permission of the Director, Prof. K. Mellanby, members were accommodated in the 'tower' at Monks Wood and were able to use the common room and other facilities which enabled dis-

cussion about problems of identification encountered in the field during the day to be sorted out in a convivial atmosphere.

During the week-end, 25 tetrads were visited and nearly 4,000 records were made. Recording was done in a variety of habitats; the intensively arable squares on the boulder clay yielded about 150 species per tetrad, while the Ouse valley, with its river, pits, meadow grasslands and villages, was more rewarding with as many as 233 species being recorded from a tetrad. *Lathyrus nissolia* was found at three sites, the abundance of this species on a new roadside verge being of special interest. *Scirpus tabernaemontani*, previously known from only two other sites in the county, was plentiful in a water-filled hole on Wyton aerodrome. Among other interesting species recorded during the weekend, the discovery of *Artemisia absinthium* in some quantity around factories in Huntingdon was noteworthy.

T. C. E. WELLS

OLD WINCHESTER HILL & EAST MEON, HAMPSHIRE. 18TH JUNE

A joint meeting of the B.S.B.I. and the botany section of the London Natural History Society was held at the above locations. Eleven B.S.B.I. members together with five visitors assembled at Petersfield station and drove by private car to a site at East Meon, which is a reserve of the Hampshire and Isle of Wight Naturalists' Trust, where the party admired hundreds of *Cephalanthera longifolia* growing with *C. damasonium*, *Galium odoratum* and *Neottia nidus-avis* in beech woodland.

The group proceeded to Old Winchester Hill National Nature Reserve where they endured appalling weather conditions to see the rich chalk flora of the hill. *Galium cruciata*, *Ophrys apifera* and *Coeloglossum viride* were growing on chalk slopes near the road. Aspects of management being carried out by the Nature Conservancy for the conservation of the flora were pointed out.

Finally, the party visited a roadside at Exton to see *Aceras anthropophorum* and *Ophrys insectifera*.

J. L. MASON

STOW-ON-THE-WOLD, GLOUCESTERSHIRE. 19TH-26TH JULY

Only five attended this meeting based at a Youth Hostel and arranged especially for younger members. On Thursday, 20th July, the area east of Stow around Broadwell, Evenlode and Aldestrop was examined. It is off the wolds, coming down into the plain, a country-side of wide-margined lanes and wettish, cattle-grazed fields with the River Evenlode winding tortuously and lazily through them. On the damp lanesides a good deal of *Stachys palustris*, *Lysimachia nummularia* and *Carex otrubae* was found. A large sheet of water at Aldestrop had a plentiful and lovely display of *Nymphaea alba* and there was much *Potamogeton crispus*. *Ceterach officinarum* was plentiful on a village wall and *Dryopteris dilatata* was in woodland near Oddington. We also saw a fine roadside display of *Cicerbita macrophylla*, which is now becoming established in abundance in the Stow area.

Friday was hot and sultry and the party, together with two U.S.A. hostellers, made for the hills around Condicote, Hinchwick and the old Roman road track. In the high country around Hinchwick a colourful and beautiful display of *Cirsium eriophorum* was seen in an old quarry and a lot of *Allium vineale* var. *compactum* was noted. The Roman road was interesting and its wide, partly short-turfed verges had some of the expected Oolitic Limestone flora; *Astragalus danicus*, still flowering, was the most interesting plant. The arable field margins by this track had several noteworthy plants, *Legousia hybrida* being quite plentiful.

Saturday was a free day, but on the Sunday in sunny weather the party went across the fields bordering the River Ey, between Lower and Upper Slaughter, to Swiss Cottage

and on through beautiful Eyford Park, by bridleway, to Swell Hill and so home. At Lower Slaughter *Cardamine raphanifolia*, a quite recently discovered Gloucestershire plant, was plentiful. *Hippuris vulgaris* and *Dactylorhiza praetermissa* were found in the river and on an adjacent marsh between the Slaughters. *Trifolium fragiferum* and *Senecio aquaticus* were in the riverside marsh just above Upper Slaughter church, and by the shady track, higher up and adjoining the stream, *Dipsacus pilosus* was plentiful. On a hillside in a nearby rocky wood there was an abundance of *Helleborus viridis* in fruit. *Impatiens parviflora* was flowering in great profusion by the margin of a wood and in several other places.

On the Monday, the party went to Moreton-in-Marsh and headed towards Batsford, Blockley, Bourton Woods and Five Mile Drive. In woodland we saw a single flowering specimen of *Campanula persicifolia* but it is probably not native here. Along a field-track coming off the Five Mile Drive *Legousia hybrida* was again seen, here growing with *Valerianella dentata*. The extensive woodlands in this area produced the most noteworthy plant: for fifty yards or more on both sides of a rocky, sloping, woodland track, *Vicia sylvatica* was seen in extraordinary profusion, some plants being well over twenty feet high. *Lathyrus sylvestris* was also in this woodland, just coming into flower, and there was also much *Alchemilla vestita*, *Valeriana officinalis* and *Campanula trachelium*.

On the final day the party ventured farther afield, by car. It was thought that Cirencester Park might be quite interesting and a halt was made at Daglingworth cross-roads to investigate Oakley Wood, and then on through to the Broad Ride. Several fruiting plants of *Aquilegia vulgaris* and immense quantities of the huge leaves of *Colchicum autumnale* were seen. The most interesting plant was *Sedum telephium*, seen in great quantity at the woodland edge of a dark, damp ride. Lunch was taken in the Broad Ride, where a hurried and unsuccessful attempt was afterwards made to find *Carex filiformis*. We then crossed the county border, through the fritillary country of north Wiltshire, to a large, hilly wood on the chalk, only a short distance from industrial Swindon. Here a fine show of *Ornithogalum pyrenaicum* was found, together with considerable quantities of *Helleborus viridis* and a little *Paris quadrifolia*.

C. S. DOWNER

CANNOCK CHASE, STAFFORDSHIRE. 5TH AUGUST

The purpose of this meeting was to study the *Rubus* flora of Cannock Chase which consists for the most part of well-defined and widely distributed species, so that it is admirably suited to introduce beginners to the perplexities and delights of bramble recognition. The party comprised sixteen members and friends. The main stop was Sycamores Hill, south of Brocton, where *Rubus cardiophyllus*, *R. carpinifolius*, *R. criniger*, *R. dasyphyllus*, *R. dumetorum* agg., *R. leightonii*, *R. lindleianus*, *R. polyanthemus*, *R. rubristylus*, *R. selmeri* and *R. vestitus* grow in close proximity. Other species were seen in the neighbourhood making twenty in all. We are very grateful to Mrs D. R. Haszard of Milford Hall for permission to visit her woods. The party dispersed at 5.30 p.m. after seven hours in the sun.

E. S. EDEES

SCOTLAND

MULL OF GALLOWAY, WIGTOWN. 10TH-11TH JUNE

Twenty-three members and friends, including members of the Andersonian Naturalists of Glasgow, took part in this joint meeting.

On the first day the primary objective was to explore as thoroughly as possible the coastal cliffs in an attempt to rediscover *Oxytropis halleri*. Two parties were formed, one working north from West Tarbert Bay and the other working south from Slock Mill. *Oxytropis* was not seen by either party in spite of careful search and

the impression gained was that this rare species should perhaps now be regarded as extinct in this locality.

Most of the well-known plant specialities were noted during the day. These included *Erodium maritimum*, *Limonium binervosum*, *Euphorbia portlandica* and *Inula crithmoides*. Other species noted were *Astragalus danicus*, *Crithmum maritimum*, *Berula erecta* and *Verbascum thapsus*. The highlight of the day however was the discovery by the second party of a colony of *Trientalis europaea* near Dunman. This species is very rare indeed in the south of Scotland and its occurrence in this locality was decidedly unexpected.

Next day the shore at Port Logan provided sandy beach and grassy habitats with some stabilised shingle in contrast to the cliff topography of the previous day. The more noteworthy species here were *Beta maritima*, *Calystegia soldanella* and *Catapodium marinum*. A magnificent patch of *Crambe* on shingle near Port Logan House attracted much attention, particularly from the photographers of the party. Near Kirkmaiden, *Ceterach officinarum* was observed on a wall, and *Geranium lucidum* on the roadside bank nearby.

Terally Bay on the coast north of Drummole was visited next in order to examine the flora of the fine shingle beach there. The form of *Vicia sylvatica* which Druce described as var. *condensata* was abundant, as was *Raphanus maritimus*. Other species noted were *Rosa pimpinellifolia* and *Trifolium striatum*. Finally a brief visit to a low-lying marsh near Logan Mill produced *Salix pentandra* and *Typha latifolia*.

A. MCG. STIRLING

LOCH LAGGAN, WESTERNESS. 8TH-15TH JULY

The party of ten met as planned on the evening of 8th July, and next day visited the NW quadrant of the square 27/37. Scattering over moorland, lochshore and woodland, and ascending on Meall Cean Dearg to the highest point in this quadrant at about 800 m, produced records of 195 plants including *Arctous alpina* and *Leucorchis albida*. On the way home a little attention was paid to other nearby squares.

Next day, 10th July, squares to the north of Glen Spean were visited. Although the weather was very showery and mist often prevented an accurate assessment of position on the mountain, no fewer than 5 quadrants received attention. The backward state of the vegetation for the time of year made identification of some plants difficult. *Carex saxatilis* for instance was very immature, but *Carex vaginata* was well advanced. In these 5 quadrants 667 records were added, though this figure includes records made on later visits during the week.

The weather continued windy next day, but it was drier and the party drove to Loch Pattack Lodge. Two cars endeavoured to continue to Loch Pattack but became bogged down and were turned with difficulty. Parties visited the high ground in three quadrants and in spite of the late season found *Cerastium cerastoides*, *Salix myrsinites* and *Carex capillaris*. Another party explored the low ground along the River Pattack. A total of 373 records was accumulated.

Next day, 12th July, was very wet and windy and so work in the shelter of the trees on Arderickie Estate was undertaken. In addition to working some previously visited areas, two new quadrants were explored adding 381 records. The sand-dunes at the NE end of Loch Laggan proved particularly productive with *Ranunculus bulbosus*, *Pimpinella saxifraga*, *Helictotrichon pubescens*, etc. Unknown to the main party another member arrived and recorded 170 plants in Glen Roy, including *Dactylorhiza incarnata* subsp. *pulchella*.

Thursday 13th July dawned clear and bright and by the time the party breasted the hills in 27/47 the sun was hot. All four quadrants were visited by various members of the party. Again the backward state of the vegetation was all too apparent, but 265 records were added including a second county record of *Arabis hirsuta* at the unusually high altitude of 1200 m. *Equisetum hyemale*, *Salix reticulata*, *Salix lanata*, *Veronica fruticans* and *Luzula arcuata* were seen by various members of the party.

After such a strenuous day, the following, 14th July, was devoted to less exhausting recording. Creag Aoil and Lon Lianachan, two contrasting areas in the shadow of Ben Nevis, were visited. The first is a limestone crag which again yielded *Arabis hirsuta* and 181 other records. The second is a bog with singularly ferocious *Molinia caerulea* tussocks and 89 other species including *Dactylorhiza incarnata* and *Carex lasiocarpa*. On the way back to the hotel, gorges in the River Spean were visited and here the very rare *Listera ovata* was seen. Another party strayed to Brackletter and the neighbourhood of the Caledonian Canal, returning with 161 records.

This concluded the organised part of the meeting as members had various transport arrangements for the following day, Saturday 15th July. However, three cars with several members *en route* for the south visited a steep limestone crag in Glen Nevis, adding 136 records for the SW quadrant of 27/17. Included in this total was *Equisetum hyemale*, *Dryopteris abbreviata* and the third record of *Arabis hirsuta* in one week! Another member visited hills beside Loch Lochy which had been worked-over last year, and added a few new records.

Altogether 401 different species of vascular plants were seen, and these constituted 2803 records, subject to adjustment as critical species are identified.

Ardverickie Estate and the Forestry Commission were most helpful regarding access to certain areas during the week, and this is a most appropriate place to record thanks to them for these facilities.

A. A. P. SLACK

SELKIRK. 29TH-30TH JULY

Those attending on both days were Miss J. Gibbons, Mr C. Badenoch, Mr G. H. Ballantyne and Mr Arthur Smith. On the 29th Miss W. Simpson and Lady Emma Tennant were present and on the 30th Mr A. McG. Stirling joined the party.

The object of the meeting was to visit underworked and potentially interesting areas in Selkirkshire (v.c.79) and to record in the relevant 10 km squares.

The party started by exploring a system of wooded ravines at the Hawkshead Burn in Ettrick, where the dominant tree is *Betula pubescens*. The main interest was the presence of *Juniperus communis* in some quantity in the Bleak Burn ravine. In v.c.79 it is probably most abundant in this locality. Although there were several dead bushes there was evidence of regeneration, with a number of small bushes and seedlings present. *Thelypteris phegopteris* and *T. dryopteris* were seen and *Sedum villosum* occurred locally in springs.

In the afternoon the Upper and Lower Shaws Lochs were examined. The Upper Loch had large stands of *Scirpus lacustris* and *Phragmites australis* with conspicuous *Nuphar lutea*. Dying *Salix pentandra* trees occurred at the fringe of the fen with much *Menyanthes trifoliata*, *Potentilla palustris* and associated *Hippuris vulgaris*. The most interesting discovery was *Calamagrostis stricta* which was scattered over a wide area in its only extant site in v.c.79, the other locality having been flooded. Among the carices present were *C. acutiformis*, *C. curta*, *C. diandra*, *C. lasiocarpa* and *C. paniculata*. *Potamogeton alpinus* was present in the burn flowing into the Upper Loch. The Lower Loch had rather uninteresting well-drained stony margins but *Isoetes lacustris* (2nd v.c. record) fragments were gathered from the shore-line with *Potamogeton crispus* and *P. berchtoldii*. At the north side *Eriophorum latifolium* occurred locally associated with *Eleocharis quinqueflora* and *Carex lepidocarpa*.

On the following day the party explored the burns on the south side of Dun Rig (2,344 ft) above the Douglas Burn in Yarrow. *Galium sternerii* was common in basic grassland and *Dryopteris abbreviata* (new v.c. record) was locally abundant on scree above the Douglas Burn. *Sedum villosum* and *Myosotis stolonifera* (new v.c. record) ascended to about 1,800 ft. Among the apparently uniform *Hieracium* flora of *H. vulgatum*, Mr Stirling found two plants of *H. duriceps* (new v.c. record). The summit of Dun Rig produced a third county record for *Carex bigelowii*, and *Melampyrum*

pratense ascended to over 2,000 ft. It was interesting to see the profusion of *Rubus chamaemorus*, with several fruiting plants present on blanket peat. We later heard that one person had gathered 15 pounds of the fruit locally some weeks before. *Vaccinium oxycoccus* was an unusual plant in the same blanket bog at a height of 2,275 ft. Near Muttonhall, *Carex laevigata* was seen in a marshy area and the hybrid *Mimulus cupreus* $\times$ *guttatus* was established on the shingle bed of the Douglas Burn.

A total of forty additions were made for the relevant 10 km squares.

R. W. M. CORNER

KINGUSSIE, EASTERNESS. 15TH–22ND JULY

The meeting was attended by twenty-one people who stayed for a varying number of days. Our purpose was to cover as many underworked quadrants (5×5 km squares) in Easternness as possible, thus furthering the Inverness-shire Survey. We visited seventeen quadrants during the week and added 88 species to the *Atlas* for the 10 km squares visited.

A party of three left Kingussie railway station at 10.30 a.m. on Saturday 15th and the vicinity of the Creagdhubb monument on the A86 road was our first stop in quadrant 27/69NE. *Trientalis europaea* was abundant in the birch woods and *Carex pauciflora* in the bogs above the woods; *Listera cordata* was also noted here. The pinewood proved uninteresting but the open moor had *Primula vulgaris* and *Helictotrichon pratense*. In the afternoon, in quadrant 27/69SW, *Cystopteris fragilis* was found growing on a graveyard wall but small ferns were uncommon in the district. A delightful riverside pasture was visited next; it was full of *Trollius europaeus*, *Cirsium heterophyllum*, *Platanthera chlorantha* and *Dactylorhiza purpurella*. Later we went to the riverside at Laggan Bridge and then on to the shingle beds, where plants were making a fine show for the photographer, particularly *Silene maritima*, *Anthyllis vulneraria*, *Gentianella campestris* and *Galium boreale*. But only one plant of *Polygala vulgaris* was found. There was a complete absence of *Sedum* species.

The following day seven of us searched the shore to the north-west of Loch Insh. Beneath the water was a carpet of *Littorella uniflora* and nearby a good stand of *Carex vesicaria* with *C. rostrata*; *Koeleria gracilis* grew by the roadside. Colonised shingle to the north-east of the road had *Platanthera chlorantha* and *Gentianella campestris*. Lunch was taken in the blessed shade of the pines, where Mr McBeath showed us *Pyrola media* and much *Goodyera repens*. He also pointed out a patch of *Listera cordata* measuring about 2ft by 1ft. For quadrant 28/80NW on this and subsequent visits we listed 235 species. A forest track in quadrant 28/80NE led us to a lochan whose cool waters contained some nice plants, viz: *Apium inundatum* and *Sparganium angustifolium*. We brought the card for this quadrant up to 200 by adding six species at the car park. It is now at 326 thanks to Messrs McBeath and Barnes. We took refuge under the shade of great pines for tea and half an hour later in intense heat were recording by the beautiful pools in the Feshie near Feshiebridge; we did not add much here.

Fourteen assembled at Kingussie station next day for an expedition up Glen Feshie, Lord Dulverton having kindly given his permission. We proceeded to Creag na Caillich in quadrant 28/89SE. We ascended the *Calluna*-covered north-east slope in great heat and went around to the cliffs above Allt Lorgaidh on the north-west; there we saw *Asplenium viride*, *Silene acaulis*, *Rubus saxatilis*, *Dryas octopetala*, *Saxifraga stellaris*, *S. oppositifolia* and *Salix myrsinites*. Amongst the *Calluna* was *Rubus chamaemorus* and *Chamaepericlymenum suecicum*. *Lycopodium selago* and *L. alpinum* grew on the top, and in a little basic patch on the east side we found *Botrychium lunaria*, *Linum catharticum* and *Coeloglossum viride*. On acid ground nearby was *Vaccinium uliginosum*. On our way down this side we found *Epilobium anagallidifolium*, *E. brunnescens*, *Saxifraga aizoides*, *Gentianella campestris* and *Briza media*. We were very pleased to have Mr

Ferguson of Antwerp University and his students with us on this occasion; we recorded 119 species.

On this very hot day four of us worked in quadrant 28/91NE at Loch Garten. The number of species was few (77) but *Pyrola minor*, *P. media* and *Goodyera repens* were making a fine show. *Equisetum sylvaticum* and *Blechnum spicant* grew to a great size in a woodland ditch; some *Blechnum* fronds were about 2ft long. In the cool of the evening we met Messrs McBeath and Barnes who, from Kincaig station, led us up Suidhe, a basic hill north-west of Kincaig; here we made many additions to quadrant 28/80NW as we traversed bog and cultivated land as well as basic grassland. The best find made by our guides was *Circaea alpina*. That afternoon Mr Martin found *Teesdalia nudicaulis* by the Spey.

On Wednesday two of us examined the swamp between Kingussie and Kincaig in quadrants 28/80SW (116 species) and 28/70SE (123 species) under a blazing sun. In the morning we waded through mud up to the thighs and crossed the railway; in a small lochan Mr Kingston found what we hope will be verified as *Callitriche obtusangula* which would be a new vice-county record. In the afternoon we found *Chaenorhinum minus* and *Galium mollugo*, both new to the 10 km square. We added 11 species to those recorded in the *Atlas* for the 10 km square in quadrant 28/80SE and 4 species in quadrant 28/80SW. In the evening we met Messrs McBeath and Barnes at Loch an Eilean and added *Ramischia secunda* and *Pyrola minor* to that quadrant.

On Thursday, another hot day, two of us worked around Loch Moy in quadrant 28/73SE; we found it disappointing botanically, but did add 22 species to those recorded in the *Atlas* for the 10 km square, noting a total of 139 species. Mr and Mrs Morrison spent the day in quadrant 27/89NW and made additional records to 28/80NE, 28/70SE and 27/79NE in Glen Feshie, Kingussie Golf Course and near Tromie Bridge. In the evening we met two others of our group and were taken to the pine forest in quadrant 28/80NE. We saw more *Ramischia secunda* here and were delighted at having a roe deer pursue us barking; at dusk some capercaillie flew up from close at hand.

We were very happy to have Mr Colin Murdoch with us on Friday 21st July, when two of us were taken by him to the delightful Spey meadows between Newtonmore and Kingussie, in quadrant 27/79NW, where he showed us *Teesdalia nudicaulis*. *Silene maritima* was common on the shingle with nice plants of *Alchemilla alpina*; *Anthyllis vulneraria* and *Thymus drucei* were most colourful here. The sandy shingle, which used to harbour *Lupinus nootkatensis*, was now bare of this showy plant, nor could we find *Saxifraga oppositifolia* in its former habitat. After lunch, taken in the shade of a large alder tree on the banks of the Spey, we added some marsh and water species from a small lochan at 27/775.991. We added 22 species to those recorded in the *Atlas* for this 10 km square. In the evening Messrs Copping, Kingston, McBeath and Morrison met the writer at the Court House, Kingussie, in order to bring records up to date.

On Saturday 6th July six of us travelled to the Pass of Drumochter in quadrant 27/67NW. Here we followed a mountain stream on foot up A'Mharconaich and saw *Geranium sylvaticum*, *Alchemilla alpina*, *Saxifraga stellaris*, *S. aizoides*, *S. oppositifolia*, *Oxyria digyna*, *Solidago virgaurea* and one plant of *Luzula spicata*. In the bogs were *Selaginella selaginoides*, *Drosera rotundifolia*, *Tofieldia pusilla*, *Eleocharis quinqueflora*, *Carex pauciflora* and *C. dioica*. Higher up we found *Sibbaldia procumbens*, *Veronica alpina* and *Juncus triglumis*. Among *Vaccinium myrtillus* and *Empetrum hermaphroditum* was much *Vaccinium uliginosum* and *Chamaepericlymenum suecicum*. We left one of our party to examine the gullies above the A9 road and proceeded through the mist and rain to the top, where vegetation was sparse, the chief species being *Loiseleuria procumbens*, *Juncus trifidus*, *Luzula spicata* and *Carex bigelowii*. We returned over the Sow of Atholl in bad visibility and pouring rain; this was the final day of the official meeting.

To Mr McBeath's local knowledge and enthusiasm the success of the week was very largely due, and to him for his untiring and continuing efforts go our most grateful

thanks. We are also greatly indebted to Mr Murdoch who gave us valuable advice in planning the week and suggested many places worth visiting, to Mr Kingston, who has been a very great help in checking records, and to Mr Ribbons, who marked the vice-county boundaries on our two sets of eleven one-inch maps. My thanks go too to all those who attended the week, worked so hard in spite of the temperature, and made it such a happy and interesting time for me.

Although the official meeting lasted from 15th–22nd July, eleven people assisted me in recording during seven days before and three days after this and to them I am very grateful; they mapped for periods varying from one to four days. During this time work was done on fifteen quadrants including Loch Morlich and district, Tomatin, Loch Einich, Loch Gynack and Loch Insh, Coire Garbhlach and other areas in Glen Feshie. Near Kingussie we stopped to look at *Sambucus ebulis*, and Miss E. Young found *Anthriscus caucalis*; this is a new vice-county record. The cliffs above Loch Einich and some peat pools above them were interesting with *Carex vaginata*, *C. rariflora* and *C. atrata* found by Messrs Copping and McBeath; *Salix myrsinites* and *S. lapponum* were plentiful here and *Coeloglossum viride* was locally abundant. Mr Mackechnie and Mr Kingston found *Subularia aquatica* and *Carex lasiocarpa* at Loch Insh and a magnificent area of *Linnaea borealis*, discovered by Messrs Barnes and McBeath, was a splendid end to our recording.

E. R. T. CONACHER

KINDROGAN FIELD CENTRE, EAST PERTH. 26TH JULY–2ND AUGUST

Fifteen members joined together for this week supported throughout by the warm hospitality and expert guidance of Brian Brookes and his staff, who joined in fully with our activities whenever their other duties permitted.

The purpose of the meeting was clear cut. During the last four years the Biological Records Centre has been conducting a survey of the size of the present population of the 300 rarest species in our flora as an essential part of a Red Data Book for British Plants to be published through the Society for the Promotion of Nature Reserves. With publication due in 1973 we were surprised to find how little information had been received about the Scottish flora and decided that a meeting in the Kindrogan area was desirable as, from it, many of the important sites of species for which information was lacking were within reach.

The first full day, Thursday, 27th July, was a training day – both physically and botanically. The whole party climbed the relatively gentle slopes of Ben Vrackie from Moulin, stopping on route to assess the effectiveness of the introduction of *Schoenus ferrugineus* from the shores of L. Tummel prior to the site being flooded, a good example of the need to know the exact localities of species and for action to be taken to protect them.

As soon as the zone containing *Astragalus alpinus* and *Oxytropis halleri* had been reached, the party, with the aid of orange marker posts, worked out the limits of the populations of the two species so that they could be recorded by Miss Hamilton of the B.R.C. staff. This exercise showed that both species were more abundant than had been previously appreciated. Most of the party then climbed to the summit to learn the more frequent mountain-top species not previously known to several of the visitors from the south. As we reached the top the clouds lifted and the descent was made in brilliant sunshine.

On the second day, Friday 28th, it was decided, in view of the promising weather, to cover the ground between the Devil's Elbow and Meikle Kilrannoch. An early start was made and the whole party started climbing Meall Odhar at 9.0 a.m. Though we were shrouded in mist for the first hour, this then lifted and the rest of the day was passed in brilliant and burning sunlight. The party was divided into four groups of

3 or 4, each of which was dropped at one point on the route to record one or two species. The first stayed on Glas Maol and recorded *Alopecurus alpinus* in several flushes.

The second descended into Caenlochan Glen and made observations on *Cystopteris montana*, *Carex rupestris*, *Erigeron borealis*, *Gentiana nivalis*, *Salix lanata* and *Veronica fruticans*.

A third party hoped to reach the bottom of Canness Glen, but found the ground north of Caderg so difficult to traverse at speed that they had to be content with working the headwaters of Canness Burn where they found a single specimen of *Alopecurus alpinus*.

Finally, two members went as far as Meikle Kiltrannoch where they found the fascinating serpentine area which contains one of the very few localities in Britain for *Lychnis alpina*. It seems there are at least 1000 plants scattered over an area of 10 acres.

Saturday was a day for exploring new ground searching for old records. Full marks for endeavour go to Mr Martin who, with his wife and Miss Hamilton, searched in vain for *Lychnis viscaria* above Pitlochry Golf Course, but he returned on Sunday morning, eventually finding 12 flowering spikes on a dry rock ledge. A second party went to Carn Dubh, the highest point in 37/06, because there were few records of mountain plants from this 10 km square. After a long walk on a very 'poor' mountain a dozen species were added to the list including *Carex pauciflora*, *Gnaphalium supinum*, *Lycomodium annotinum* and *Sibbaldia procumbens*. The rest of the party went up Glen Tilt hoping to scour mountains on either side for long-lost records. In the event the length of the journey and Forestry fences thwarted this endeavour. However, a sortie up Allt Fheannach produced a small population of *Juncus alpino-articulatus*.

Sunday was a day of comparative rest, except for Mr Martin scrambling above Pitlochry, but the majority decided to meet at St Cyrus in the afternoon to explore the cliff and sand-dune flora. This was an aesthetic experience as much as a botanical one; the size and abundance of *Campanula glomerata* in the fixed dunes continues to be a source of wonder to me. During the visit a dozen species were added to the published list for this N.N.R., including *Rumex longifolius* and the hybrid *Silene alba* × *dioica*.

Monday was one of the most rewarding days in terms of plants seen and populations recorded. One party went to the Sow of Atholl where, besides plotting the area covered by *Phyllodoce caerulea*, they re-found an old locality for *Salix arbuscula*, though only 2 widely separated bushes were discovered. A second party visited the Birks of Aberfeldy to record *Melampyrum sylvaticum*. Five separate populations were encountered, adding up to about 200 plants, and reaching an altitude of 900 ft. The rest of the team was detailed to record *Scheuchzeria palustris* on Rannoch Moor. This was done at the classic site and over 500 flowering spikes were counted; a plan to make a wide search for other sites was defeated by a plague of voracious midges, followed by a very heavy downpour to which they were a prelude. *En route*, a diversion was made at Craig Varr, near Kinloch Rannoch, to try to re-find an old record for *Lychnis viscaria*. Once again, Mr Martin's nose had its reward and a good colony of 86 flowering spikes covering 100 square yards was located after a 2 hour search.

The last day, Tuesday, 1st August, was spent in the lowlands to the south-east on the borders of Perth and Angus. Old records of *Melampyrum sylvaticum* and *Polygonatum verticillatum* in wooded river valleys near Blairgowrie were followed up, but in vain. The only successful party was that which set out to look for *Najas flexilis*. After searching for an hour with two grabs, a quantity was found near the south-west corner of the Loch of Clunie. Four other lochs nearby were investigated during the day without success. Although it is recorded 'in almost all of the chain of lakes between Dunkeld and Blairgowrie' by White in *The Flora of Perthshire*, the only localised records at B.R.C., based on the major herbaria, are from Loch of Clunie.

On the final evening during a discussion on the week's work, it was agreed that a meeting of this kind with clear objectives was worthwhile, and that another meeting in two years' time was highly desirable. However, it was felt that next time we should

concentrate on a limited number of problems, generally working as a single party so that we could cover one area in detail on each day. We all hoped that on the next occasion we should have the pleasure of the company of more indigenous botanists.

F. H. PERRING

DUNNET, CAITHNESS. 15TH–21ST AUGUST

The Dunnet meeting, which was attended by 28 members and guests, was unique in two respects. It was the first C.S.S.F. meeting to be held in Caithness, and the occasion was marked by an invitation from H.M. Queen Elizabeth, the Queen Mother and Patron of the B.S.B.I., to visit her at the Castle of Mey.

At the Northern Sands Hotel a meeting was held on the evening of Tuesday 15th August to complete the plans for the programme and to give the visitors to Caithness the opportunity to meet Mr J. M. Gunn, the recently appointed B.S.B.I. recorder for v.c. 109 and joint leader of the meeting. On Wednesday, five groups visited different areas on Dunnet Head, the most northerly part of the British mainland; the day was spent, in damp weather, recording from the heather moors, lochs and sea cliffs. The western part of the peninsula is in 10 km square 39/17 and 56 new records were made, including *Ophioglossum vulgatum* subsp. *vulgatum*, abundant above the west-facing sea cliffs, *Anthyllis vulneraria* subsp. *lapponica* (Hyl.) Jalas and *Drosera* × *obovata*, all of which are new vice-county records. It was particularly interesting to see *Salix herbacea*, *Arctous alpinus* and *Saussurea alpina*, all normally species of higher altitudes, growing on Dunnet Hill, which has a height of 398 ft. *Carex bigelowii* was found on Burifa Hill. Square 39/27 includes the eastern portion of Dunnet Head, and here a rather wider range of habitats enabled 96 new records to be listed. *Drosera* × *obovata* was also found here, *Salix repens* subsp. *repens* was common and *Agropyron junceiforme* × *repens* was seen; all are new to the vice-county.

Most of the party went to Wester Farm on Thursday morning to look at the rare grass *Calamagrostis stricta* growing in a fen immediately to the west of the farm. Some members remained to map the full extent of the colony and found that the species is spread over some three acres, all within square 39/26. As Caithness is the only vice-county north of Mid Perth in which *Calamagrostis stricta* is known, it is desirable that the habitat at Wester should not be thoughtlessly destroyed. In addition, two grasses from the same site have been tentatively identified by Dr C. E. Hubbard respectively as intermediate between *Agrostis canina* subsp. *montana* and *A. tenuis* and as *Calamagrostis scotica*. Dr Hubbard also identified as *C. stricta* specimens collected near St John's Loch in square 39/27. The other members travelled to the Thurso Museum to see and advise upon the herbarium of the Caithness naturalist, Robert Dick (1811–66). This collection was, some years ago, 'rescued' by Mr Gunn and, currently, with the assistance of Miss Valerie Hewison, has been painstakingly looked after by him. The herbarium consists of Caithness plants together with specimens from other parts of the British Isles, obtained by Dick in exchanges.

In the afternoon all the members of the party had the honour of meeting H.M. Queen Elizabeth the Queen Mother, at the Castle of Mey. Her Majesty received us in the Drawing Room and afterwards presided over an extremely sumptuous Scottish tea. Later the Queen Mother invited us to see her garden and spent some time in taking the party round the flower, fruit and vegetable beds, delighted, one felt, at the surprise evinced by her visitors, especially those from southern Britain, at the luxuriant plant growth in this garden on the remote northern coast of Scotland – just as we were delighted at the first-hand evidence of our Patron's great and intimate knowledge. Of particular interest was the wide variety of well-developed plants in the herb border which had been started by Her Majesty some years earlier.

Queen Elizabeth then put those present particularly deeply in her debt by enquiring whether it would be of interest to see *Mertensia maritima* on the seashore. Doubt was



PLATE 1. Her Majesty, Queen Elizabeth the Queen Mother, with members of the Society who attended the C.S.S.F. field meeting at Dunnet, returning from the shore at the Castle of Mey, Caithness.



PLATE 2. Her Majesty, Queen Elizabeth the Queen Mother, with the President of the Society, David McClintock, and other members of the Society who attended the C.S.S.F. field meeting at Dunnet, in the garden of the Castle of Mey, Caithness.

expressed about imposing any further on Her Majesty's generosity but, when she learned that some of her guests had never seen this species, she insisted on fetching her anorak and hood and, donning strong shoes, led the way in blustery weather over the fields to the shore, to everyone's keen satisfaction. In anticipation of this, we learnt from her staff, she had made a special visit there that morning to check on it. The three specimens of Oyster Plant were in good flower. In the photograph opposite p. 420 Her Majesty is seen returning from the shore, accompanied by Mr Gunn and followed by other members. In the driveway of the Castle, Her Majesty again spent some time talking to the members of the party, some of whom showed her plants we had collected. She was interested in the Adder's Tongue and accepted for her garden half a clump of a most unusual dwarf *Calluna* which had been collected on Dunnet Head. Her Majesty subsequently indicated that, as suggested by the President of the B.S.B.I., it might be named in commemoration 'Castle of Mey'. She expressed a keen interest in and knowledge of Robert Dick and gave precise directions to some members who wished to photograph late-flowering *Primula scotica*.

The members then took their individual leaves of the Queen Mother and left the Castle drive as she and her party, who had also entertained us magnificently, remained on the lawn waving goodbye. The visit, attended throughout by sunshine and by the friendliest Scottish hospitality, will undoubtedly remain for ever in the memories of those who had the privilege of taking part.

In the evening some members attended a Ceilidh in Thurso organised by the Caithness Field Club. The programme on Friday began with a visit to the Caithness glass factory at Wick; thereafter the day was devoted to recording in square 39/36. Small groups visited different parts of the square and produced a total of 183 new records of which the following are new to vice-county 109: *Papaver somniferum*, *Impatiens glandulifera*, *Alchemilla vestita*, *Rosa rugosa*, *Ribes uva-crispa*, *Fuchsia magellanica*, *Symphytum* × *uplandicum*, *Utricularia intermedia*, *Mentha* × *gentilis*, *Tripleurospermum maritimum* subsp. *maritimum*, *Lilium pyrenaicum*, *Scirpus fluitans* and *Agropyron junceiforme* × *repens*. At Wick harbour *Puccinellia capillaris* (conf. C.E. Hubbard) was found.

The weather on Saturday 19th August was not good enough to permit a hoped-for visit to the Island of Stroma with the Caithness Field Club and instead the day was devoted to the River Thurso and neighbouring areas, including Thurso railway station sidings. In square 39/16, which includes the last five miles of the River Thurso, 50 new records were obtained and of these 14 were new to the vice-county: *Sinapis alba*, *Rorippa* × *sterilis*, *Viola cornuta*, *Hypericum maculatum*, *Rubus latifolius* (det. A. Newton), *Ribes uva-crispa*, *Epilobium adenocaulon*, *Symphytum* × *uplandicum*, *Mimulus guttatus* × *luteus* (this hybrid, det. M. McC. Webster, was found also at John o'Groats, 39/37), *Veronica montana*, *Mentha* × *verticillata*, *Doronicum pardalianches*, *Sparganium erectum* subsp. *erectum* and *Agrostis gigantea*. On the terracing in Thurso cemetery *Alchemilla conjuncta* and *Saxifraga* × *urbium* D. A. Webb were plentiful. A search of the river banks nearby for *Ajuga pyramidalis* proved fruitless.

In the adjoining squares: 39/06 yielded 20 new records, the hybrid *Mimulus guttatus* × *luteus* (det. D. McClintock) and *Hieracium latobrigorum* (conf. C. West) from the Burn of Acharole being new to the vice-county; 39/15 produced 65 new records, *Anthyllis vulneraria* subsp. *vulneraria* and subsp. *lapponica* (Hyl.) Jalas and *Sparganium erectum* var. *microcarpum* (Newman) C. Cook being new to the vice-county; and in square 39/25 76 new records were made, among which *Aconitum vulparia*, *Aubrieta deltoidea* (L.) DC., *Lupinus polyphyllus* Lindley, *Laburnum alpinum* (Miller) Berchtold & J. Presl, *Rubus latifolius* (det. E. S. Eedes), *Cotoneaster horizontalis*, *Sorbus intermedia*, *Saxifraga* × *urbium* D. A. Webb, *Ribes sylvestre*, *Heracleum sphondylium* × *mantegazzianum* (conf. C. W. Muirhead), *Humulus lupulus*, *Salix nigricans*, *Symphytum caucasicum*, *Symphoricarpos rivularis* and *Campanula latifolia* were new to the vice-county. *Hieracium latobrigorum* (conf. C. West) was found on a cliff at Crosskirk near the mouth of the Forss Water.

On the final day of the meeting most of the 16 members who were still present went to search for *Saxifraga hirculus*, northwest of Loch Rangag in square 39/14. The old record for this species (see *Trans bot. Soc. Edinb.* 26: 73-75 (1911)) was not confirmed but 22 new records were made for this square. A grass collected at the Loop Burn was submitted to Dr C. E. Hubbard who thought it might be *Agrostis canina* $\times$ *tenuis*. In the afternoon members diverged and recorded in Squares 39/26 at Dunnet Bay and Links and 39/23 at Achastle. Fifty new records, including some made on the previous day, were made from the former and six from the latter; none was new to Caithness. *Rubus mucronulatus* (det. A. Newton) was found at Latheronwheel (39/13) and *R. septentrionalis* (det. A. Newton) at Dunbeath and Berriedale (39/12) and at Latheronwheel (39/13). These Rubi are new to Caithness.

This most memorable and worthwhile meeting ended with an expression of thanks to the Caithness Director of Education for making the former Dunnet School available as a meeting room, and also to the joint leaders of the meeting and to those who helped the vice-county recorder with the preliminary arrangements. Special thanks are due to Mr Gunn who, although newly appointed as a vice-county recorder, shouldered a full share of the responsibility for the meeting and provided most of the information about the records on which this report is based.

'New records' in this report means records additional to those shown on the composite 10 km square lists supplied by the Biological Records Centre in advance of the meeting.

B. W. RIBBONS

IRELAND

CO. WICKLOW. 31ST MAY-2ND JUNE

A residential meeting was held at Avondale at which most of the people actively involved in vegetation studies in Ireland participated. The number of people professionally involved in vegetational surveys has shown a marked increase in the last four years. At present, major studies on the grasslands, heaths, bogs, woodlands and sand-dunes are in progress. There appears also to be a considerable interest in the preparation of county Floras.

Sixteen people came to the meeting. On the first morning vegetational surveys in northern and southern Ireland were reviewed by Dr Roland Randall (N.U.U.) and Dr A. M. O'Sullivan (Agricultural Institute) respectively. Fr J. J. Moore (U.C.D.) then acted as discussion leader for a session on field work methodology in which phytosociological approaches were mainly considered.

On the afternoon of the first day a field-trip to see and describe stands of grassland, heath and bog on Fanierin Mountain was made by the group. This gave experts on particular vegetational formations a chance to show how they did their field descriptions. On the following day a long excursion was made to such diverse areas as the Brittas dunes, the Laragh oakwoods and the upper Glendalough valley with its steep scree slopes and old mine workings.

In the evenings informal discussions continued and a rough mapping scheme of the vegetation-types described on Fanierin Mountain was drawn up as a group exercise.

On the third day the group went out on Fanierin Mountain to test this mapping scheme. The weather was appalling so this activity had to be cut short.

Before dispersing, the group decided that another meeting should be held in 1973. Subject to the approval of the Regional Branch Committee, Killarney was chosen as that year's venue, as there are currently about eight people doing ecological studies in that area. The intention would be to have papers dealing with the main topics of study, interspersed with field excursions. To facilitate University participation the

meeting will probably be in mid-September. All B.S.B.I. members will get further details when plans are more advanced.

A. M. O'SULLIVAN

NEW ROSS, CO. WEXFORD, 8TH — 12TH JULY

The object of the meeting was to explore the flora of the neighbourhood especially in counties Kilkenny and Wexford. Nine members attended.

Saturday was spent in Co. Kilkenny. In the morning a visit to the site of *Cirsium oleraceum*, an apparent escape, in a damp field near Ringwood House (Irish GR S 71.31) also yielded *Rosa arvensis*, *Humulus lupulus* (another escape), *Carex pendula*, *C. acutiformis* and *C. riparia*. South of New Ross, a damp field by a tidal stream near Bearstown Railway Bridge (S 68.23) held *Ranunculus sceleratus*, *Carex otrubae*, *Scirpus maritimus*, *Scirpus tabernaemontani* and *Hordeum secalinum* and, on dry banks, *Dipsacus fullonum*. At Carricketony (S 68.22) *Geranium columbinum* and *Juncus bufonius* subsp. *foliosus* were seen. A stop at Ballinlaw (S 67.16) produced *Osmunda regalis* in a shady hedgebank. Lough Cullin (S 62.18) was visited in the afternoon. The surrounding acid heath held *Calluna vulgaris*, *Erica tetralix* and *E. cinerea*, *Cirsium dissectum* and *Platanthera bifolia*, together with *Carex* species including *C. caryophylla*, *C. demissa*, *C. echinata*, *C. flacca*, *C. hostiana*, *C. ovalis* and *C. panicea* and also *Sieglingia decumbens*, while *Osmunda regalis*, in magnificent clumps, belied its easterly location. The extensive marshy area surrounding the lake containing abundant *Menyanthes trifoliata* defied the best efforts of the party to reach the open water which R. L. Praeger had visited in 1899. In the evening, after dinner and suitably refreshed, some members explored old walls near the Five Counties Hotel and recorded *Catapodium rigidum* subsp. *majus* (C. Presl) F. H. Perring & P. D. Sell, *Vulpia myuros*, *Linum bienne* and the garden escape *Sedum reflexum*. Sunday was spent in Co. Kilkenny. Dysertmore (S 67.34) was searched for *Pyrola minor* without success. The woods, however, yielded *Carex sylvatica*, *C. pendula*, *Dryopteris aemula* and an unusual form of *Luzula pilosa* with rather erect branches in the fruiting inflorescence. The grounds of Woodstock House at Inistioge (S 64.37) were next explored. Despite conifer planting by the Forestry Department the demesne held many fine specimen trees. *Mercurialis perennis*, an introduction, was frequent among the woods while *Juncus tenuis*, new to Co. Kilkenny, was found on damp ground. Old walls at Inistioge held *Saxifraga tridactylites*, *Catapodium rigidum* subsp. *majus* and *Vulpia bromoides*. Among the riverside vegetation were *Campanula trachelium*, a Nore valley species, and two introductions: *Impatiens glandulifera* and *Angelica archangelica*. Acid rocks by the river held an odd mixture of species, some with calcicole tendencies. *Asplenium adiantum-nigrum* and *Polypodium australe* grew among such calcifuge species as *Erica cinerea*, *Teucrium scorodonia* and *Digitalis purpurea*, while *Fraxinus excelsior* covered the crag at a higher level.

C. BREEN

Monday and Tuesday were spent in the southern parts of Co. Wexford, with Dr A. O'Sullivan leading. While travelling in the direction of Hook Head, the party paused at Slievecoiltila (S 7.2) where *Lepidium heterophyllum* was frequent, along with a little *Geranium columbinum* and *Salix aurita* × *cinerea* subsp. *oleifolia*. *Lepidium heterophyllum* was again noted at Gusserane (S 7.1) along with *Dryopteris pseudomas* and *Rosa sherardii* in roadside hedgerows. *Bromus lepidus* and *Lolium multiflorum* grew in nearby fields.

Near the town of Fethard (S 7.0), on the Hook peninsula, a narrow stretch of salt-marsh produced *Spergula salina* and *Spartina* × *townsendii*, with, a little higher up, *Carex otrubae*, *C. paniculata*, *Typha latifolia* and *Scirpus maritimus*. In drier parts nearer the road, *Carex divulsa* and *Linum bienne* were seen.

Rubia peregrina was the most interesting plant seen at Baginbun cliffs (S 7.0) and at the coastal village of Slade (X 7.9) there was *Pastinaca sativa*, *Catapodium rigidum* subsp. *majus* and *Lycium chinense*.

The extensive sand-dune system at Ballyteige (S 9.0) was examined the following day. *Viola tricolor* subsp. *curtisii* was abundant, and there was some *Asparagus officinalis* subsp. *prostratus*, *Calystegia soldanella*, and *Vulpia membranacea*. *Atriplex littoralis* was the only plant of note in the salt-marsh behind the dunes.

There was an abundance of *Orobanche minor*, growing on *Trifolium repens*, close to the beach at Cullenstown. Close by grew *Linum bienne* and *Coronopus squamatus*, and *Trifolium scabrum* grew on hard-packed sand nearby.

Stachys arvensis grew in field margins at Barrystown (S 8.1) and in ditches close by there was *Oenanthe fistulosa* and *Lycopus europaeus*.

Carex divulsa was again seen along the roadside at Nelsons Bridge (S 8.1) along with *Valerianella locusta*, while *Eleocharis uniglumis* was recognised in the brackish marsh on the banks of the Owenduff River.

It was not possible to search for *Serratula tinctoria* in New Ross on the last day, but on the way home a pause was made at Bunclody (S 9.5) where Miss E. Booth showed us *Pyrola minor*, *Potamogeton* × *cooperi*, *Festuca altissima* and *Equisetum hyemale*, all quite close to the town.

A. M. O'SULLIVAN & D. DOOGUE

LOUGH SHESK, CO. MEATH. 29TH JULY

The purpose of the meeting was to explore further the flora of the area first visited by the leader in August, 1971, in the course of field-work for a Flora of Co. Meath. The attendance was 15.

The area (N 62.68) is situated in the morainic country of the Kells moraine and comprises a number of former lakes now at various stages of transition from fen to raised bog. The first area, with pH 6.5, was notable for the abundance of *Carex limosa*. Other species seen were *Pinguicula vulgaris*, *Utricularia vulgaris*, *U. minor*, *Menyanthes trifoliata*, *Hydrocharis morsus-ranae*, *Sparganium minimum* and *Carex* species including *C. dioica*, *C. lepidocarpa*, *C. panicea*, *C. paniculata*, *C. diandra* (abundant) and *C. rostrata*. *Phragmites australis* and *Cladium mariscus* were also seen. The new station for *Pyrola rotundifolia* in Co. Meath was demonstrated by the leaders while *Dactylorhiza traunsteineri*, also new to the county flora, was found by Mr Synott. Areas containing *Sphagnum* spp. and *Aulacomnium palustre* were covered with *Vaccinium oxycoccus*. Other less wet areas nearby held *Parnassia palustris*, *Galium uliginosum* and *Carex hostiana*. The second area was Dalton's bog, a transition complex with pH 5-6.2 with a rather dry centre with abundant *Sphagnum* spp., *Calluna vulgaris*, *Vaccinium oxycoccus* and *Ulex europaeus* and surrounded by wetter ground where bog development was less advanced. Bryophytes here included *Aulacomnium palustre*, *Mnium pseudopunctatum* and *Acrocladium stramineum*, together with *Menyanthes trifoliata*, *Ranunculus lingua* (in drains), *Carex diandra* (abundant) and *C. limosa*, the latter now almost excluded by the bog development. Acid grassland on moraines yielded *Juncus squarrosus*, *Galium saxatile*, *Molinia caerulea* and *Carex pilulifera*, while *C. curta* was seen near Connell's Lough. Murray's Lake proved to be dominated by dense beds of *Phragmites australis*, the more open margins of which yielded *Bidens cernua*, *Berula erecta*, *Hippuris vulgaris*, *Utricularia minor*, *Lycopus europaeus* and *Senecio* × *ostenfeldii*. *Coeloglossum viride* was found on the moraine nearby.

C. BREEN

EXHIBITION MEETING, 1972

The Annual Exhibition Meeting was held in the Department of Botany, British Museum (Natural History), London, on Saturday, 25th November, 1972, from 1200 to 1730 hours.

FOSSIL TEA IN BRITAIN?

Examination of the surface fine-structure of seeds from plants in the family Theaceae shows that modern species have a smooth surface while that on most fossil specimens is densely pitted. Seeds from the modern species *Actinidia arguta*, *A. coriacea*, *A. kolomikta*, *A. polygama*, *Eurya macartneyi*, *E. japonica* and *Cleyera ochracea* have been subjected to a variety of techniques (including KOH treatment, ultrasonic vibration and sectioning) in order to remove the smooth, outer surface layer of the testa. The results show that the pitted surface observed in the fossil seeds of *Actinidia* represents the inner cytoplasmic surface of the lower epidermal cell-wall. Specimens of the fossil species *Eurya stigmosa* have been examined from the Oligocene of Ireland, the Miocene, Oligocene and Eocene of England, and the Miocene of Germany, suggesting that this single species had a broader Tertiary distribution, both geographically and stratigraphically, than had previously been anticipated.

M. C. BOULTER

DOT-MAPS OF SPANISH PLANTS

A B.S.B.I.-type recording card for the Flora of Andalucia was shown, together with blank maps of Spain on the same scale as those in the *Atlas of the British Flora*. The object of the exhibit was to encourage members of the B.S.B.I. to start work on a Distribution Atlas of Spanish plants based on the U.T.M. 10 km squares, as the Spaniards themselves have not the amateur enthusiasm of our members (their interest mostly being in the practical use of plants, either as food, medicines or timber).

J. W. CARR

FLORA EUROPAEA AND ACCESSORY PROJECTS

The main exhibit gave some idea of the organisation of *Flora Europaea*, emphasizing the international collaborative nature of the project. Some of the accessory projects which have arisen out of the *Flora* were also shown. These included the *Index to European Taxonomic Literature*, compiled by R. K. Brummitt *et alii*, volumes for 1965–1969 published in *Regnum Vegetabile*, I.A.P.T., Utrecht (volume for 1970 in press); the first of a number of regional Floras of Europe to be based on *Flora Europaea*, J. Do Amaral Franco, *Nova Flora de Portugal*, 1. *Lycopodiaceae – Umbelliferae*, Lisbon, 1972; and the first volume of distribution maps to be published by the Committee for Mapping the Flora of Europe, J. Jalas & J. Suominen, ed., *Atlas Florae Europaeae (Distribution of Vascular Plants in Europe)*, 1. *Pteridophyta (Psilotaceae to Azollaceae)*, Helsinki, 1972 (distributed by Akateeminen Kirjakauppa, Keskuskatu 1, SF-00 100 Helsinki 10, Finland).

A. O. CHATER

LAMIAM ALBUM IN WALES

Maps and photographs were exhibited to show the occurrence of *Lamium album* in Wales and the adjacent parts of England in relation to altitude, type of locality (village roadside, railway premises, farm, garden, etc.), soil conditions, and association with ancient human occupation sites (including the coincidence with Roman sites). The location of early records and of known instances of long-distance transportation by

man were also illustrated. It is suggested that man is responsible for primary introduction and influences secondary spread. The survival and establishment (or otherwise) of seedlings and mature plants is likely to be linked not only to man's activities but also to other factors, both edaphic and climatic. Many factors probably account for the rarity of this species in western Wales and also for its virtual absence from western and north-western Scotland and from all but easternmost Ireland. Whether it is truly wild anywhere in Europe today is problematical.

A. P. CONOLLY

THE SEGREGATES OF *JUNCUS BUFONIUS* AGG.

Juncus bufonius L. agg. is a very variable taxon, but much of the variability is the result of phenotypic plasticity in various habitats. Three of the taxa often recognised as varieties of *J. bufonius* and which occur in western Europe appear to be best recognised as species distinct from *J. bufonius sensu stricto*.

The four species were illustrated by herbarium specimens, and maps and diagnoses were provided. *J. bufonius sensu stricto* is hexaploid (and octoploid?) and is ubiquitous. *J. foliosus* Desf. is frequent in wet or damp places mostly in western Britain and in Ireland; it is a tetraploid. *J. hybridus* Brot. (often called *J. bufonius* var. *fasciculatus* auct.) is a circum-Mediterranean diploid only known in the British Isles as a casual. The last species, *J. ranarius* auct. (Song. & Perr.?) is also a diploid and is frequent in the British Isles, mainly near the coast in saline or brackish areas.

T. A. COPE & C. A. STACE

VULPIA SICULA AND THE GENUS *VULPIA*

Vulpia sicula (Presl) Link (incl. *V. setacea* Parl.) is a very local grass of Sicilia and adjacent areas of which we have seen no specimens collected after 1881. In May 1972 we located it in western Sicilia and brought back living and pressed specimens for study. Since it and its segregates are the only known perennial species of *Vulpia* it is of both evolutionary and taxonomic interest. We have found it to be a diploid and most closely related to *V. geniculata* (L.) Link. The exhibit was illustrated by living and pressed specimens of *V. sicula*, *V. geniculata* and other species of *Vulpia*. From a world-wide study of *Vulpia* we have concluded that it in fact consists of four distinct genera. *V. sicula*, *V. geniculata* and two other annuals belong to *Loretia* Duval-Jouve, and the four British (as well as the majority of other) species to *Vulpia sensu stricto*. The other two genera are Mediterranean taxa.

R. COTTON & C. A. STACE

BRITISH PTERIDOPHYTE ATLAS - AN INTERIM PUBLICATION

The exhibit showed examples of the fern maps to be published in an A4 format in 1973. Considerable changes from the distribution patterns previously published in the *Atlas of the British Flora* (1962) are mostly due to more complete coverage. Certain critical groups are being reworked, e.g. *Dryopteris filix-mas/pseudomas*, *Asplenium trichomanes* subsp. *trichomanes/quadrivalens*, *Isoetes lacustris/echinospora*, *Diplazium alpinum/issleri/complanatum* and *Polypodium vulgare/interjectum/australe*. Local workers who find difficulties with these species are asked to send them to the Department of Botany, British Museum (Natural History).

The co-operation of vice-county recorders was greatly appreciated in this project, and we hope the resulting maps will help botanists to plan their field work during the following years so that the maps which will be published in the second edition of the *Atlas* will be even more useful.

J. A. CRABBE, A. C. JERMY, F. H. PERRING & A. J. WORLAND

CAREX MURICATA AGG.

Herbarium sheets and colour photographs were shown of the four generally accepted taxa of this group occurring in Britain: *C. spicata* Huds., *C. muricata* L., *C. muricata* subsp. *leersii* Aschers. & Graebn., and *C. divulsa* Stokes, together with the plant sometimes referred to *C. chaberti* F. Schultz. Attention was drawn to the two outstanding questions: Is there really, as Nelmes thought, a distinct limestone form of *C. muricata* L. as well as the common form of sandy and gravelly soils (which Nelmes named *C. bullockiana*)? And what are the status and relationships of subsp. *leersii* and of *C. chaberti*?

R. W. DAVID

RISE AND FALL IN B.S.B.I. MEMBERSHIP, 1942-1972.

This exhibit showed by histograms the rise from 450 to 1900 members in the above period. It revealed rises in some periods, due partly to the Maps Scheme, with checks in others, probably due to rises in the rates of subscription.

C. M. DONY

REVISION OF THE FLORA OF BEDFORDSHIRE

The *Flora of Bedfordshire* (1953) went out of print in 1971 and in anticipation of this a revision based on tetrad recording was begun in 1970. The revised Flora will be similar to the *Flora of Hertfordshire* (1967) and link it with work now being done in neighbouring counties.

The exhibit consisted of a number of maps showing progress in the three years of the survey and illustrating patterns of distribution already emerging. It is estimated that 67% of the work required to achieve the same intensity of recording that was realised for the Hertfordshire survey has been accomplished.

J. G. & C. M. DONY

FLOWERS OF EUROPE

The exhibit showed a selection of photographs taken by O. Polunin for *Flowers of Europe - A Field Guide* (1969), and line drawings executed for the same book by B. Everard. The latter were mainly drawn from herbarium specimens loaned by the Royal Botanic Garden, Edinburgh.

B. EVERARD & O. POLUNIN

STEREOPHOTOGRAPHS OF SOME INCONSPICUOUS
BRITISH FLOWERING PLANTS

Close-up stereophotographs of living plants make it possible to see small structures in their proper relation and in more detail than can be seen with the naked eye. Starting with *Wolffia arrhiza*, in which the entire plant is difficult to see, a series of photographs were shown of small flowers taken in the field in natural conditions with the minimum of disturbance. The photographs were taken at a distance of 12 cm using a split lens of 55 mm focal length with offset stops (to f 28) 12 mm apart. This gives a magnifying effect with little exaggeration of apparent depth.

J. H. FREMLIN

THE CORNE FLAGGE - A NEOLITHIC PLANT?

The 'Corne Flagge', *Gladiolus italicus* Miller (*G. segetum* Ker-Gawler), was one of the three common gladioli grown in English gardens for several centuries before the intro-

duction of today's African hybrids during the nineteenth century. It is a serious Mediterranean agricultural weed.

This species has certain unusual characters which make its origin and evolution a matter of some interest. Thus it is confined to cultivated fields, usually cornfields; it is the only recorded *Gladiolus* (out of *c* 200 species) which exhibits gynodioecism; it has hard, pellet-like seeds unlike the usual winged *Gladiolus* seeds; it exhibits very high aneuploid chromosome counts that approach duodecaploidy ($2n = 180$), whereas most species are either diploids or tetraploids.

An obvious conclusion is that *G. italicus* is a 'man-made' plant. From the limited evidence available the exhibit made out a *prima facie* case for species like tetraploid *G. triphyllus* Sibth. & Sm. and *G. persicus* Boiss. being incorporated as weeds into seed corn by Neolithic Man, and the subsequent simultaneous but unconscious selection of duodecaploid *Gladiolus* and hexaploid wheat from their tetraploid progenitors.

A. P. HAMILTON

THE FLORA OF ESSEX

The exhibit reported on progress with production of this new Flora. Water-colour plates of six famous Essex plants prepared for inclusion in the Flora (among them *Lathyrus tuberosus*, *Tordylium maximum* and *Bupleurum falcatum*) were displayed along with manuscript text entries outlining in some detail the history of these plants in the county. 24 individual 1 km dot-maps were selected from the 200 or so to appear in the Flora, along with each appropriate text entry, as examples of species distribution patterns showing distinct edaphic and climatic associations. The complexity of the late Eocene and subsequent glacial deposits was shown to give rise to some unusual distributions. Specimen printed pages showing the format of the main species-occurrence and -distribution section and a full-page plate of 10 km square distribution maps of commoner species were exhibited along with preliminary artwork for a $\frac{1}{4}$ " fold-out geological map of the county.

S. T. JERMYN & K. J. ADAMS

BETA TRIGYNA AND LINARIA $\times$ DOMINII IN BERKSHIRE

B. trigyna was first recorded in its Berkshire site in 1902, and then remained unnoticed until 1966, when it was found by the exhibitor. It needs to be kept free from brambles and other coarse vegetation, and this may be one reason for its rare and sporadic appearances; it has been recorded only from Gloucestershire, Oxfordshire, Surrey and Cambridgeshire. The Berkshire stand is flourishing and increasing.

There appear to be few records of *L. $\times$ dominii* in Britain. The flowers of the specimens exhibited were short-spurred, but had the deep violet upper lip of *L. purpurea*; the leaf-growth varied, one plant having the whorled lower leaves of *L. repens*. All the hybrid plants had non-creeping rootstocks in contrast to the long rhizomes of *L. repens*. They were apparently semi-fertile, some capsules being full of seeds.

W. M. KEENS

WHERE HAS VICIA SATIVA GONE?

Specimens were exhibited to suggest that British populations of *Vicia sativa* agg., past and present, mostly fell into three categories – not two as stated in some national Floras. Using flower-colour, pod-colour, pod-breadth and the shape of upper leaflets (criteria which seem more helpful than others previously used), they may be keyed as follows:

1. Delicate plant to 60 cm; leaflets often 5 times as long as broad; standard petal virtually as dark as wings; flowers 11–14 mm .. *V. angustifolia* subsp. *angustifolia*
1. Coarser plant to 1 m; leaflets broader; standard petal much paler than wings; flowers usually over 14mm
2. Pods 4–5·5 (–6)mm broad, ripening black; flowers 12–17 mm; leaflets typically 3–4 times as long as broad *V. angustifolia* subsp. *segetalis*
2. Pods 6–9 mm broad, ripening yellowish-brown; flowers (17–) 20–30 mm; leaflets typically 2–3 times as long as broad *V. sativa sensu stricto*

These taxa, based on those outlined in the *Flora of Wiltshire* (Grose 1957), agree well with those recognized in Germany by Mettin & Hanelt (1964).

The cultivated plant (*V. sativa sensu stricto*) seems scarce, doubtfully self-perpetuating and decreasingly grown. Nearly all the British plants belong to *V. angustifolia sensu lato*, of which subsp. *angustifolia* is commonly found in permanent, acid or nutrient-poor grassland, and subsp. *segetalis* among coarse grasses on 'good' soil.

REFERENCES

- GROSE, J. D. (1957). *The Flora of Wiltshire*. Devizes.
 METTIN, D. & HANELT, P. (1964). Cytosystematische Untersuchungen in der Artengruppe um *Vicia sativa* L., 1. Kulturpflanze, 7: 163–225.

H. J. KILLICK

EXTENSION OF RANGE OF *ALISMA GRAMINEUM*

IN BRITAIN

Maps were shown illustrating the Continental distribution of *A. gramineum* subsp. *gramineum* and the old newly-discovered British localities, together with their respective herbarium sheets; flight lines of migrating ducks were superimposed.

Migration and movement of wildfowl was suggested as the reason for the new localities in Norfolk and Cambridgeshire. In support of our claim that ducks and waders are the most likely agents for both introduction and dispersal we have received confirmation from Mr R. P. Bagnall-Oakley that 'thousands of ducks come through Denmark from the Baltic area every autumn. Ringing recoveries show constant movement between the Ouse Washes and the Humber region. Examination of stomach contents of ducks shows that seeds of a wide variety of marsh and water plants, including Water Plantains, are regularly eaten'. Although seeds may not survive passage through the alimentary tract, they can readily adhere to the plumage of the birds.

R. P. LIBBEY & E. L. SWANN

HERACLEUM SPHONDYLIIUM × *H. MANTEGAZZIANUM*

Heracleum sphondylium is so common that it will never be far off where the Caucasian *H. mantegazzianum* occurs in Britain. Some of the differences between the two species were shown in a table, together with herbarium specimens collected in 1972 in Caithness, Edinburgh and Berwick, and in the exhibitor's wild-garden at Platt, W. Kent.

It is difficult to be sure of the hybrid origin of many plants, but the putative hybrids exhibited were intermediate in most characters, had a scruffy look and showed a reduction in, or absence of, fertility. Only one mention of this hybrid has been traced in print (Praeger 1951) and there is no specimen in support. The only other specimens of it known were collected by Miss Muirhead in 1970 and are now in E. But before that Dr Brummitt felt sure he had found it in a large mixed colony near London Airport, in Middlesex.

Will others look out for this hybrid, which must surely be much more widespread, and report?

REFERENCE

- PRAEGER, R. L. (1951). Hybrids in the Irish Flora: a tentative list. *Proc. R. Ir. Acad.*, Sect. B, 54: 1-14.

D. MCCLINTOCK

THE FLORA OF FOULA

The exhibit consisted of maps, photographs, plant lists and reports showing how the study of the vegetation of Foulis has progressed since 1956 under the aegis of the Brathay Exploration Group of Ambleside.

K. G. MESSENGER

A NEWLY-DISCOVERED *HORTUS SICCUS*

DATING FROM THE 1820s

This collection was discovered in Stockport Museum in 1972. It contains a large number of specimens from the Stamford area of S. Lincs. and Rutland, south-eastern Ireland, Scotland, Cambridgeshire, etc. Efforts are currently being made to establish the identity of the collector, and there are pointers to the possibility that he was an associate of Professor Henslow.

K. G. MESSENGER & THE MANCHESTER MUSEUM

SOME CHANNEL ISLANDS STAMPS AND PLANTS

During 1972 the postal administrations of both Jersey and Guernsey each issued a set of four wild-flower stamps. On display were first day of issue envelopes, presentation packs, maximum cards, and herbarium material loaned by the Société Jersiaise. The Jersey set illustrated *Anogramma leptophylla*, *Armeria arenaria*, *Orchis laxiflora* and *Echium plantagineum*; and the Guernsey stamps depicted *Oxalis pes-caprae*, *Orchis maculata* (sic), *Carpobrotus edulis* and *Anagallis arvensis*.

Y. L. MOSCATI

AN UNEXPECTED SOURCE OF BOTANICAL RECORDS

A note on *Spiranthes spiralis* growing in the precincts was published in the Winchester Cathedral Diary for 22nd October-18th November, 1972.

F. H. PERRING & T. G. TUTIN

KENT TETRAD MAPPING SCHEME 1971-1975

A progress map showed the number of species so far recorded from each tetrad in the county. The total number of records in and processed to date was well over 100,000. The exhibit also contained several species maps in which the present recorded distribution in the county was compared with that given in the *Flora of Kent* (Hanbury & Marshall 1899). Some species such as *Phyteuma tenerum* and *Myosurus minimus* had now gone from the county whilst others such as *Campanula glomerata* and *Centaurea calcitrapa* showed marked declines. On the other hand there were species which showed a spectacular increase in distribution such as *Petasites fragrans* and *Coronopus didymus*,

whilst others such as *Impatiens glandulifera* and *Spartina anglica* had appeared since 1899. Perhaps more interesting were those species such as *Ranunculus penicillatus*, *Legousia hybrida* and *Lemna gibba* which showed an almost identical distribution with that of over seventy years ago.

E. G. PHILP

LEICESTERSHIRE & RUTLAND FLORA: THE ECOLOGICAL AND GEOLOGICAL SETTING

Most Leicester and Rutland species of great local interest are found in four main habitats, now drastically reduced: predominantly acid soil in Charnwood Forest; open or semi-open habitats on oolitic limestone; small areas of marsh, wet heath or fen; and remnants of ancient woodland.

Charnwood has a few northern or montane species (e.g. *Empetrum nigrum*) and south-western or western species (e.g. *Umbilicus rupestris*) at the limit of their British range, probably restricted to the area for climatic reasons. Species with an Atlantic or Sub-Atlantic distribution (e.g. *Erica tetralix*) also are concentrated in Charnwood, at least partly for climatic reasons. Other more common British species (e.g. *Nardus stricta*) are missing elsewhere because of the absence of suitable habitats.

Likewise, climatic factors probably explain the restriction to the oolite of some southern or eastern species, here near the British limits of their ranges; other 'oolite' species (e.g. *Blackstonia perfoliata*) reach their limits further north or west than Leicestershire and Rutland. Another group of species is concentrated on the oolite for edaphic reasons only (e.g. *Helianthemum nummularium*).

D. RATCLIFFE & A. P. CONOLLY

THE VISIT TO THE CASTLE OF MEY

H.M. Queen Elizabeth, the Queen Mother, graciously received the members attending the C.S.S.F. field meeting at Dunnet, Caithness at the Castle of Mey on 17 August, 1972 (see p. 420 for full report). Her Majesty entertained the party to tea, showed them her garden and led a visit to the shore of the Pentland Firth where a fine specimen of *Mertensia maritima* was seen. Photographs by Mr A. M. E. Luciani and press cuttings referring to this occasion, unique in the history of the Society, were exhibited.

B. W. RIBBONS

THE HERBARIUM OF LORD DE TABLEY (1835-1895)

A Xerox page of the MSS of the *Flora of Cheshire* (1899) in the handwriting of John Byrne Leicester Warren, 3rd Baron de Tabley, referring to *Centunculus minimus* and *Chelidonium majus* conjointly with the specimens, was exhibited. The de Tabley Herbarium of 20,000 sheets was donated in 1899 to the Science and Art Museum (later the National Museum of Ireland) by Eleanor Lady Leighton, Knutsford House, Cheshire, a sister of Lord de Tabley. The herbarium forms the core of the British section of the Herbarium now at the National Botanic Gardens, Glasnevin, Dublin.

M. J. P. SCANNELL

RECENT ADDITIONS TO THE IRISH FLORA

Herbarium specimens of three taxa recently added to the Irish flora were exhibited.

Juncus planifolius R.Br. was collected at Lough Truscan, W. Galway, in July 1971.

It is common in wet habitats in Australia, Tasmania and New Zealand, and is also found in Chile and Hawaii; the Irish record appears to be the first in the Northern Hemisphere.

Rorippa islandica (Oeder ex Murray) Borbás *sensu stricto* was collected from Renvyle, W. Galway by Shuttleworth in 1832 and by Dr B. Jonsell in 1964. In August 1971 it was found at Turlough, south of Bealaclogga, Clare. In Britain also it is much rarer than the widespread *R. palustris* (L.) Besser.

Polystichum $\times$ *illyricum* (Borbás) Hayek (*P. lonchitis* $\times$ *P. aculeatum*) was collected by Praeger at Glenade, Leitrim, in 1932, but its identity was not confirmed until 1972, by Dr A. Sleep. It is so far the only record for the British Isles. For a full report see *Br. Fern Gaz.*, 10: 281-282 (1972).

M. J. P. SCANNELL

DOUBLE-FLOWERED FORMS OF *ERICA MACKAIANA*

Despite various claims to the contrary (cf. McClintock 1966) *Erica mackaiana* is the only *Erica* of which a double-flowered form has undoubtedly existed. Moreover there have been two different ones:

1. A fully double form 'Plena', called *E. crawfordii* by Druce, was collected at Craigamore by A. G. More in 1869, by Crawford in 1891, by Father Brenan in 1965 and by D. Burke in 1970. All the collections seem identical and the clone has probably persisted there for at least a century.

2. A form also exists with only the corolla duplicated; the stamens and style are intact. This was collected by A. G. More in 1874 at Carna. The character is not obvious and there is no indication that he was aware that some of his plants had this unique feature. The Rev. E. F. Linton probably also collected it in 1885, Miss Knowles did in 1910, and Miss M. Scannell rediscovered it in 1970. In 1971 she brought back living plants, which have been propagated; one of these was exhibited along with dried specimens of earlier gatherings.

REFERENCE

McCLINTOCK, D. (1966). Double-flowered hardy heathers. *J. R. hort. Soc.*, 91: 438-443.

M. J. P. SCANNELL & D. McCLINTOCK

FESTUCA GLAUCA LAM. AND ITS VAR. *CAESIA* (SM.) K. RICHT.

The var. *caesia* has usually been considered a distinct variety of *Festuca glauca* Lam. From a study of *F. glauca* in the Suffolk Breckland it is concluded that var. *caesia* is only a habitat modification resulting from unfavourable conditions.

The exhibit illustrated a paper published in *Watsonia*, 9: 257-262 (1973). It included herbarium sheets showing *Festuca glauca* grown under 'normal' conditions; depauperate specimens of var. *caesia* illustrating the drought-induced poverty of leaf-growth; a normal plant of *F. glauca* grown under garden conditions from a depauperate plant formerly considered as var. *caesia*; and a collection of depauperate grasses from the Suffolk Breckland (*Vulpia ambigua*, *V. bromoides*, *Aira praecox* and *Poa subcaerulea*).

P. J. O. TRIST

PANELS OF PHOTOGRAPHS

Further excerpts from an attempted photographic record of the wild plants of a hill sheep farm in the upper reaches of Tima Water, Selkirkshire (v.c. 79), were shown. The plants illustrated were *Anemone nemorosa*, *Ranunculus ficaria*, *Galium boreale*, *Cirsium vulgare* and *Cirsium heterophyllum* (see *Watsonia*, 9: 205 (1972)).

A. WALKER

The following also exhibited:

- COMMITTEE FOR THE STUDY OF THE SCOTTISH FLORA. Inverness-shire survey.
T. W. J. D. DUPREE & S. M. WALTERS. *Senecio paludosus* L. refound in Britain.
G. ELLIS. Flora of Glamorgan.
A. N. GIBBY. Some botanical postage stamps.
G. S. PHILLIPS. Majorcan selection.

In the lecture hall the following members gave short talks illustrated by colour-slides:

- H. J. B. BIRKS. Flowers of the Durmitor area, Montenegro.
J. W. CARR. Some unusual Spanish flowers.
E. R. T. CONACHER, B. W. RIBBONS & O. E. WATT. The field-meeting at Dunnet, Caithness, August, 1972.
J. L. MASON. Vegetation on the Mountains of the Moon.
F. H. PERRING. Kindrogan field-meeting, July, 1972.
C. F. SMITH. Wild orchids of Dorset.
F. M. TAYLER. Flora of cliffs and denes on the Durham coast.



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Edited by P. J. Wanstall

The purpose of this volume is to make available to a wider public the papers read at the Conference held by the Botanical Society of the British Isles in 1961. The contributors include D. E. Allen, Dr H. J. M. Bowen, Dr J. G. Dony, J. S. L. Gilmour, Prof. J. G. Hawkes, D. H. Kent, J. E. Lousley, D. McClintock, R. D. Meikle, Dr F. H. Perring, R. C. Readett and C. C. Townsend.

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THE *TARAXACUM* FLORA OF THE BRITISH ISLES

By A. J. RICHARDS

*A Supplement to Watsonia, Journal and Proceedings of the
Botanical Society of the British Isles, vol. 9, 1972*

Price £2.00 plus postage

The genus *Taraxacum*, commonly known as Dandelions, has been largely neglected in the British Isles, although it is of botanical, ecological and economic importance. Most accounts of the genus in this country consider only four species, which are too general in scope to be of much service.

In the present account the author shows that, due to the apomictic (non-sexual) means of reproduction usual in the genus, a much larger number of clear-cut species can be recognised in Britain, 132 in all, and that these demonstrate characteristic ecological and distributional behaviour.

A substantial introduction, with notes on the taxonomic history, biology, genetics, taxonomy, distribution, identification, cultivation and collection of the British species, is followed by a key to the species. In the main account, each species is treated individually with nomenclature, a full description, breeding behaviour, ecology, British distribution (including a vice-county list), European distribution and general notes and comments repeated in each case.

Each species is illustrated with line drawings and there is a full index.

Although our knowledge of the British species of the genus is still incomplete, it is hoped that this work will form a standard reference for a number of years and thus should be valuable to Universities, Colleges, Field Stations, Museums and to all botanists interested in the higher plants of the British Isles.

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A. J. RICHARDS

Supplement to Volume 9, 1972

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THE *TARAXACUM* FLORA OF THE BRITISH ISLES

A. J. RICHARDS

Department of Botany, University of Newcastle-upon-Tyne

Supplement to Volume 9, 1972

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Introduction

HISTORICAL

The first attempts to differentiate the British and Irish species of *Taraxacum* were made at the beginning of this century when Beeby, Marshall, Druce and others attempted to apply a few 'macrospecies' names to a number of forms. This met with mixed success, and the situation did not improve with the appearance of works by Handel-Mazzetti (1907) and Raunkiaer (1906). The complications arising from efforts to impose a 'macrospecies' system onto an agamospermous group have dogged the taxonomy of this and other genera ever since.

Later, Druce became aware of the work of Dahlstedt, Lindberg and Palmgren, who, following the discovery of agamospermy in *Taraxacum* by Murbeck in 1904, delimited 'microspecies', and later created sections in the genus. In the 1920's, Druce and Johnston sent a very large number of British collections to Dahlstedt, who described no less than 72 species from this material. Dahlstedt's determinations were all reported in the *Reports of the Botanical Society and Exchange Club of the British Isles*. Of these 72 new species, only 20 are recognised in the present work. Another 32 are synonyms, 12 are *nomina nuda* without types or descriptions (some resulting from Druce's mis-spellings of Dahlstedt's names), and 8 are, in my opinion, worthless due to the inadequacy of the type material.

In addition, Dahlstedt recorded another 81 species from the British Isles. Of these, I accept 53, although not all from the original Dahlstedt records. Of the remainder, 25 are mis-identifications, or are identified from material that I consider inadequate, and three are long-standing synonyms. This inauspicious start to the understanding of British and Irish *Taraxaca* has been instrumental in retarding interest in this important genus in the British Isles.

In 1933, Degelius, a colleague of Haglund at Stockholm, paid a visit to Ireland and Wales in search of lichens, and returned with a number of seed-packets of *Taraxacum*. These were grown at Lund, and the results published (Haglund 1935). Two new species were described (one of which is a synonym) and seven new species were recorded (one of which is a synonym for another unrecorded species). Eight new species were thus added to the British and Irish lists.

No further work was published until the late 1950's when van Soest, of the Hague, revised the collections of Oxford, Kew and the British Museum. This excellent work has done much to clarify problems of synonymy and mis-identification, and provides the corner-stones upon which the present work is based. Van Soest was able to identify 15 species new to the British Isles, making a total of 96 accepted species by 1960. Nearly 200 names had appeared in the literature for the British Isles by then. Since that time, with much help from Professor van Soest and Dr Lundevall, of Stockholm, I have recorded 28 more species from the British Isles and, in addition, described a further seven. Altogether 132 species are known at present.

With such a chequered history, it is not surprising that *Taraxacum* has earned

an equivocal taxonomic reputation in Britain. This is not true elsewhere. Scandinavia, in particular, has seen many competent Taraxacologists (at least 40 in as many years). Many of them, such as Gustafsson, Sørensen, Wendelbo, Persson and Hultén are well-known botanical personalities. They have used *Taraxacum* microspecies in geographical, ecological and genetic studies with some considerable effect.

In my opinion, such confidence is well-placed. I first approached the genus with a view to 'lumping' the microspecies into aggregates through the techniques of experimental taxonomy and taximetrics. Although this work produced results of interest, I became increasingly convinced that the microspecies obeyed all the dictates of 'good' species, being well-defined by constantly correlated characters, each microspecies with its own diagnostic geographical, ecological and genetic behaviour. It seemed that taxonomic difficulties had arisen, not so much as a result of the inherent difficulty of the genus, but more through a history of uncritical work. In particular, leaf characters seem to have caused confusion.

PHENOTYPIC PLASTICITY

All species, but particularly those belonging to the section *Vulgaria*, produce leaves of a wide variety of shapes during the life of the plant (Fig. A). Juvenile leaves are atypical, usually being ovate-spathulate and somewhat entire. These persist through to the second year, and even longer in some cases (e.g. the *T. croceum* group, nos. 52–57). It is likely that the leaves of (for instance) 17. *T. oxoniense*, 36. *T. faeroense*, 49. *T. lainzii* and 57. *T. hypochaeris* represent neotenuous forms, never reaching, at least in some instances, the adult dissected condition. This argument can be carried further to suggest that the occurrence of various degrees of leaf-dissection found in individuals, in species and in groups of closely related species may be regarded as various phases on an ontogenetic scale. This ontogeny may be interrupted by habitat: plants from unusually shaded sites usually have rather entire leaves and cannot be identified. Conversely, plants from mown or grazed turf, paths or particularly exposed sites usually have very dissected leaves, which, combined with their dwarfness, renders identification very difficult. An additional difficulty is that in most species the ontogenetic pattern is recapitulated each year. The first leaves to emerge after the winter frosts are small, rather undissected, and bear what may be usefully regarded as the basic theme of characters in a simple form. These leaves, which are usually found around the outside of a plant in full spring flower are most important taxonomically, both for purposes of identification, and as a basis for the understanding of the phenotypic potential of the later leaves. These latter, usually more dissected, always bigger, and much more plastic, are dominant during the main flush of flowering. As flowering ceases, they die back, and are replaced by the summer leaves, of a phenotype which is maintained for the remainder of the season. These are still larger in most cases, and often even more dissected. In these summer leaves, the characteristic leaf morphology of each species is usually lost, and identification depends on other characters. However, these (for instance the posture, shape and colour of exterior bracts) can also become unreliable late in the season. For these reasons the identification of individuals from abnormally exposed or shaded sites, or from outside the main flowering period (April and May, except at altitude)

should never be attempted. Small juvenile forms should also be ignored in most cases, particularly in sections *Spectabilia* and *Vulgaria*.



FIGURE A. Plasticity in leaf-shape in *Taraxacum nordstedtii* Dahlst.

- (a) Juvenile leaf from Bix Bottom, Nettlebed, Oxford, 17/5/1968.
- (b) Mature leaf from shade, Hexham, Northumberland, 14/5/1971.
- (c) Mature leaf from meadow, Bråborg, Östergötland, Sweden, 10/6/1967.
- (d) 'Summer form' leaf, Hexham, Northumberland, 19/9/1970.
- (e) Cultivated plant, originally from Bontddu, Dolgellau, Merioneth. All plants transplanted to greenhouse conditions assume this morphology.

CULTIVATION

If identification is required of individuals in an unsuitable phase, the only solution is cultivation. *Taraxaca* grow very readily from seeds or roots, and spring-flowering individuals in the experimental garden or greenhouse can usually be identified. Summer and autumn-flowering specimens, however, show the usual difficult phenotypes (often accompanied by mildew), but the spring phenotypes can be induced in a greenhouse by subjecting the plants to a 12 hour day.

While cultivation is important as an aid to the identification of difficult material, it is also valuable as a taxonomic tool, for it is only through the comparison of two plants in standard conditions that sound conclusions may be drawn as to their relationship. For instance, cultivation has enabled many 'species' to be relegated to synonymy. However, the frequent criticism that *Taraxacum* species have not been tested in this way, and only represent phenotypic modifications of the same genotype (often made in the same breath as another frequent criticism, that *Taraxacum* species are untenable because there is an infinity of different genotypes!) is not on the whole justified. Although it is true that a number of *Taraxacum* species have not been tested in cultivation, this has been due to the lack of material suitable for cultivation, rather than any

shortcomings on the part of the taxonomist. Indeed, all the major *Taraxacum* taxonomists have been great cultivators, and the nature of the plasticity of *Taraxacum* leaves has been described by several of them. The poor quality of the British Dahlstedt species can be blamed on the quality of the material sent to him (the quality of *Taraxacum* material collected by the British has changed little in 50 years!) and his failing powers in later years. His early work, the foundations of *Taraxacum* taxonomy, is excellent and clearly shows his full understanding of phenotypic modifications.

SEXUALITY

One basic chromosome number is found throughout *Taraxacum*, $x=8$. Diploid ($2n=16$) species are invariably sexual, and usually self-sterile. It is thought that about 10% of all *Taraxacum* species may be of this type (Richards 1970a). These are mostly confined to Asia, but are also found in North Africa, Greenland, South America and in Europe. Two are native to the British Isles (1. *T. brachyglossum* and 67. *T. subcyanolepis*), but neither are restricted to the diploid state, and both can be agamosperous. Also, 5. *T. austriacum* and 66. *T. obtusilobum*, which have been found as casuals in this country, are diploid and sexual. It is not improbable that a rare type of facultative agamospermy described by Sørensen (1958) is also found in this country, although there is as yet no evidence of it. This might be found in some disomic triploid individuals ($2n=23$).

Triploid species ($2n=24$, or rarely 25, 26, 27, 28) are usually obligate agamosperms, that is to say that they are invariably apomictic in reproduction, producing seeds and progeny of an identical genotype to the parent, without sexual fusion, and with little if any recombination and segregation. This has the effect of minimising genetic variation within a species. Indeed, it may well be that many species are virtually genetically uniform and are unchanged since their origin as agamosperms.

However, triploids ($2n=24$) in species which have diploid members can be partially sexual. These are known as facultative agamosperms. This mechanism, which is found in the British species *T. brachyglossum* and *T. subcyanolepis*, is more fully explained elsewhere (Richards 1970a). These facultative agamosperms share with diploid sexuals the characters of small, regular pollen (due to a relatively regular male meiosis) and poor seed-set (due to self-incompatibility in sexual ovules).

Tetraploids ($2n=32$), pentaploids ($2n=40$) and hexaploids ($2n=48$), all found among British species, are, as far as is known, invariably obligate agamosperms.

The sexual species of Asia and southern Europe are no less critical taxonomically than the agamosperms. They form local races and clines and show polymorphism, and are in some cases but poorly separated. They occur in areas in which agamosperms are comparatively local, but in northern Europe, sexual species result in taxonomic chaos when growing with agamosperms. Populations in northern England containing *T. brachyglossum* and *T. subcyanolepis* cause considerable problems, and this has been shown to be due to hybridisation of the sexuals with polliniferous agamosperms (Richards 1970b). Sexuality was first suspected in *T. obtusilobum* on account of the wide range of phenotypes occurring in some Swedish populations (Gustafsson 1937). More recently, the

variation in the *T. punctatum* A. J. Richards—*T. austriacum* complex in Slovakia has been shown to be due to sexuality (Richards 1970c). It is not unlikely that the complexity of the *T. laetum*—*T. obscurans* Hagl. group in Sweden will be found to have a similar cause. However, sexuality is not common, and at most sites the individuals of a microspecies will show no variation, being probably of one genotype (see Fűrnkranz (1966) for the opposite opinion). What is very probably the same genotype can be found throughout Europe, well-defined, and separated from its nearest relatives by a considerable taxonomic distance.

This situation is one for which I was unprepared, and which will sound remarkable to those not acquainted with the genus. Tradition says 'sexual species are not critical; agamosperms are'. Here we find the converse. Why should this be the case? I think it is likely that the sexual progenitors of the British species evolved in isolation in southern Europe or western Asia during the glacial periods. They did not evolve isolating mechanisms and are interfertile when they meet. At the close of the last glacial period they may have migrated north as an enormous 'hybrid swarm', meeting ancestral arctic agamospermous species (now placed in the sections *Ceratophora* Dahlst. and *Arctica* Dahlst.), and becoming 'fixed' as agamosperms as a result of hybridisation with them. Thus a vast hybrid swarm would have been 'frozen' in a short space of time, as inviolate genetic units in a vast morphological continuum (this model will be argued more fully in a forthcoming paper). The reason that this continuum has not been passed down to the present-time unscathed, is the same as that controlling the discreteness of sexual species. Natural selection operates on agamosperms just as efficiently as it does on sexual species, and we can only expect the fittest genotypes to have survived, resulting in the present morphological discontinuities, or, if it is preferred, species or microspecies.

THE STATUS OF *TARAXACUM* SPECIES

The principles governing the taxonomy of *Taraxacum*, and other genera containing obligate agamosperms, have long been a source of vigorous controversy. The two schools of thought can be briefly designated as 'splitters', who believe in describing agamospecies or microspecies, invariable genetic units of 'low' status such as are to be found in this account; and 'lumpers', who prefer to look for wider discontinuities which may be used to describe 'macrospecies' or 'circle-species'. These are frequently of a similar nature, or even identical to the sections used by the splitters. It must be admitted that the large number and the critical nature of microspecies found in such genera as *Hieracium*, *Rubus*, *Sorbus*, *Alchemilla*, *Crataegus* and *Ranunculus auricomus* agg. (and, to a great extent, in *Taraxacum*) are not suited for general use by the non-specialist. Just when they can be used is not readily stated. Many leading field-botanists have become proficient at the identification of critical groups, as the maps of *Hieracium*, *Sorbus* and *Alchemilla* in the *Critical Supplement to the Atlas of the British Flora* testify, and such expertise is of value especially when one or more specialists in the groups are willing to give fully of their time in aiding more difficult identifications and acting as a control and guide. Phytogeographical studies, and phytosociological work will undoubtedly benefit from the use of microspecies; and one must expect workers on physiological, genetic and cytological problems in the genera to be conversant with the microspecies taxonomy. At the same time, more general studies can quite usefully be restricted to taxa of a wider

scope, and here the 'macrospecies' can be defended. My personal opinion is that in most cases taxa of wider scope, the sections, already exist and should be used.

DISTRIBUTION OF SPECIES IN THE BRITISH ISLES

Although some Watsonian vice-counties have been fairly thoroughly covered, our knowledge of the distribution of the species over most of the country is at best uneven, and is mostly very inadequate (see p. 12). We are not yet anywhere near a state in which *Taraxacum* species can be mapped on a 10km grid. It is hoped that this goal will be achieved in the fairly near future, and it is towards this that this work is aimed, at least in part. Only then will we be able to make meaningful phytogeographic conclusions, based on an objective and thorough system. At present, many anomalies appear, and these will no doubt be seized upon by critics of this work, and of agamospecies in general. For instance, during this work I have resided at Durham (v.c. 66) and Oxford (v.cs 22 and 23). Not only do these counties figure prominently in the distribution lists, but many rare species are found to be restricted to one or more of them.

Although I admit this bias, and although these are among the few counties which I consider have received an adequate coverage, there are a few points to be made in defence. Firstly, the bias in favour of the Thames Valley basin is due more to the work of Druce, 50 years ago, than to mine. Secondly, other areas which I have worked thoroughly (Buckinghamshire (v.c. 24), Northumberland (v.cs 67 and 68) and Cumberland (v.c. 70) for instance) and which other people have worked (Cambridgeshire (v.c. 29), Channel Islands (v.c. S) and Mull (v.c. 103) do not show a concentration of rarities; while other, relatively little-known counties (Fife (v.c. 85), Mid-Perth (v.c. 88), Forfar (v.c. 90) and West Sutherland (v.c. 108) for instance) do show such a concentration. Furthermore, Durham and the Thames Valley have localities of some botanical renown, and it is in these (Upper Teesdale, the Thames meads etc.) that the rare dandelions are found. The bias is, I suspect, not important in the rare and local native species. These, being mostly of a relict nature, are found in well-known areas, favoured by botanists, much as rare and local species in other genera are. The bias is rather important in many of the commoner species however. There is no doubt that some of these are very widespread and may occur in every county, but at present they are recorded from only those counties for which there is adequate coverage. This is particularly true for species in the section *Vulgaria*. The distribution of the remainder is better known, and in many cases, although in no way exhaustive, the coverage may give a reasonable picture of the species' distribution in Britain. In Ireland, however, the coverage is totally inadequate, and most counties have no records whatsoever.

The recording bias can also be detected in the rare species that are thought to be introduced. These are plants of waste, man-made places, which are local, scattered and without a coherent distributional pattern in this country. Although in no case can recent introduction through the agency of man be proven, early records being far too scanty, in a number of species recent introduction can be very strongly suspected. Here there is a natural tendency for a recording bias in favour of the most thoroughly worked areas.

There are two groups of species belonging to the section *Vulgaria* restricted

in the main to the south Midlands, and centred around Oxford, which appear to be genuinely localised to this area. The 'mead' dandelions (85. *T. subundulatum*, 86. *T. sublaeticolor*, 108. *T. melanthoides*, 109. *T. tamesense*, 110. *T. fulgidum* and 111. *T. haematicum*) are confined to water-meadows mown for hay, principally in the Oxford area of the Thames Valley. The second is a group of local, south Midlands endemics (72. *T. stenacrum*, 82. *T. lacerabile*, 92. *T. cherwellense*, 122. *T. hemipolyodon* and 132. *T. cophocentrum*). This supposition is reinforced by the occurrence of other local endemics which are commonest in the south Midlands, but also found elsewhere (89. *T. valdedentatum*, 95. *T. porrectidens* and 104. *T. adsimile*). Two other species, 101. *T. mucronatum* and 126. *T. reflexilobum*, display what seems to be a genuine localisation to the south Midlands (they are conspicuous species that are locally common in this area) and are only otherwise found, locally, in eastern Fennoscandia. Whether this remarkable disjunction is a result of introduction is not clear.

In the other sections of *Taraxacum* occurring in the British Isles, the distributional patterns are more complete (presumably because the species look more 'interesting' and have therefore been more frequently collected), and some useful geographical distributions have emerged. There seem to be two 'Lusitanian' species, being restricted to western regions of the British Isles and the Iberian Peninsula (10. *T. hispanicum* and 49. *T. lainzii*). There is an arctic contingent, mostly restricted in Britain to high mountains in Scotland. This can be subdivided into 'general arctic' species found in Scandinavia, Iceland, Greenland and some of the arctic islands (52. *T. croceum*, 53. *T. ceratolobum* and 54. *T. cymbifolium*); non-Scandinavian species, occurring in Iceland, the Faroes and, in one case, Greenland (39. *T. reclinatum*, 56. *T. pycnosticum*); and Scandinavian species all of which occur also in Iceland (50. *T. naevosum*, 55. *T. craspedotum* and 57. *T. hypochaeris*). Species centred on western Scandinavia (e.g. 43. *T. maculigerum* and 44. *T. praestans*) are frequent. There are a few species which are centred on the Baltic (11. *T. gotlandicum*, 28. *T. obliquum*, 29. *T. platyglossum*); these are commonest in eastern Scotland. There are a few thermophilous species from France and Germany (e.g. 18. *T. retzii* and 24. *T. placidum*). However, on the whole our *Taraxacum* flora is Scandinavian, and there are very few species which are centred elsewhere. In particular, there are no examples of Alpine, Mediterranean or Pontic species native to the British Isles (5. *T. austriacum* is Pontic in affinity, but is almost certainly introduced).

The *Taraxacum* flora of Fennoscandia, the Netherlands and Switzerland is well known, and many species have been accurately mapped in these areas. That of northern France, northern Germany, the Baltic States of the Soviet Union, Poland, Czechoslovakia, Austria, Greece and Turkey is known to some extent. However, that of the Iberian peninsula, southern France, Italy, Yugoslavia and much of the Balkans and of Germany and the Soviet Union is at present very little known. It is to these areas that particular attention must be paid before an accurate picture of the overall distribution of European species can be obtained. These shortcomings must be borne in mind in considering the extra-British distribution quoted after each species. However, it seems likely that the European distribution of many species found in the British Isles, western Scandinavia, the Netherlands, Belgium, France and Germany, but absent from the Iberian Peninsula, the Mediterranean region and central and eastern Europe, is genuine.

It is surprising that relatively few of our species are endemic (compared with those of the Alps (van Soest 1969) or the genera *Hieracium*, *Rubus* and *Sorbus* in this country). Altogether, 25 out of 132 species appear to be endemic (19%). These are either widespread (34. *T. fulvicarpum*, 51. *T. laetifrons*), or local and apparently with specialised habitat requirements (22. *T. acutum*, 45. *T. anglo-larssonii*, 65. *T. cambriense* and several others, perhaps including the south Midlands endemics already referred to). A few are restricted to Orkney and/or Shetland (39. *T. acrifolium*, 41. *T. calophyllum*, 47. *T. subsimile* and 131. *T. orcadense*), but the pattern of local endemics so conspicuous in *Hieracium* and *Sorbus* is noticeably absent in *Taraxacum* in the British Isles. This suggests either that the genus is efficiently dispersed by seed (but so is *Hieracium*?), or, more probably, that the species are older, perhaps dating back to the end of the last glacial period in most instances, and that speciation has, at least for the present, effectively ceased.

IDENTIFICATION

If I have given the impression that *Taraxacum* species are readily identified, then I have misled. Through an understanding of genetic processes in a genus, and through an examination of distributional patterns, it is possible to interpret taxonomic problems in the light of knowledge of the evolutionary history of the morphological units. Thus we can expect *Rubus*, with not infrequent sexual behaviour in apomictic segregates, and *Rosa*, in which part of the genome is sexual and the remainder apomictic, to present extremely difficult taxonomic problems which may not lend themselves to artificial 'parcelling' in a taxonomic system. We must expect *Hieracium*, with many local endemics, which may be of rather recent origin, to display a bewildering array of forms, which, although distinct, are but slightly separable from their relatives. In this case natural selection may not have had sufficient time in which to 'weed-out' poorly adapted genotypes. In *Taraxacum*, at least in the British Isles, we find, for the most part, rather old, well-defined and stable species. However, due to the sheer number of species that occur, and also as a result of the complex patterns of leaf plasticity, correct identification is not easily achieved. In 1968 I circulated to some interested British botanists a duplicate key to the British and Irish species as they were then understood. It is true that this key had many imperfections, and at least some of these have been improved as a result of this experience. Also, no descriptions, illustrations or distributional notes were supplied, and in most cases no herbarium specimens were available. Most experienced field botanists (although without knowledge of *Taraxacum*) identified about 40% of specimens correctly. I hope that in the present work a much higher success rate may be achieved. Trials at the Department of Botany at Newcastle suggest that an 80% success rate is not being over optimistic. However, this is a critical and very plastic genus, and a useful level of correct identification by the inexperienced will only be achieved through the careful selection and preservation of material; the thorough examination of specimens (with particular emphasis on the characters of the involucre and achenes) and through being prepared not to name the often considerable amount of inadequate material. However, in all cases, there is no substitute for the use of a good reference herbarium. Reasonable collections are now to be found at the Botany Departments of the British Museum, and

Cambridge, Oxford and Newcastle Universities. Other collections of some substance exist at the Liverpool and Cardiff museums. However, the most important and substantial collections are to be found outside Britain, and it is necessary for the serious student of the genus to visit Leiden and Stockholm. The herbaria of Copenhagen, Helsinki and most other Scandinavian botanical centres also have excellent collections, and there is a fine living collection maintained at Uppsala.

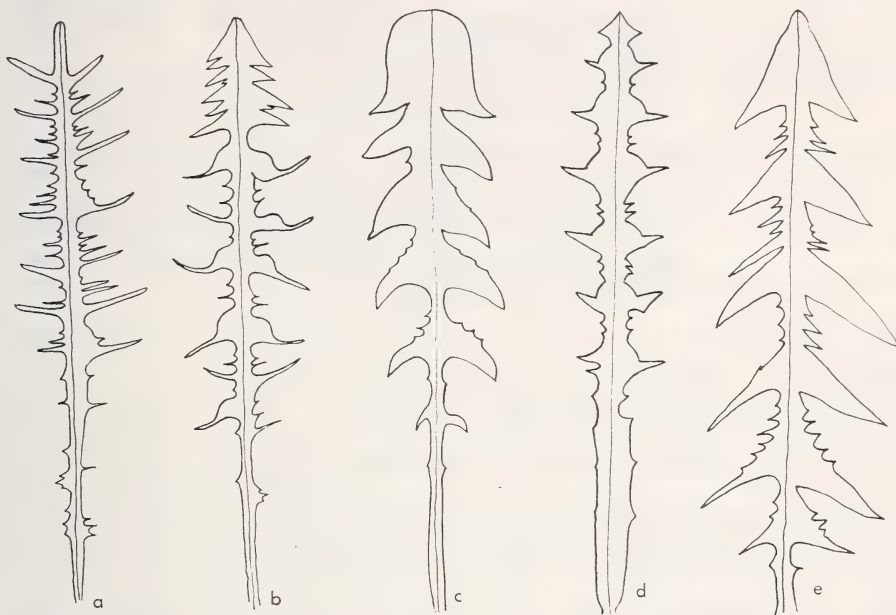


FIGURE B. Leaf characters in *Taraxacum*.

(a) Leaf narrow, oblong, lacinate; lateral lobes 5-6, narrow, $\pm$ linear, acute, patent or forward-pointing; terminal lobe tripartite; interlobes with large teeth and lobules. Petiole approaching $\frac{1}{2}$ length of leaf, somewhat winged.

(b) Leaf rather narrow, oblong-lanceolate; lateral lobes 5, forward-pointing, patent or recurved, with linear processes, distal margin with a convex hump near the base; terminal lobe acute, sub-divided; interlobes long-acuminate, dentate. Petiole not or scarcely winged, $\frac{1}{3}$ length of leaf.

(c) Leaf rather broad, lanceolate; lateral lobes 4, recurved, acute, with filiform teeth below, distal margin convex; terminal lobe rounded, helmet-shaped. Petiole $\frac{1}{2}$ length of leaf, unwinged.

(d) Leaf narrow, oblong; lateral lobes 6, patent or somewhat forward-pointing, short, deltoid, distal margin with a concave angle; terminal lobe small, diamond-shaped; interlobes dentate. Petiole $\frac{1}{2}$ length of leaf, winged.

(e) Leaf broad, lobate almost to base; lateral lobes 4 (5), recurved, long, narrowly triangular, straight-sided, acute, entire above, large-dentate below; terminal lobe sagittate, acute, entire; interlobes large-dentate and $\pm$ lobulate. Petiole very short, $\pm$ winged.

GLOSSARY

achene

The fruit (strictly speaking, a cypsela and not an achene). Measurements are of length, and exclude the cone and rostrum (Fig. C).

<i>arachnoid</i>	Hairy, with the indumentum having the appearance of a spider's web.
<i>blotched</i>	Interlobes coloured black or purple.
<i>coloured</i>	Reddish or purple with anthocyanin.
<i>cone</i>	The appendage to the achene, connecting the body of the achene to the rostrum (Fig. C).
<i>corniculate</i>	The presence of a small appendage on the abaxial side near the apex on the exterior and interior bracts of species in the sections <i>Erythrosperma</i> and <i>Obliqua</i> .
<i>exterior bracts</i>	The smaller external row of bracts surrounding the involucre; these may be adpressed (to the involucre, i.e. to the interior bracts), erect, spreading or recurved; these positions and intermediate ones represent the entire range from all exterior bracts pointing directly upwards to all being recurved. In the case of spreading bracts, individual bracts may be sub-erect or sub-recurved. Exterior bracts may have a white, scarious or coloured border.

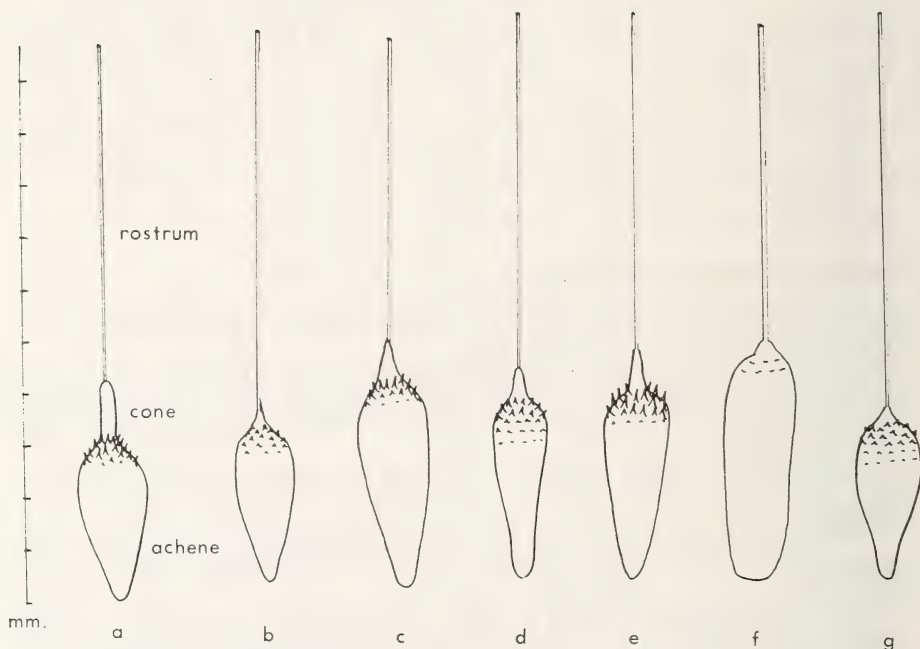


FIGURE C. Basic fruit-shapes in British *Taraxaca*.

- (a) Section *Erythrosperma*.
- (b) Section *Obliqua*.
- (c) Section *Palustria*.
- (d) Section *Spectabilia*, *Naevosa* group.
- (e) Section *Spectabilia*, *Crocea* group.
- (f) Section *Spectabilia*, *Euspectabilia* group.
- (g) Section *Vulgaria*.

<i>filiform-dentate</i>	Leaves with teeth which are narrowly linear and frequently flexuose.
<i>interlobes</i>	The narrow parts of the leaf between the lobes.
<i>laciniate</i>	Highly and irregularly divided and cut (as opposed to lobate).
<i>leaf-lobes</i>	The lateral leaf-lobes.
<i>lobule</i>	A leaf segment intermediate in size between a lobe and a tooth; often found on laciniate leaves.
<i>leaves crisped</i>	Lobes crinkled.
<i>pollen present</i>	The emerging style brushes past the anthers carrying pollen from the hidden anthers to the exterior. The presence of pollen is readily determined in fresh or dried plants by examination of the style with a lens.
<i>processes</i>	The distal (usually linear) part of a leaf-lobe when clearly differentiated from the rest of the lobe (base) (Fig. B(b)).
<i>rostrum</i>	The beak of the fruit, connecting the cone of the achene to the pappus (Fig. C).
<i>spinulose</i>	Most species have small spines or tubercles on the achene near the cone (i.e. 'above').
<i>spotted</i>	Some of the <i>Spectabilia</i> species (nos. 36–50) and 110. <i>T. fulgidum</i> have black spots on the leaf-lobes. This character seems to be under genetic control, but it is only manifested in certain conditions, one of which seems to be high insolation. Only the presence of spots is, therefore, of taxonomic significance.
<i>striped</i>	The ligules of the outer florets of nearly all <i>Taraxacum</i> species have a single coloured stripe (usually red, grey or purple) on the back.
<i>style discoloured or yellow</i>	This character refers to the colour of the style <i>in a dried condition</i> . In a few species it is clear or pale yellow; in the remainder discoloured: greenish, greyish or blackish. However, fungal attack or age can result in discolouration in yellow material. It is as well to examine several heads if possible.
<i>style exserted</i>	Emerging above the level of the central florets.
<i>terminal lobe</i>	The terminal, often $\pm$ entire, leaf-lobe; this may be sub-dissected, when it is incised like the lateral lobes, but to a lesser degree.
<i>colours</i>	Fairly good matches on the Royal Horticultural Society and British Colour Council chart can be found for the following colours:— violet 033, carmine 025, chestnut-red 014 (but darker), purple 1028, red 821, chestnut 013, brown 00918, pale green 860/3, pale yellow 2/2, orange-yellow 9, cinnamon 013/2, dark green 000861, deep yellow 7, straw 07/3.

The colour cinnamon is traditionally termed fulvous in *Taraxacum* (as in *T. fulvum*). However, this colour is not fulvous, as I understand the term, but is closer to cinnamon.

NOTES

1 MEASUREMENTS

All measurements are of length (in mm) unless otherwise stated, except those of the capitulum which are of the diameter when fully open. Measurements of scapes and exterior bracts are taken at the time of flowering.

2 CHROMOSOME COUNTS

These are all my own, unless otherwise stated; those asterisked are from British material. Observations on breeding behaviour are also my own.

3 DISTRIBUTION

The list of numbers following the notes on habitat and distribution are of Watsonian vice-counties (see Perring & Walters 1962, Dandy 1969), the total number being in brackets, e.g. (36, H2, S), H referring to Ireland and S to the Channel Islands. The abbreviations for European countries and the distributional areas, e.g., North-west Europe, are those used in *Flora Europaea* (Tutin *et alia* 1964).

4 TYPOLOGY

The typology of the British and Irish species is as yet incomplete, but it is hoped that an account of this will appear at a later date. The types of most of Dahlstedt's species are at Stockholm and some of his species have been lectotyped by Haglund. Those published in *Reports of the Botanical Society and Exchange Club of the British Isles* and in *Transactions and Proceedings of the Botanical Society of Edinburgh* are at Oxford and Edinburgh respectively. In these cases the lectotype is the specimen bearing Dahlstedt's manuscript description. Haglund's types are all at Stockholm. Those of van Soest are at Leiden. Those of the Finnish authors Lindberg, Palmgren, Brenner and Marklund have not been investigated, but are probably at Helsinki.

5 ILLUSTRATIONS

These are mostly drawn by Mrs K. Miller of the Botany School, Oxford. All are taken from herbarium specimens, mostly from the Fielding-Druce Herbarium at Oxford, but a few from Cambridge and the British Museum. The scale represents 5 cm.

6 VICE-COUNTY RECORDING

As mentioned above, the cover is most uneven. A few vice-counties, notably 22, 23, 66 and 67, have been fairly thoroughly worked, although there may still be some species to be found. The following are reasonably adequately covered, although further work will doubtless reveal many new records in every case:—9, 12, 17, 20, 22–24, 29, 32, 39, 41, 45, 49, 58–60, 62, 66–68, 82, 88, 90, 92, 94, 96, 99–101, 103, 105, 108, 111, 112, S.

All records reported in this work have been checked personally.

COLLECTING

It is most important that specimens of *Taraxacum* be collected carefully and selectively if identification is to be feasible. For reasons stated earlier, specimens should only be collected during the first flowering period (until late May in lowland areas, and rarely after the end of June, even on mountain-tops). Specimens should be well-grown, and should not come from shaded, heavily trodden, mown or grazed areas, in which abnormal phenotypes are often adopted. If possible, and especially with small material, several specimens should be collected. It is useful if the style colour of the fresh specimen is noted, although this is not essential.

The specimen should be excised at the very top of the root. In many cases, it is necessary to divide the specimen to ensure that leaves do not overlap, and that adequate drying is permitted. The removal of small buds in the rosette may also facilitate drying. If possible, the specimen should show both flowering and fruiting capitula (the latter will often mature in the press). Young leaves may also be removed, but all old leaves should be preserved, and pressed as well as possible. Each leaf should be flattened individually revealing the complete outline, and they should be arranged symmetrically without overlapping. Capitula should be pressed from the side, rather than from above or below. Remnants of dried ligules from old capitula, and loose achenes should be preserved in separate packets; loose leaves and scapes should also be preserved, although individual ones are rarely sufficient for identification. Plants are best preserved if pressed immediately after collection. Although often staying fresh in a polythene bag for some days after collection, they curl up very rapidly and are not suitable for pressing. The press should be well-aerated and a generous amount of drying paper is essential; it is usually necessary to change the paper daily for at least 5 days, and for many specimens, especially in the section *Vulgaria*, twice-daily changes may be advisable.

Specimens which are submitted for identification should be pressed as described above; specimens which have become blackish or mouldy are usually impossible to name. Material should be loose or mounted with detachable mounts, not glued or mounted with adhesive strip. All material from the British Isles should be accompanied by a grid reference as well as other details.

Key to the Sections

- 1 Plant small, delicate with strongly dissected leaves; exterior bracts usually corniculate (plants of dry places) 2
 Plant robust; exterior bracts never corniculate although sometimes with a small callus 3
- 2 Achenes pale brown; leaf-lobes 6–10; capitula deep yellow or orange-yellow, often involute (plants of dune-slacks etc.)... **Obliqua** (p. 40)
 Achenes of varying colour, often reddish or purple; leaf-lobes 3–6 (– 10); capitula pale yellow or yellow, rarely involute **Erythrosperma** (p. 27)
- 3 Leaves linear, smooth, green, entire or $\pm$ lobed; exterior bracts, adpressed, ovate, with a broad scarious border (plants of fens etc.)
Palustria (p. 42)
 Leaves never linear, usually lobed; exterior bracts recurved to adpressed, linear to ovate-lanceolate, never with a broad scarious border ... 4
- 4 Leaves spotted, often dark, with a red petiole and mid-rib, sometimes green throughout; exterior bracts to 10 mm, ovate-lanceolate to lanceolate, spreading to adpressed; ligules often striped carmine or purple; pollen often absent; achenes 3·0–5·0 mm (plants of wet places)... ..
Spectabilia (p. 45)
 Leaves never spotted; exterior bracts 7–18 mm, erect to recurved, lanceolate to linear; ligules usually striped grey-violet, sometimes purple, never carmine; pollen usually present; achenes to 3·5 mm
Vulgaria (p. 62)

There is some overlap between the sections *Vulgaria* and *Spectabilia* in the British Isles due to a number of species placed in the *Vulgaria* which are morphologically intermediate. The other sections are quite distinct, although 34. *T. fulvicarpum*, has affinities with both the *Erythrosperma* and *Spectabilia*, and 32. *T. anglicum* can be placed in either the *Palustria* or *Spectabilia*.

Sectional keys to the species

SECTION OBLIQUA

Leaves pale green; lobes obtuse; capitulum 25–30 mm, usually involute

28. obliquum

Leaves dark green; lobes acute; capitulum 30–40 mm, sometimes involute

29. platyglossum

SECTION PALUSTRIA

Pollen absent; leaves variable, extremely narrow; if lobed, then lobes very short, distant, deltoid; exterior bracts 7 mm, with a broad, scarious border

30. palustre

Pollen present; leaves never lobed, narrowly spathulate, denticulate; exterior bracts 5 mm, with a greenish border ...

31. austrinum

Pollen present; leaves shortly lobed, lobes 3–4, sagittate; exterior bracts 7 mm, with a clear, narrow, white border ...

32. anglicum

SECTION ERYTHROSPERMA

1 Mature achenes straw-brown or pale brown, without a reddish tinge 2
Mature achenes purple, reddish, chestnut or cinnamon* ... 9

2 Petiole and midrib clear purple; leaf-lobes short, deltoid; exterior bracts to 5 mm, recurved ... **24. placidum**

Petiole green or dull purple, midrib usually green; leaf-lobes various, rarely short and deltoid; exterior bracts *c* 7 mm ... 3

3 Leaves laciniate; lobes linear, often variously directed ... 4
Leaves lobed; lobes triangular ... 6

4 External bracts to 7 mm, recurved; leaves grey-green ... **26. canulum**
External bracts to 10 mm, spreading to erect; leaves pale or dark green 5

5 Leaves dark green; petiole purple; involucre dark, suffused purple; ligules striped purple; pollen present ... **25. pseudolacistophyllum**

Leaves pale green; petiole green, or lightly suffused rose; involucre pale green with conspicuous white borders to the exterior bracts; ligules striped pale grey or unstriped; pollen usually absent ... **23. degelii**

6 Petiole narrowly winged; styles yellow or pale grey ... **27. proximiforme**
Petiole unwinged; styles darker ... 7

7 Exterior bracts recurved; leaf-lobes slightly recurved, the lower filiform-dentate ... **21. simile**

Exterior bracts spreading or erect; leaf-lobes triangular-dentate or scarcely dentate ... 8

* see note p. 11.

- | | | |
|----|---|--------------------------|
| 8 | Leaf-lobes strongly recurved, terminal lobe acute; exterior bracts not clearly bordered | 22. acutum |
| | Leaf-lobes scarcely recurved, terminal lobe rounded or tripartite; exterior bracts clearly bordered | 23. degelii |
| 9 | Achenes cinnamon | 10 |
| | Achenes chestnut, red or purple | 14 |
| 10 | Exterior bracts erect, ovate-lanceolate | 1 |
| | Exterior bracts recurved, lanceolate | 12 |
| 11 | Leaf-lobes recurved, broad; pollen absent | 16. fulviforme |
| | Leaf-lobes patent, narrow, terminal lobe often broad and long; pollen present | 17. oxoniense |
| 12 | Leaves narrowly oblong; lobes 7-10, short, lobules present; pollen absent | 19. glauciniforme |
| | Leaves spatulate or lanceolate; lobes 4-6; pollen present or absent | 13 |
| 13 | Leaves rather broad; lobes long, scarcely dentate; exterior bracts to 10 mm; achenes 3.5 mm | 18. retzii |
| | Leaves narrow; lobes short, acute, dentate; exterior bracts to 7 mm; achenes 3.0 mm | 15. fulvum |
| 14 | Styles clear yellow; petiole and midrib usually green | 15 |
| | Styles discoloured (except in 7. <i>T. commixtum</i>); petiole and midrib with some red or purple (except in 13. <i>T. laetiforme</i>) | 17 |
| 15 | Achenes dark purple; leaves pale green | 12. laetum |
| | Achenes brick-red; leaves dull green | 16 |
| 16 | Pollen present; styles always pure yellow | 11. gotlandicum |
| | Pollen absent; styles dull yellow or greyish | 13. laetiforme |
| 17 | Petiole green; styles pale grey; exterior bracts recurved, linear | 13. laetiforme |
| | Petiole coloured; styles usually discoloured, but not pale grey; exterior bracts rarely recurved or linear | 18 |
| 18 | Achenes c 3.5 mm; leaf-lobes linear, variously directed | 19 |
| | Achenes c 3.0 mm; leaf-lobes not linear, or, if so, not variously directed | 20 |
| 19 | Achenes reddish; involucre robust; exterior bracts to 10 × 3 mm, erect; styles yellow | 7. commixtum |
| | Achenes purple; involucre delicate; exterior bracts to 7 × 2 mm, recurved; styles discoloured | 14. dunense |
| 20 | Ligules involute; stigmas included; leaves dark, with 4, patent, acute, triangular lobes | 2. argutum |
| | Ligules flat; stigmas exserted; leaves paler, or, if dark, not regularly triangular lobed | 21 |

- 21 Exterior bracts not corniculate, adpressed; leaves pale green with 3-4,
 ± entire, short, wide-based, deltoid lobes **10. hispanicum**
 Exterior bracts usually corniculate, not adpressed (sometimes erect); if
 leaves pale green, lobes narrow, dentate 22
- 22 Achenes dark purple-brown (puce); pollen absent; leaf-lobes 5-6, rather
 long, regular, acute, dentate **20. proximum**
 Achenes sometimes dark purple, never puce; pollen present or absent;
 leaf-lobes rarely exceeding 4 23
- 23 Achenes warm chestnut-brown; exterior bracts 6 × 2 mm, recurved, clearly
 bordered; leaf-lobes 3, long, triangular-acute, strongly dentate **8. disseminatum**
 Achenes sometimes chestnut-red, but scarcely brownish; exterior bracts
 and leaves various; leaf-lobes 4 or more 24
- 24 Achenes purple to dark violet; plant small, neat; base of plant clothed with
 persistent shining leaf-bases 25
 Achenes reddish; plant often larger; leaf-bases not obviously persistent 26
- 25 Cone of achene *c* 1.5 mm; exterior bracts 4 × 1 mm; young scapes ±
 arachnoid below capitulum **5. austriacum**
 Cone of achene *c* 1.0 mm; exterior bracts *c* 6 × 1.5 mm; scapes always
 glabrous **4. rubicundum**
- 26 Plant robust, pale glaucous-green; exterior bracts 8-10 mm, erect;
 capitulum *c* 40 mm **9. glaucinum**
 Plant less robust, not glaucous; exterior bracts rarely exceeding 7 mm,
 ± spreading; capitulum *c* 30 mm 27
- 27 Pollen absent; leaves pure green; terminal lobe rounded ... **6. silesiacum**
 Pollen present; leaves olive-green; terminal lobe acute 28
- 28 Exterior bracts *c* 6 × 1.5 mm, spreading, not suffused purplish; leaf-lobes
 usually broad at base **3. lacistophyllum**
 Exterior bracts *c* 7 × 2 mm, spreading-recurved, suffused purplish; leaf-
 lobes usually narrow at base... .. **1. brachyglossum**

SECTION SPECTABILIA

- 1 Achenes reddish; exterior bracts spreading; leaf-lobes often strongly
 recurved 2
 Achenes not reddish, usually straw-coloured; exterior bracts and leaf-lobes
 various 4
- 2 Exterior bracts ovate-acuminate, dark glaucous green, with a clear white
 border, pink-tipped; leaf-lobes strongly recurved, filiform-dentate ... **33. unguilobum**
 Exterior bracts ± concolorous; leaf-lobes various 3

- | | | |
|----|--|------------------------|
| 3 | Leaf-lobes recurved, coarsely dentate | 34. fulvicarpum |
| | Leaf-lobes $\pm$ patent, entire | 54. cymbifolium |
| 4 | Exterior bracts adpressed to erect in flower; petiole purplish ... | 5 |
| | Exterior bracts spreading, or, if erect, petiole green | 15 |
| 5 | Leaves often spotted; ligules striped carmine (except 40. <i>T. acrifolium</i>);
pollen absent; achenes straw-coloured, exceeding 4.0 mm (penta-
ploids) | 6 |
| | Leaves never spotted; ligules not striped carmine (sometimes purple);
pollen often present; achenes variously coloured, not exceeding
4.0 mm | 9 |
| 6 | Terminal leaf-lobe very long (about $\frac{1}{2}$ length of leaf), narrow, acute ... | 40. acrifolium |
| | Terminal leaf-lobe shorter | 7 |
| 7 | Leaves $\pm$ entire, almost glabrous, dark, shining; capitulum <i>c</i> 55 mm;
achenes exceeding 4.5×1.2 mm | 38. eximium |
| | Leaves lobed, or sometimes entire; capitulum <i>c</i> 40 mm; achenes $4.0-4.5$
$(-5.0) \times 1.0-1.2$ mm | 8 |
| 8 | Leaf-lobes 2-3, or leaves entire; exterior bracts ovate-lanceolate ... | 36. faeroense |
| | Leaf-lobes 4-6; exterior bracts variable, but more usually lanceolate | 9 |
| 9 | Leaf-lobes with sigmoid margins above; achenes 4.0×1.3 mm, with
broad-based spinules above (very rare) | 39. reclinatum |
| | Leaf-lobes lacking sigmoid margins; achenes 4.3×1.0 mm, scarcely spinulose
(common) | 37. spectabile |
| 10 | Leaf-lobes concave on distal margin | 11 |
| | Leaf-lobes convex on distal margin | 12 |
| 11 | Exterior bracts clearly bordered; achenes 3.8 mm, straw-coloured (Wales) | 65. cambriense |
| | Exterior bracts not bordered; achenes 3.5 mm, olive-brown (common) ... | 61. nordstedtii |
| 12 | Leaf-lobes strongly dentate (Orkney) | 41. calophyllum |
| | Leaf-lobes scarcely or sparsely dentate | 13 |
| 13 | Ligules long, striped grey-purple (common) | 14 |
| | Ligules short, striped purple (very local species) | 15 |
| 14 | Leaves pale green; lobes short, strongly recurved (W. Ireland) ... | 64a. hibernicum |
| | Leaves dull, blue-green; lobes not as above (widespread) ... | 64. adamii |

15	Pollen present; leaf-interlobes very narrow (Upper Teesdale)	60. <i>pseudonordstedtii</i>	16
	Pollen absent; leaf-interlobes broader		
16	Leaf-lobes 2-3, distant, $\pm$ sagittate (water-meadows, Oxford)	63. <i>litorale</i>	
	Leaf-lobes 4-5, neither distant nor sagittate (Glen Clova)	59. <i>caledonicum</i>	
17	Leaves pale to mid-green, rarely spotted; petiole green; capitulum deep yellow or orange-yellow		18
	Leaves dark green (except in 51. <i>T. laetifrons</i>), often spotted; petiole purple; capitulum pale yellow or yellow		24
18	Leaves small; lobes recurved, distal margin convex (marshes, Kent)	62. <i>hygrophilum</i>	
	Leaves medium-sized; leaves entire, or, if lobed, lobes patent		19
19	Leaves oblong, obtuse, coarsely dentate (Inverness)	57. <i>hypochaeris</i>	
	Leaves lanceolate, lobed		20
20	Leaf-lobes 2-3, long, sagittate (N. Scotland)	47. <i>subsimile</i>	
	Leaf-lobes 4-8, shorter (high mountains)		21
21	Exterior bracts spreading-recurved, narrowly lanceolate, scarcely bordered	54. <i>cymbifolium</i>	
	Exterior bracts spreading-erect, ovate-lanceolate, clearly bordered		22
22	Leaf-lobes 6-9, narrow	53. <i>ceratolobum</i>	
	Leaf-lobes 3-5, broader		23
23	Terminal leaf-lobe short, often rounded; achenes <i>c</i> 3.5 mm	55. <i>craspedotum</i>	
	Terminal leaf-lobe not very short, acute; achenes <i>c</i> 4.0 mm	52. <i>croceum</i>	
24	Terminal leaf-lobe rounded		25
	Terminal leaf-lobe acute		26
25	Leaves large, stiffly erect, grey-green; lobes strongly recurved, long	58. <i>stictophyllum</i>	
	Leaves smaller, weak, yellowish-green; lobes patent, short	48. <i>drucei</i>	
26	Pollen present		27
	Pollen absent		28
27	Leaves narrow; petiole unwinged	43. <i>maculigerum</i>	
	Leaves broader; petiole winged	42. <i>euryphyllum</i>	
28	Leaves smooth, unspotted; lobes short, narrow, deltoid; achenes 3.0 mm	35. <i>landmarkii</i>	
	Leaves rough, spotted; lobes longer, not deltoid; achenes 3.5 mm		29

- 29 Capitulum *c* 30 mm; plant small, delicate; leaves spatulate, entire or shortly lobed **49. lainzii**
 Capitulum *c* 40 mm; plant robust; leaves lanceolate, lobed... .. 30
- 30 Leaf-lobes strongly recurved **46. naevosiforme**
 Leaf-lobes patent or slightly recurved... .. 31
- 31 Leaves never spotted, pale green; lobes strongly dentate ... **51. laetifrons**
 Leaves often spotted, dark green; lobes entire, or filiform-dentate... 32
- 32 Petiole winged; leaves rough 33
 Petiole unwinged; leaves smooth 35
- 33 Involucre large; capitulum *c* 50 mm **50. naevosum**
 Involucre smaller; capitulum *c* 40 mm 34
- 34 Leaves narrow, pure green; involucre 'thistle-like' (with overlapping rows of stiff, glaucous bracts) **56. pycnostictum**
 Leaves broader, dull green; involucre not thistle-like... **42. euryphyllum**
- 35 Achenes 3.0 mm; leaves unspotted; lobes short, narrow, deltoid **35. landmarkii**
 Achenes 3.5 mm; leaves often spotted; lobes rarely deltoid... .. 36
- 36 Leaves shining, dark green, usually with red, purple or black markings; lobes regular, patent (rare) **45. pseudolarssonii**
 Leaves dull green with black markings or unspotted; lobes irregular (wide-spread) 37
- 37 Petiole and midrib purple, shining; terminal leaf-lobe about $\frac{1}{3}$ length of leaf, subdivided into lobules **44. praestans**
 Petiole and midrib dull violet or purple; terminal leaf-lobe short, entire **43. maculigerum**

SECTION VULGARIA

- 1 Pollen absent 2
 Pollen present 5
- 2 Stigmas yellow in living and dried condition... .. 3
 Stigmas orange-yellow, dirty yellow or discoloured in living condition, discoloured when dry... .. 4
- 3 Leaf-lobes short, recurved, usually with one tooth ... **107. duplidens**
 Leaf-lobes longer, $\pm$ patent, with up to 4 teeth ... **88. tanylepis**
- 4 Terminal leaf-lobe helmet-shaped, long, entire ... **73. inane**
 Terminal leaf-lobe not helmet-shaped, short, usually dentate ... **124. parvuliceps**

- | | | |
|----|---|---------------------------|
| 5 | Petiole white or green, or occasionally faintly rose at base, mid-rib usually green | 6 |
| | Petiole and mid-rib with some red or purple colouration | 31 |
| 6 | Exterior bracts strongly suffused with purple... .. | 7 |
| | Exterior bracts colourless, or almost so | 10 |
| 7 | Leaves grey-green, entire, or if lobed, lobes short, entire, obtuse | |
| | 66. obtusilobum | |
| | Leaves green, lobed; lobes longer, acute | 8 |
| 8 | Leaf-lobes distant, patent, narrow; exterior bracts spreading-erect | |
| | 91. laciniosum | |
| | Leaf-lobes recurved, broader; exterior bracts recurved | 9 |
| 9 | Leaf-lobes markedly convex on distal margin; exterior bracts violet-purple | 68. cyanolepis |
| | Leaf-lobes straight-sided or distal margin slightly convex; exterior bracts reddish-purple | 67. subcyanolepis |
| 10 | Petiole broadly winged | 11 |
| | Petiole unwinged, or almost so... .. | 19 |
| 11 | Leaf-lobes 5-8 | 12 |
| | Leaf-lobes 2-4 | 17 |
| 12 | Leaf-lobes strongly recurved | 77. pallescens |
| | Leaf-lobes variously directed | 13 |
| 13 | Leaf-lobes obtuse; exterior bracts spreading-erect | 84. insigne |
| | Leaf-lobes acute; exterior bracts recurved | 14 |
| 14 | Leaf-lobes with large teeth; petiole $\pm$ absent | 80. aequisectum |
| | Leaf-lobes lacking teeth, or with filiform teeth; petiole about $\frac{1}{4}$ length of leaf | 15 |
| 15 | Capitulum <i>c</i> 45 mm, orange-yellow | 81. croceiflorum |
| | Capitulum <i>c</i> 60 mm, mid-yellow | 16 |
| 16 | Leaf-interlobes lobulate; terminal lobe short, deltoid | 79. lingulatum |
| | Leaf-interlobes without lobules; terminal lobe longer, sagittate | 74. procerum |
| 17 | Leaf-lobes large, usually 2, distal margin convex-rounded... .. | 70. ancistrolobum |
| | Leaf-lobes smaller, 3-4 (-5), distal margin straight-sided or convex... .. | 18 |
| 18 | Exterior bracts 4-6 mm wide, pale green; leaves pale green... .. | 83. expallidiforme |
| | Exterior bracts 3 mm wide, glaucous, pink-tipped; leaves darker... .. | 78. alatum |

- 19 Leaf-lobes 3–4, long, narrow, proximal and distal margins strongly dentate; capitulum 35–40 mm **89. valdedentatum**
 Leaf-lobes 4–6, proximal margin entire; capitulum 35–60 mm ... 20
- 20 Leaf-lobes rather broad, slightly recurved, not ending in linear processes; capitulum *c* 40 mm 21
 Leaf-lobes patent or variously directed (rarely recurved), ending in linear processes; capitulum 40–60 mm 23
- 21 Terminal leaf-lobe attenuate; petiole about $\frac{1}{2}$ length of leaf... ..
75. pannucium
 Terminal leaf-lobe short; petiole about $\frac{1}{4}$ length of leaf 22
- 22 Exterior bracts 7×2 mm, stiff, spreading, dark green
87. tenebricans
 Exterior bracts 10×2 mm, lax, recurved, often suffused violet
69. sellandii
- 23 Linear processes strongly recurved, especially at tip... **90. spilophyllum**
 Linear processes variously directed, not strongly recurved... .. 24
- 24 Exterior bracts spreading or erect 25
 Exterior bracts recurved 28
- 25 Linear processes of leaf-lobes often recurved; terminal lobe distinct, obtuse, often rounded or elongated **76. linguatum**
 Linear processes of leaf-lobes patent or variously directed; terminal lobe indistinct, dissected 26
- 26 Linear processes of leaf-lobes often pointing forward, rather short; exterior bracts to 3.5 mm wide 27
 Linear processes of leaf-lobes never pointing forward, long; exterior bracts 4–6 mm wide **82. lacerabile**
- 27 Plant robust; involucre *c* 18 mm wide; exterior bracts 12×3 mm
85. subundulatum
 Plant slender; involucre *c* 10 mm wide; exterior bracts 8×2 mm... ..
86. sublaeticolor
- 28 Leaf-lobes somewhat obtuse; capitulum 40 mm ... **92. cherwellense**
 Leaf-lobes acute; capitulum 55–60 mm 29
- 29 Terminal leaf-lobe rather long, sagittate **74. procerum**
 Terminal leaf-lobe shorter, not sagittate 30
- 30 Leaf-lobes recurved; exterior bracts 4–5 mm wide ... **71. sublaciniosum**
 Leaf-lobes patent; exterior bracts 2–3 mm wide ... **72. stenacrum**
- 31 Leaves very narrow; terminal lobe long, $\frac{1}{3}$ – $\frac{1}{2}$ length of leaf; exterior bracts erect **97. copidophyllum**
 Not as above; terminal leaf-lobe always less than $\frac{1}{3}$ length of leaf .. 32

- 32 Terminal leaf-lobe $\pm$ rounded 33
 Terminal leaf-lobe obtuse or acute, but not rounded 35
- 33 Leaves not spotted or blotched; petiole dull purple; exterior bracts recurved **132. cophocentrum**
 Leaves sometimes spotted or blotched; petiole shining purple; exterior bracts spreading 34
- 34 Involucre 10 mm wide; capitulum 40 mm **110. fulgidum**
 Involucre 15 mm wide; capitulum 50 mm **131. orcadense**
- 35 Leaves dark green; lobes 3–5, recurved, distal margin convex; exterior bracts spreading or erect (the *T. hamatum* group, nos. 108–118) ... 36
 Not as above; exterior bracts usually recurved 45
- 36 Exterior bracts suffused with purple; terminal leaf-lobe obtuse, apiculate 37
 Exterior bracts green, or partially or lightly coloured; terminal leaf-lobe usually acute 39
- 37 Leaves mid-green, without dark blotches; mid-rib green **118. oblongatum**
 Leaves dark green, often blotched dark on interlobes; mid-rib purple 38
- 38 Leaf-lobes 3, short, entire or filiform-dentate (rare) ... **109. tamesense**
 Leaf-lobes 4, longer, shortly dentate (common) ... **116. marklundii**
- 39 Exterior bracts erect; achenes c 3.5 mm 40
 Exterior bracts spreading; achenes c 3.0 mm... .. 41
- 40 Exterior bracts dark green, the outermost 1 mm wide... **113. bracteatum**
 Exterior bracts very dark, glaucous green, the outermost 2.5 mm wide ... **114. hamatum**
- 41 Exterior bracts with clear, white borders **112. christiansenii**
 Exterior bracts not obviously bordered 42
- 42 Leaf-lobes 3, distant; interlobes usually blotched dark, bearing teeth and lobules **105. longisquameum**
 Leaf-lobes 4–5, not distant; interlobes sometimes blotched dark (in *111. T. haematicum*), entire or filiform-dentate 43
- 43 Petiole bright purple; distal margin of leaf-lobes straight-sided or even concave, not convex **111. haematicum**
 Petiole dull purple; distal margin of leaf-lobes usually convex, occasionally straight-sided 44
- 44 Leaves and lobes rather narrow; petiole unwinged; exterior bracts erect-spreading **115. hamatiforme**
 Leaves and lobes rather broad; petiole $\pm$ winged; exterior bracts spreading-recurved **117. latisectum**

- | | | | | | | | |
|----|---|-----|-----|-----|-----|-----|-----------------------------|
| 45 | Leaf-lobes with linear processes | ... | ... | ... | ... | ... | 46 |
| | Leaf-lobes not differentiated into base and linear processes | ... | ... | ... | ... | ... | 50 |
| 46 | Linear processes of leaf-lobes recurved | ... | ... | ... | ... | ... | 99. aurosulum |
| | Linear processes of leaf-lobes patent or variously directed | ... | ... | ... | ... | ... | 47 |
| 47 | Capitulum <i>c</i> 35 mm; leaves decumbent | ... | ... | ... | ... | ... | 48 |
| | Capitulum <i>c</i> 55 mm; leaves erect | ... | ... | ... | ... | ... | 49 |
| 48 | Leaves grey-green; processes linear, $\pm$ obtuse | ... | ... | ... | ... | ... | 128. canoviride |
| | Leaves dark green; processes very narrow, tapering to an acute apex | ... | ... | ... | ... | ... | 127. crispifolium |
| 49 | Leaf-lobes 5–9, distal base lacking a convex hump; interlobes dentate, but lacking lobules... | ... | ... | ... | ... | ... | 93. aequilobum |
| | Leaf-lobes 7–10, distal base often enlarged with a convex hump; interlobes with conspicuous narrow lobules | ... | ... | ... | ... | ... | 98. pectinatiforme |
| 50 | Upper leaf-lobes conspicuously dentate | ... | ... | ... | ... | ... | 51 |
| | Upper leaf-lobes entire, or with a few filiform teeth... | ... | ... | ... | ... | ... | 57 |
| 51 | Exterior bracts spreading-erect, 14 $\times$ 4 mm | ... | ... | ... | ... | ... | 122. hemipolyodon |
| | Exterior bracts variously directed, less than 10 $\times$ 3 mm | ... | ... | ... | ... | ... | 52 |
| 52 | Leaf-lobes 6–8, strongly recurved; interlobes usually with dark blotches | ... | ... | ... | ... | ... | 126. reflexilobum |
| | Not as above; leaf-lobes never strongly recurved | ... | ... | ... | ... | ... | 53 |
| 53 | Leaves dark green, lacking dark blotches on the interlobes; exterior bracts spreading | ... | ... | ... | ... | ... | 54 |
| | If leaves dark, then with dark blotches on the interlobes; exterior bracts recurved | ... | ... | ... | ... | ... | 55 |
| 54 | Mid-rib dull purple; terminal leaf-lobe $\pm$ entire | ... | ... | ... | ... | ... | 121. duplidentifrons |
| | Mid-rib green; terminal leaf-lobe dentate | ... | ... | ... | ... | ... | 123. obscuratum |
| 55 | Leaves olive-green, lacking dark blotches, oblong; terminal lobe sub-dissected, indistinct | ... | ... | ... | ... | ... | 129. obliquilobum |
| | Leaves dark green, with dark blotches on the interlobes, lanceolate; terminal lobe $\pm$ distinct | ... | ... | ... | ... | ... | 56 |
| 56 | Scapes usually about $\frac{1}{2}$ length of leaves at flowering; leaf-lobes 4–5, longer, distal margin usually somewhat convex | ... | ... | ... | ... | ... | 119. maculatum |
| | Scapes usually equalling leaves at flowering; leaf-lobes 5–6, short, distal margin never convex | ... | ... | ... | ... | ... | 125. polyodon |
| 57 | Stigmas yellow in living and dried condition | ... | ... | ... | ... | ... | 58 |
| | Stigmas orange-yellow, dirty yellow or discoloured in living condition, discoloured when dried | ... | ... | ... | ... | ... | 59 |

- 58 Terminal leaf-lobe narrow, acute; lobes regular, recurved ... **130. primum**
 Terminal leaf-lobe broad, helmet-shaped; lobes irregular, patent or slightly recurved ... **100. xanthostigma**
- 59 Exterior bracts with conspicuous white borders ... **112. christiansenii**
 Exterior bracts $\pm$ unbordered ... **60**
- 60 Capitulum exceeding 55 mm; leaf-lobes 2-3 (-5) ... **102. dilatatum**
 Capitulum rarely exceeding 55 mm, if so, then leaf-lobes 4 or more... **61**
- 61 Leaf-lobes tapering to a long, acuminate point ... **62**
 Leaf-lobes sometimes long and tapering, but, if so, not acuminate **64**
- 62 Leaf-lobes 5-8; involucre more than 20 mm wide; capitulum exceeding 55 mm ... **99. aurosulum**
 Leaf-lobes 3-5; involucre less than 20 mm wide; capitulum less than 55 mm ... **63**
- 63 Leaf-lobes strongly recurved; exterior bracts recurved, green ... **96. biforme**
 Leaf-lobes patent or slightly recurved; exterior bracts spreading, suffused purple ... **101. mucronatum**
- 64 Leaves dark green, with dark blotches on the interlobes ... **65**
 Leaves rarely dark green, never with dark blotches on the interlobes **69**
- 65 Exterior bracts c 14 $\times$ 4 mm, recurved, green ... **120. fasciatum**
 Exterior bracts rarely exceeding 12 $\times$ 3 mm, spreading and often suffused purple ... **66**
- 66 Leaf-lobes $\pm$ convex on distal margin; exterior bracts recurved, suffused purple ... **67**
 Leaf-lobes straight-sided or concave on distal margin; exterior bracts $\pm$ spreading, green ... **68**
- 67 Leaves narrow; scapes exceeding leaves at flowering... **108. melanthoides**
 Leaves broader; scapes about $\frac{1}{2}$ length of leaves at flowering ... **119. maculatum**
- 68 Leaf-lobes 3, distant; interlobes dentate and lobulate... **105. longisquameum**
 Leaf-lobes 4-5, not distant; interlobes entire or filiform-dentate... **111. haematicum**
- 69 Petiole bright purple; terminal leaf-lobe usually rather long, subdivided **106. dahlstedtii**
 Petiole dull purple; terminal leaf-lobe short, $\pm$ entire (except 129. *T. obliquilobum*) ... **70**
- 70 Leaf-lobes narrow, lingulate, usually 5-8, crowded; leaves usually pale green ... **71**

- | | | |
|----|---|--------------------------|
| | Leaf-lobes triangular, usually 4-5, not crowded; leaves usually mid-green 72 | |
| 71 | Involucre more than 20 mm wide; capitulum exceeding 55 mm | |
| | | 99. aurosulum |
| | Involucre <i>c</i> 15 mm wide; capitulum <i>c</i> 45 mm | 95. porrectidens |
| 72 | Leaves oblong, olive-green; interlobes dentate and lobulate | |
| | | 129. obliquilobum |
| | Leaves lanceolate, pure green; interlobes entire or dentate... .. | 73 |
| 73 | Leaf-lobes 2-4, large; terminal lobe large, subdivided | 94. ekmanii |
| | Leaf-lobes 4-7, smaller; terminal lobe smaller, entire | 74 |
| 74 | Leaf-lobes recurved, regular, straight-sided | 104. adsimile |
| | Leaf-lobes patent or slightly recurved, slightly irregular; distal margin somewhat concave | 103. cordatum |

Section *Erythrosperma*

Section **ERYTHROSPERMA** (H. Lindb. f.) Dahlst., *Acta Fl. Suec.*, **1**: 41 (1921), *emend.* H. Lindb. f., *Acta bot. fenn.*, **17**: 8 (1935)

Erythrosperma H. Lindb. f. *Acta Soc. Fauna Flora fenn.*, **29** (9): 45 (1907)

Section *Dissimilia* Dahlst., *K. svenska Vetenskakad. Handl.*, ser. 3, **6** (3):3 (1928)

Section *Fulva* M. P. Chr., *Bot. Iceland*, **3** (3):253 (1942)

Plants small (—medium-sized), delicate. Leaves never spotted in the British species, strongly dissected; petiole and mid-rib usually coloured. Exterior bracts small, rarely exceeding 7mm, recurved to adpressed, corniculate. Achenes to 3.5mm, narrow, violet, purple, red, chestnut, brown, cinnamon or straw-coloured; cone *c* 1.0mm long and cylindrical. $2n = 16, 17, 18, 22, 23, 24, 32$ (usually 24 or 32). Sexuels, facultative agamosperms or obligate agamosperms, usually the latter. Flowering April or May.

Dry places; rocky and sandy ground and short grassland, usually with a shallow soil and full insolation (south-facing and unshaded). Throughout Europe except for montane regions and the Arctic, but present in all countries except Svalbard. Outside Europe native only in Turkey, Iran and Afghanistan, but introduced into North America (van Soest 1958) and probably elsewhere.

These are among the shortest-lived *Taraxaca*. In cultivation they may flower within 3 months of germination, and they may be biennial in some localities. Certain dark-fruited species (4. *T. rubicundum*, 6. *T. silesiacum*, 5. *T. austriacum*, 12. *T. laetum* and a number of non-British species) can have silver-grey achenes. This is controlled by a single gene (Richards 1970b) and is of no taxonomic significance. These must not be confused with inviable seeds which are very thin, lacking contents, and are also of a silver colour. These latter can indicate sexuality, which is found in at least two British species in this section. The section seems to be a natural one, and may have arisen spontaneously from the Asian and the Mediterranean section *Erythrocarpa* Hand.-Mazz. *emend.* Dahlst. However, 34. *T. fulvicarpum*, here placed in the *Spectabilia*, and the Scandinavian *T. intercedens* Markl., sometimes assigned to the *Palustria*, are of uncertain sectional status.

SPECIES WITH REDDISH OR PURPLISH ACHENES (NOS. 1–14)

1. *T. brachyglossum* (Dahlst.) Dahlst. in Sernander *et alia*, *Bot. Studier till. F. R. Kjellman*, 183 (1906)

T. erythrospermum subsp. *brachyglossum* Dahlst., *Bot. Not.*, **1905**: 170 (1905)

T. brachyglossum (Dahlst.) Dahlst. in Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 257 (1906)

Leaves 30–200mm, dull green; leaf-lobes 4–6, patent or slightly recurved, narrow, sometimes linear; petiole dull purple, unwinged. Scapes 30–150mm, prostrate to erect, usually suffused purple, arachnoid below the capitulum; exterior bracts 7×2 mm, spreading, glaucous, usually suffused purplish above, corniculate, with a pale border; capitulum 20–30mm, yellow; ligules striped purple; styles exserted, discoloured, pollen present. Achenes 2·8mm, chestnut-red; cone 0·9mm. $2n = 16^*$, 17^* , 18^* , 20^* , 22^* , 24^* , 26^* . Sexual, facultative agamosperm or obligate agamosperm. **Fig. 1.**

Dry places: calcareous downs, sandy heaths, sand-dunes, walls etc. Widespread and locally frequent throughout Britain. Not recorded from Ireland. 1–3, 5, 6, 9, 10, 12–17, 20–26, 28, 29, 32–41, 44, 45, 47–49, 52, 55–60, 62, 64, 66–71, 82, 85, 88–91, 93–98, 101, 103, 105, 109, S. (68, S). Native.

Central Europe extending westward to France and Britain, and northwards to southern Scandinavia. Au, Be, Br, Da, Ga, Ge, He, Ho, It, Ju, No, Su.

One of the commonest of the British *Erythrosperma* species, *T. brachyglossum* is readily recognised by its spreading, glaucous-purple exterior bracts, discoloured, polliniferous styles and reddish achenes. It is the commonest British species to show partial and complete sexuality; hybrids have been reported with 17. *T. oxoniense*, 67. *T. subcyanolepis* and 114. *T. hamatum*. However, sexuals do not seem to be very common and *T. brachyglossum* frequently occurs alone in pure populations. Nevertheless, the possibility of hybrids should always be borne in mind when examining populations of this species.

2. *T. argutum* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, 8:619 (1929)

Leaves 50–100mm, dark green, shining; leaf-lobes 4–5, regular, triangular, acute, scarcely dentate; petiole dull purple, scarcely winged. Scapes 100–150mm, erect, arachnoid below the capitulum; exterior bracts 6×2 mm, spreading, green, scarcely corniculate, unbordered; capitulum deep yellow, closed; ligules involute; styles inserted, pollen absent. Achenes 3·0mm, deep red; cone 0·8mm. $2n = 24^*$. Obligate agamosperm. **Fig. 1.**

Dry calcareous places and sandy roadsides under light shade. Local and restricted to southern and north-west England and central Scotland. 9, 15, 17, 22–24, 26, 30, 60, 69, 88, 89, 101. (13). Endemic.

This is the only British *Erythrosperma* species with habitually closed capitula and involute ligules. This condition is occasionally found in other species, from which it can be satisfactorily distinguished by its dark green, regularly triangular-lobate leaves. Seed production is usually rather poor, and it may be that this species has evolved from triploid facultatively agamospermous forms of 1. *T. brachyglossum*, achieving obligate agamospermy through structural isolation (the closed ligules and capitulum) rather than meiotically (Richards 1970a).

3. **T. lacistophyllum** (Dahlst.) Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 257 (1906)

T. erythrospermum subsp. *lacistophyllum* Dahlst., *Bot. Not.*, 1905: 168 (1905)

Leaves 30–200mm, mid-green; leaf-lobes 4–6, patent, narrow, entire, *abruptly widening at base*; petiole dull purple, unwinged. Scapes 50–200mm, erect, rarely coloured, arachnoid below the capitulum; *exterior bracts* 6×1.5 mm, spreading (to erect), *green*, corniculate, scarcely bordered; capitulum 20–30mm, yellow; ligules striped purple; styles exserted, discoloured, pollen present. Achenes 2.7mm, dark red; cone 0.8mm. $2n = 24^*$. Obligate agamosperm. **Fig. 1.**

Dry places: calcareous downs, sandy heaths, walls, paths etc. Commoner in towns than 1. *T. brachyglossum* and rare or absent on sand-dunes. Widespread and locally common in southern England, becoming rare northwards; not recorded from Ireland. 1–3, 6–12, 14–26, 28, 29, 32, 34, 36–42, 44, 45, 49, 52, 54, 55, 57–60, 62, 64–66, 69, 71, 75, 78, 81–83, 85, 90, 96, 106, S. (59, S). Native. Western Europe, southern Scandinavia and the Baltic. Be, Br, Da, Ga, Ge, He, Ho, Hs, Lu, No, Rs(B), Su.

T. lacistophyllum is best distinguished by the abruptly expanded bases to the leaf-lobes, which give the leaf a distinctive appearance. Small forms are not easily distinguished from 1. *T. brachyglossum*, except on involucre characters.

4. **T. rubicundum** (Dahlst.) Dahlst. in Sernander *et alia*, *Bot. Studier till. F. R. Kjellman*, 183 (1906)

T. erythrospermum subsp. *rubicundum* Dahlst., *Bot. Not.*, 1905:166 (1905)

A small and delicate plant. Leaves 20–70mm, dull green, *very dissected*; leaf-lobes 4–7, patent or pointing forward, linear; interlobes narrow, straight, dentate; petiole dark violet-purple, unwinged; persistent dark leaf-bases conspicuous. Scapes many, 50–80mm, thin, wiry, purplish, *glabrous*; *exterior bracts* 5×1.5 mm, *erect, ovate, dark glaucous green*, often suffused purple, conspicuously corniculate, bordered; capitulum 15–20mm, pale yellow; ligules, short, striped dark violet; styles exserted, discoloured, pollen present or *absent*. Achenes 2.5mm, *dark violet*; cone 1.0mm. $2n = 24^*$. Obligate agamosperm. **Fig. 1.**

Dry places; mostly restricted to calcareous downland, locally on sandy heaths. Widespread and locally common in southern England, becoming rarer northwards; not recorded from Ireland. 1–3, 6, 7, 9–11, 15–17, 20, 22–24, 26–29, 32–34, 36, 37, 39, 41, 42, 45, 47, 49, 51, 55, 57, 59, 60, 62, 65, 68–71, 82, 90, 95, 96, 101, 108, S. (47, S). Native.

Central Europe, extending westwards to Britain and northwards to southern Fennoscandia. Be, Br, Da, Fe, Ga, Ge, He, Ho, It, Ju, No, Su.

The diagnostic features of *T. rubicundum* include the glabrous scapes (particularly just below the involucre), the erect, ovate exterior bracts and the dark

violet achenes. However, the whole plant has a most distinctive appearance. It is a most attractive species and one of the easiest to identify.

5. *T. austriacum* van Soest, *Proc. K. ned. Akad. Wet.*, ser. C, **69**(4):434 (1966)

A small and delicate plant. Leaves 30–80mm, dull green; leaf-lobes 4–7, variable, distant, often obtuse and recurved, entire or slightly dentate; petiole dark purple, unwinged; *persistent dark leaf-bases conspicuous*. Scapes 50–80mm, many, thin, wiry, rarely coloured, slightly arachnoid below capitulum; *exterior bracts* 4×1 mm, spreading (to erect), *pale green*, corniculate, scarcely bordered; capitulum 15–20mm, pale yellow; ligules striped violet; styles exserted, dark, nearly black, pollen present. *Achenes* 2.5mm, *dark violet purple*; *cone* 1.3mm. $2n = 16^*$, 24. Sexual or facultative agamosperm. **Fig. 2.**

Clinker path by dock, Haverton Hill, Co. Durham. 66. (1). Almost certainly introduced.

Central Europe. Au, (Br), Cz, Ge, Hu, It, Ju.

This species resembles 4. *T. rubicundum*, of which it may be a sexual ancestor, but it differs in leaf morphology, in having scapes which are hairy below the involucre (at least in bud), and very long cones to the achenes.

6. *T. silesiacum* Dahlst. ex Hagl., *Bot. Not.*, **1938**:500 (1938)

T. silesiacum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**:629 (1929), *nomen nudum*

T. silesianum Dahlst. ex Druce, *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**:124 (1930), *nomen nudum*

Leaves 30–100mm, *pure green*; leaf-lobes 4–5, crowded, slightly recurved, mostly entire, distal margin convex; *terminal lobe rounded*; petiole short, purple, winged. Scapes 30–120mm, arachnoid when young; exterior bracts 6×2 mm, erect-spreading, green, slightly corniculate, scarcely bordered; capitulum 30mm, yellow; ligules striped purple; styles exserted, discoloured, pollen always absent. *Achenes* 3.2mm, *dark red*; *cone* 1.0mm. $2n = 24$. Obligate agamosperm. **Fig. 2.**

Dry calcareous grassland. Local, and confined to southern England, Wales and Co. Galway. 17, 22, 23, 27, 36, 41, 42, 49, 55, H15. (9, H1). Native.

North-west and central Europe extending northwards to southern Sweden. Au, Br, Cz, Da, Ga, Ge, Hb, He, Ho, Hu, It, Po, Rm, Su.

This pretty little species is best recognised by its distinctive, bright green leaves and rather large, dark red achenes.

7. *T. commixtum* Hagl. in Hylander, *Förteckn. Skand. Växter* (Lund Bot. För.), 156 (1941)

T. commutatum Dahlst. in Lindman, *Svensk Fanerogamfl.*, 573 (1918), *pro parte*, *non* Jordan, *Pug. Pl. Nov.*, 116 (1852)

T. commixtum Hagl. in Holmgren, *Blekinges Flora*, 323 (1942)

Leaves 70–200mm, dull green; leaf-lobes pointing forward, patent or recurved, *linear, often swollen at apex or bifurcate*; interlobes with lobules and long teeth; petiole purple, unwinged. Scapes 150–250mm, rather stout, ascending to erect, often suffused purple, arachnoid; *exterior bracts 8–10mm, erect, dark green*, neither obviously corniculate nor bordered; capitulum 40mm, deep yellow; ligules striped reddish-purple; styles exserted, *yellow*, pollen present. *Achenes 3.5mm, dark red*; cone 1.0mm. **Fig. 2.**

Sandy heaths; known only from Jersey, three stations in southern England and one in Northumberland. 22, 25, 29, 68, S. (4, S). Probably native.

Southern Scandinavia, around the North Sea and into the English Channel. Br, Da, Ga, Ge, Ho, Su.

This is a robust species with characteristic laciniate leaves and large achenes and bracts.

8. *T. disseminatum* Hagl., *Svensk bot. Tidskr.*, **41**:85 (1947)

Leaves 50–150mm, rather pale green, almost glabrous; *leaf-lobes 2–3, long, triangular, with large teeth on distal margin*; petiole dark violet, unwinged. Scapes 100–200mm, erect, rarely coloured, arachnoid below the capitulum; exterior bracts 6 × 2mm, recurved, slightly corniculate, clearly bordered; capitulum 30mm, pale yellow; ligules striped grey-violet; styles exserted, *blackish*, pollen present. *Achenes 3.2mm, chestnut*; cone 0.8mm. $2n = 24$. Obligate agamosperm. **Fig. 2.**

Short dry grassland. Surrey and Glamorgan. 17, 41. (2). Probably introduced. From Scandinavia and England southwards to central Europe. Au, (Br), Da, Fe, Ga, Ge, He, Ho, No, Su.

The leaves, blackish styles and chestnut achenes of this species are all quite distinctive.

9. *T. glaucinum* Dahlst., *Bot. Not.*, **1909**:177 (1909)

Leaves 80–200mm; pale glaucous green; leaf-lobes pointing forward, patent or recurved, linear; interlobes with many lobules and teeth; petiole reddish, winged. Scapes 150–300mm, erect, green, arachnoid; exterior bracts 9 × 2mm, erect, *pale glaucous-green, with a clear white border*; capitulum 40mm, pale yellow; ligules *striped red*; styles exserted, discoloured, pollen present. *Achenes 3.0mm, red*; cone 1.0mm. **Fig. 3.**

Sand-dunes in Lancashire. 59, 60. (2). Probably native.

Local in southern Fennoscandia, England and Germany. Br, Fe, Ge, Su.

This is the only large, glaucous *Erythrosperma* species with laciniate leaves.

10. *T. hispanicum* H. Lindb. f., *Acta Soc. Sci. fenn.*, nov. ser. B, **1** (2): 171(1932)

T. vachellii Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1932*, **10**:26 (1933)

Leaves 100–150mm, yellow-green, almost glabrous; leaf-lobes 3–4, *triangular-deltoid, entire*; petiole reddish, winged. Scapes 150–220mm, not coloured, *glabrous*; exterior bracts 7×2 mm, erect, *dark glaucous green, neither corniculate nor bordered*; capitulum 30mm, yellow; ligules striped purple; styles exserted, discoloured, pollen present. Achenes 3·0mm, red; cone 1·0mm. **Fig. 3.**

Habitat uncertain, but probably dry rocky places in partial shade. Devon, Brecon and Westmorland. 3, 42, 69. (3). Native.

England, Wales and Spain. Br, Hs.

The leaves and exterior bracts of this apparently Lusitanian species serve to distinguish it from all others.

11. *T. gotlandicum* (Dahlst.) Dahlst., *Bot. Not.*, **1909**:171 (1909)

T. erythrospermum subsp. *gotlandicum* Dahlst., *Bot. Not.*, **1905**: 169 (1905)

Leaves 50–100mm, mid-green; leaf-lobes 4–6, patent, short, often obtuse, usually entire, distal margin concave; *petiole usually green*, winged or unwinged. Scapes rather many, 80–150mm, decumbent to erect, not coloured, arachnoid; exterior bracts 7×2 mm, erect, glaucous, suffused violet, bordered; capitulum 30mm, pale yellow; ligules striped violet; styles exserted, *yellow*, pollen present. Achenes 3·0mm, *brick-red*; cone 0·8mm. **Fig. 3.**

Dry, rocky places. Angus and Banff. 90, 94. (2). First recorded by Miss M. McCallum Webster in 1967, since when it has been found in a further 5 localities. Probably native.

Scotland, the Oslofjord, the south-east coast of Sweden, Öland, Gotland and Estonia. Br, No, Rs(B), Su.

This species has a most interesting disjunct distribution. Before the Scottish localities were known it was considered by Wendelbo (1959) to be a thermophilous pre-boreal relict. With the exception of 13. *T. laetiforme*, which, however, lacks pollen, *T. gotlandicum* is the only species with green petioles, yellow styles and red achenes. It has a most distinctive leaf shape.

12. *T. laetum* (Dahlst.) Dahlst. in Sernander *et alia*, *Bot. Studier till. F. R. Kjellman*, 183 (1906)

T. erythrospermum subsp. *laetum* Dahlst., *Bot. Not.*, **1905**:169 (1905)

T. laetum (Dahlst.) Dahlst. in Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 257 (1906)

Leaves numerous, 50–100mm, mid-green; *leaf-lobes 5–8*, regular, recurved, *narrow, acute*; petiole usually green, unwinged. Scapes many, 50–100mm,

green, arachnoid above; exterior bracts 6×2 mm, erect, pale green, with a purple corniculation, bordered; capitulum 30mm, pale yellow; ligules striped violet or grey; styles exserted, yellow, pollen present. Achenes 2.5mm, dark violet; cone 0.8mm. **Fig. 3.**

Sand-dunes and sandy grassland; rarely in calcareous grassland, local. 1, 3, 13, 22, 24, 27, 29, 41, 45, 46, 48, 52, 55, 57, 60, 66, 74, 85, 90, 94, 96, 101, 107, S. (23, S). Native.

Britain, southern Fennoscandia and the Russian Baltic coast. Br, Da, Fe, No, Rs(B), Su.

The green petioles and yellow styles distinguish this species from all except 11. *T. gotlandicum* and 13. *T. laetiforme*. The latter two both have reddish achenes and *T. laetiforme* also lacks pollen.

13. *T. laetiforme* Dahlst., *Bot. Not.*, 1909: 174 (1909)

T. agauriforme Saarsoo, *ined.*, *nom. in herb.*

Leaves 40–80mm, mid-green; leaf-lobes 5–8, $\pm$ recurved, short, acute or obtuse; petiole usually colourless, unwinged. Scapes 50–100mm, colourless, arachnoid above; exterior bracts 7×1 mm, recurved, with a purple corniculation, bordered; capitulum 30mm, pale yellow; ligules striped violet; styles exserted, pale yellowish or greyish, pollen present. Achenes 2.7mm, reddish; cone 0.7mm. **Fig. 4.**

Sand-dunes and dry rocks. Norfolk, Derbyshire, Moray and Kintyre. 28, 57, 95, 101. (4). Doubtfully native.

Scattered in northern and north-west Europe. (Br), Da, Ga, Ho, No, Su.

Superficially similar to 12. *T. laetum*, this species differs in its long, narrow, recurved exterior bracts and red achenes.

14. *T. dunense* van Soest, *Acta bot. neerl.*, 5: 95 (1956)

Leaves 50–120mm, dark green, often purplish; leaf-lobes 5–10, patent, linear; interlobes straight, very narrow, often with lobules and teeth; petiole very narrow, dark violet-purple, unwinged. Scapes 50–150mm, decumbent to erect, purplish, arachnoid; exterior bracts 7×2 mm, spreading, green, corniculate, scarcely bordered; capitulum 30mm, deep yellow; ligules striped purple; styles exserted, discoloured, pollen present. Achenes 3.5mm, dark violet; cone 1.2mm. $2n = 24$. **Fig. 4.**

Sand-dunes, extending north to Anglesey in the west and Angus in the east. 14–16, 34, 41, 45, 52, 66, 67, 90. (10). Native.

Britain, Belgium, the Netherlands and southern Sweden. Be, Br, Ho, Su.

T. dunense is a most distinctive species with very narrow leaf-lobes and mid-ribs and large, violet achenes.

SPECIES WITH CINNAMON* ACHENES (NOS. 15-19)

15. *T. fulvum* Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 258 (1906)

Leaves 50-180mm, dull green; leaf-lobes 4-7, recurved, acute, usually filiform-dentate; interlobes dentate; petiole dull purple, winged. Scapes 60-200mm, erect, arachnoid; *exterior bracts* $5 \times 1\text{mm}$, recurved, dull green, neither corniculate nor bordered; capitulum 35mm, deep yellow; ligules striped grey-violet; styles exserted, discoloured, *pollen absent*. *Achenes* 3.0mm, cinnamon; cone 0.7mm. $2n = 32^*$. Obligate agamosperm. **Fig. 4.**

Dry grassland, occurring in more closed communities than is usual in this section. Locally frequent; not recorded from Ireland. 1, 2, 6, 7, 9, 10, 12-24, 26, 28, 29, 31, 32, 37, 39, 41, 49, 53-55, 57, 60, 62, 64, 67-69, 79, 80, 90, 96, 98, 101, 110, S. (45, S). Native.

Northern Europe extending southwards to Czechoslovakia; widespread and locally common in Scandinavia, occurring further north than the other members of this section. Br, Cz, Da, Fe, Ga, No, Rs (B, N), Su.

Not one of the more attractive members of this section, *T. fulvum* is characterised by its narrow, recurved exterior bracts, absence of pollen and cinnamon achenes. The differences between this species and 18. *T. retzii* are given under the latter.

16. *T. fulviforme* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, 6: 775 (1923)

Leaves 40-100mm, dull green; leaf-lobes 4-5, recurved, dentate; petiole dull purple, narrowly winged. Scapes 60-150mm, erect, not coloured, arachnoid above; *exterior bracts* $7 \times 2\text{mm}$, erect, dark green, scarcely corniculate or bordered; capitulum 25mm, mid-yellow; ligules striped grey-violet; styles exserted, discoloured, *pollen absent*. *Achenes* 3.0mm, cinnamon; cone 0.8mm. $2n = 32^*$. Obligate agamosperm. **Fig. 4.**

Dry places, especially sand-dunes, cliff-tops and calcareous grassland. Also in paths and lawns. Throughout Britain, but scarce in the north and east; not recorded from Ireland. 1, 3, 6, 7, 10, 13, 14, 16, 17, 22, 23, 30, 31, 35, 37, 39, 41, 42, 45, 48, 49, 52, 54, 55, 57, 59, 60, 67, 74, 90, 96, 98, 101, 110, S. (34, S). Native.

Britain, France and Belgium. Be, Br, Ga.

Well-grown forms have a distinctive leaf-shape; smaller forms from cliff-tops are confusing, especially when growing with 15. *T. fulvum* and 17. *T. oxoniense*, as in Pembrokeshire. It is, however, clearly differentiated as the only cinnamon-fruited species lacking pollen and with erect exterior bracts.

* see note p. 11.

17. *T. oxoniense* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, **6**: 776 (1923)

T. aloniense Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1924*, **7**: 441 (1925), *nomen nudum*

T. helvicarpum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 619 (1929)

T. neglectum Hagl., *ined., nom. in herb., non Nakai & Koidzumi, Bot. Mag. Tokyo*, **50**: 145 (1936)

T. neoneglectum van Soest, *ined., nom. in herb.*

Leaves 30–250mm, pure green; leaf-lobes irregular, patent, narrow, acute; terminal lobe often long, subdivided; interlobes with teeth and lobules; petiole narrow, bright purple. Scapes 50–280mm, decumbent to erect, purplish, glabrous; *exterior bracts* 7 × 2mm, erect, dark green, scarcely corniculate, with a white border, capitulum 30mm, mid-yellow; ligules striped grey-violet; styles exserted, yellowish, pollen present. *Achenes* 3·0mm, cinnamon; cone 1·0mm. $2n = 32^*$. Obligate agamosperm. **Fig. 5.**

Dry neutral or calcareous ground, especially downland and sand-dunes. Wide-spread and locally common in England and Wales; local in Scotland. 1, 3, 5–7, 9–15, 17, 20, 22–30, 32–39, 41–50, 52, 53, 55, 57–62, 64, 66–71, 75, 82, 100, 101, 107, H9, S. (62, H1, S). Native.

North-west Europe. Be, Br, Ga, Hb, Ho, No.

This is the commonest member of the section in England and Wales. The leaf-morphology, although varying from highly dissected to almost entire, is nevertheless characteristic, especially in combination with the bright green colour of the leaves, and the bright purple of the petioles. The erect, dark green, white-bordered exterior bracts are also distinctive. This is also the only cinnamon-fruited species with erect bracts possessing pollen.

18. *T. retzii* van Soest, *Acta bot. neerl.*, **10**: 290 (1961)

Leaves 80–250mm, dull green; *leaf-lobes* 4–7, slightly recurved, very long, dentate, often on both margins; petiole dull reddish, unwinged or winged. Scapes 100–300mm, greenish, arachnoid above; *exterior bracts* 9–10mm, recurved, green, neither corniculate nor bordered; capitulum 35mm, yellow; ligules striped grey-violet; styles exserted, discoloured, pollen absent. *Achenes* 3·5mm, cinnamon; cone 1·2mm. **Fig. 5.**

Acid sandy heaths in southern England, very local. 20, 22, 28, 29, S. (4, S). Native.

England, France and Italy. Br, Ga, It.

The leaf-shape and the large achenes serve to separate *T. retzii* from 15. *T. fulvum*.

19. *T. glauciniforme* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 620 (1929)

Leaves 40–200mm, narrowly oblong, *pale green, shortly laciniate*; leaf-lobes 8–12, patent, short, acute; interlobes with many short lobules and teeth; petiole usually green, winged. Scapes 20–100mm, erect, green, arachnoid; exterior bracts 7×2 mm, recurved, green, slightly corniculate, unbordered; capitulum 30mm, pale yellow; ligules striped pale grey; styles exserted, discoloured, *pollen absent*. Achenes 2.5mm, *cinnamon*; cone 0.8mm. **Fig. 5.**

Dry calcareous downland; also not infrequently on paths, walls and in gardens. Widespread and locally common in England and Wales, also recorded from Ayrshire and Co. Galway. 1, 6, 11, 14, 16, 17, 22–24, 28–30, 33, 41, 47, 55, 59, 66, 75, H16, S. (19, H1, S). Native.

British Isles, Belgium and France. Be, Br, Ga, Hb.

This most characteristic species is instantly recognised by its leaf-shape and distinguished from small forms of 9. *T. glaucinum* by the cinnamon achenes.

SPECIES WITH DARK-BROWN ACHENES (NO. 20)

20. *T. proximum* (Dahlst.) Dahlst. in Sernander *et alia*, *Bot. Studier till. F. R. Kjellman*, 183 (1906)

T. erythrospermum subsp. *proximum* Dahlst., *Bot. Not.*, **1905**: 105 (1905)

T. proximum (Dahlst.) Dahlst. in Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 257 (1906)

T. praevenum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**: 28 (1930), *nomen nudum*

Leaves 50–200mm, dull green; leaf-lobes 5–8, triangular, acute, dentate; petiole dull purple, winged. Scapes 60–250mm, erect, green, arachnoid; exterior bracts 8×2 mm, erect, dark green, slightly corniculate, scarcely bordered; capitulum 35mm, convex, deep yellow; ligules striped purple; styles exserted, discoloured, *pollen absent*. Achenes 2.8mm, *dark brown to purple-brown (puce)*; cone 0.8mm. $2n = 24^*$. Obligate agamosperm. **Fig. 5.**

Dry grassland and meadows, local. 1, 6, 26, 28, 47, 58, 59, 62, 65–68, 75, 78, 83, 95, 103, 108. (18). Native.

Europe, except the Arctic, Alpine and Mediterranean regions. Be, Br, Cz, Da, Fe, Ga, Ge, Hb, He, Ho, No, Rs (B, C, W), Su.

T. proximum is characterised by the absence of pollen, the distinctively shaped leaves and the unique colour of the achenes among British species.

SPECIES WITH PALE BROWN, GREY-BROWN, STRAW-BROWN OR STRAW-COLOURED ACHENES (NOS. 21–27)

21. *T. simile* Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 257 (1906)

Leaves 40–100mm, *pale green*; leaf-lobes 3–5, recurved, acute, dentate; petiole green, unwinged. Scapes 60–150mm, erect, green, arachnoid; *exterior bracts* 7 × 2mm, *recurved*, green, shortly corniculate, unbordered; capitulum 30mm, yellow; ligules striped dark violet; styles exserted, discoloured, *pollen absent*. Achenes 2·8mm, *straw-brown*; cone 0·7mm. $2n = 32^*$. Obligate agamosperm. **Fig. 6.**

Rock-crevices, walls, paths etc., mostly on silicious rocks. Local, absent from Ireland. 9, 14, 17, 20, 22–24, 27, 29, 34–36, 38, 44, 48, 55, 57, 67, 82, 101, 108, S. (21, S). Native.

North-west Europe and Sweden; scattered. Br, Da, Ga, Ho, No, Su.

Of the brown-fruited species, *T. simile* is characterised by recurved exterior bracts and absence of pollen.

22. *T. acutum* A. J. Richards, sp. nov. (see p. 96)

Leaves 30–60mm, *dark green*; leaf-lobes 4–5, *recurved*, acute, with one or several teeth; petiole green or purple, unwinged. Scapes 50–100mm, ascending-erect, narrow, green, arachnoid; *exterior bracts* 6–7mm, *spreading*, *dark green*, neither corniculate nor bordered; capitulum convex, deep yellow; ligules striped dark violet; styles exserted, discoloured, *pollen present*. Achenes 3·0mm, *straw-brown*; cone 0·7mm. **Fig. 6.**

Short calcareous turf in Hertfordshire and Norfolk. 20, 28. (2). Endemic.

T. acutum is closest to 21. *T. simile* but is readily distinguished by the dark, strongly recurved leaf-lobes and erect exterior bracts.

23. *T. degelii* Hagl., Bot. Not., 1935: 430 (1935)

Leaves 30–100mm, pale green; leaf-lobes variable, triangular-acute, or ± linear, almost entire; terminal lobe rounded or tripartite; petiole rose-coloured, unwinged or winged. Scapes 50–150mm, erect, green, arachnoid; *exterior bracts* 8–9mm, *erect*, slightly corniculate, *with a conspicuous white or rose-coloured border*; capitulum 30mm, pale yellow; ligules striped grey; styles exserted, discoloured, pollen present or *absent*. Achenes 3·0mm, *grey-brown*; cone 1·3mm. **Fig. 6.**

Rocky places, usually near the sea. Mid-Wales, Kintyre, western Ireland. 42, 43, 101, H9, 16, 27. (3, H3). Endemic.

This species is best identified by the wide white borders of the pale green exterior bracts.

24. *T. placidum* A. J. Richards, sp. nov. (see p. 96)

Leaves 60–200mm, narrow, pale green; leaf-lobes 5–8, *short, deltoid, entire* or

denticulate; petiole long, *bright purple*, narrowly winged. Scapes 100–300mm, erect, purple, arachnoid above; *exterior bracts* $7 \times 3\text{mm}$, patent, corniculate, with a white border; *involucre* narrow; *capitulum* 40–50mm, mid yellow; ligules striped silver-grey; styles exserted, *yellow*, pollen present. *Achenes* 3·5mm, *grey-brown*; cone 0·8mm. $2n = 24^*$. Obligate agamosperm. **Fig. 6.**

Dry grassy paths near St Annes, Alderney. S. Native.
Channel Isles, central France and northern Spain. Br, Ga, Hs.

This very distinctive species bears little resemblance to other species in this or any other section. The narrow, pale leaves with vivid petiole and mid-rib and short, deltoid leaf-lobes, the narrow involucre, large capitula with yellow polliniferous styles and large achenes are all characteristic.

25. *T. pseudolacistophyllum* van Soest, *Bull. Jard. bot. État Brux.*, **26**: 228 (1956)

T. affine Hagl., *Ber. schweiz. bot. Ges.*, **60**: 233 (1950), *non* Jordan, *Pug. Fl. Nov.*, 113 (1852)

Leaves 40–100mm, dark, *often suffused purple*; leaf-lobes 5–10, patent, pointing forward or recurved, *linear*; interlobes with lobules and teeth; petiole deep purple, unwinged. Scapes 50–120mm, ascending, purplish, especially below, arachnoid; *exterior bracts* $7 \times 2\text{mm}$, *erect, dark, suffused purple*, neither corniculate nor bordered; *capitulum* 30mm, convex, deep yellow; ligules striped purple; styles exserted, discoloured, pollen present. *Achenes* 3·0mm, *straw-brown*; cone 0·8mm. $2n = 32^*$. Obligate agamosperm. **Fig. 7.**

Dry grassland and sand-dunes; local and chiefly in southern and western England. 3, 15, 16, 27, 39, 41, 44, 55, 57, 58, 70, 82, 101, 103. (14). Native.
North-west and central Europe; local. Au, Be, Br, Ga, Ge, He, Ho, It.

Of the brown-fruited species, *T. pseudolacistophyllum* is distinguished by its purplish colour, narrow, more or less laciniate leaves, the erect, dark purplish, unbordered bracts and the presence of pollen.

26. *T. canulum* Hagl. in Marklund, *Acta bot. fenn.*, **26**: 134 (1940)

Leaves 50–150mm, *grey-green, laciniate*; leaf-lobes pointing forward, patent or recurved, *linear*; interlobes with lobules and teeth; petiole purple, unwinged. Scapes 40–100mm, ascending, green, arachnoid; *exterior bracts* $7 \times 2\text{mm}$, *spreading*, green, shortly corniculate and slightly bordered; *capitulum* 30mm, mid-yellow; ligules striped grey-violet; styles exserted, discoloured, *pollen absent*. *Achenes* 3·5mm, *warm straw-brown*; cone 1·0mm. **Fig. 7.**

Dry grassland in southern and central England; scattered. 16, 24, 29, 55. (4). Probably introduced.
England, Belgium, Sweden and Finland. (Be, Br), Fe, Su.

This species has been considered a form of, or identical with, *T. falcatum* Brenner (Lundevall 1962, Saarsoo & Haglund 1962). Van Soest (1966) suggests that the stigmas are greyer and the achenes more yellow-brown. I agree with him. Further, comparison in the field of the two taxa on Åland, Finland, where both are frequent, suggests that the leaves are more grey-green, and that the leaf-shape is different. Of the brown-fruited British species, *T. canulum* is unique in its greyish, lacinate leaves.

27. *T. proximiforme* van Soest in Lambinon & van Soest, *Lejeunia*, nov. ser., **8**: 2 (1962)

Leaves 50–250mm, dull green; leaf-lobes 3–6, slightly recurved; petiole winged, dull purple. Scapes 80–250mm, erect, arachnoid; exterior bracts 8×2mm, spreading, green, scarcely corniculate or bordered; capitulum 30mm, flat or convex, mid-yellow; ligules striped grey-violet; styles exserted, *yellow, pollen present*. Achenes 3·0mm, *straw-brown*; cone 0·8mm. $2n = 24^*$. Obligate agamosperm. **Fig. 7.**

Dry grassland on Magnesian Limestone; two localities in Co. Durham. 66. (1). Native.
England, the Channel coasts of France, Belgium and the Netherlands. Be, Br, Ga, Ho.

T. proximiforme is very similar to 20. *T. proximum* but has yellow styles, pollen and straw-brown achenes.

Section *Obliqua*

Section **OBLIQUA** Dahlst., *Acta Flor. Suec.*, **1**: 142 (1921)

Plants small. Leaves many, narrowly oblong, highly dissected, never spotted. Scapes exceeding leaves, coloured, nearly glabrous; exterior bracts ovate-lanceolate, adpressed or erect, corniculate, bordered; capitulum flat, or almost closed, deep or orange-yellow; ligules striped red; styles discoloured, pollen present. Achenes 3mm, grey-brown, with a short (0.4mm) conical cone. $2n=24$. Obligate agamosperms. Flowering May.

Plants of open sandy turf by the sea, especially 'machair'. Local and confined to the coasts of Britain, Belgium, the Netherlands and Scandinavia. Be, Br, Da, Ho, No, Su. There are only two species, both of which occur in Britain.

Although superficially similar to certain species of the section *Erythrosperma* (especially 12. *T. laetum* and 13. *T. laetiforme*), from which they may only be distinguished with certainty by the achenes, they are perhaps more closely related to the high-alpine section *Dissecta* van Soest, from which they may have become differentiated in late-glacial times in response to maritime conditions. The small size, many-lobed leaves, almost orange heads and shortly coned, greyish achenes are all very distinctive. All previous records of this section from Britain are erroneous, while most of the records of *T. obliquum* from central Europe usually refer to brown-fruited *Erythrosperma* species, never to *T. obliquum*.

28. *T. obliquum* (Fries) Dahlst., *Bot Not.*, **1905: 164 (1905)**

Leontodon obliquum Fries, *Nov. Fl. Suec.*, **1**: 14 (1814)

Leaves 30–80mm, *pale green*; leaf-lobes 7–10, *patent*, short, *obtuse*, scarcely dentate; petiole green, winged. Scapes many, 20–100mm, slender, green, glabrous; exterior bracts 6×2 mm, adpressed, with a purple corniculation and pale border; *capitulum orange-yellow*, usually closed; *ligules involute, striped red*; styles $\pm$ exserted, pollen present. *Achenes 3.0mm, grey-brown; cone 0.4mm, conical*. $2n = 24$. Obligate agamosperm. **Fig. 7.**

Dune-slacks and grey-dunes. Coasts of northern and western Scotland. 95, 101–103, 106, 107. (6). Native.
Scotland and Scandinavia. Br, Da, No, Su.

29. *T. platyglossum* has darker leaves, more acute, dentate leaf-lobes and a usually flat, deep yellow capitulum.

29. *T. platyglossum* Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 256 (1906)

Leaves 30–120mm, *dark green*; leaf-lobes 7–12, *recurved, acute*, filiform-dentate; petiole green, winged. Scapes many, 20–100mm, slender, often coloured, glabrous; exterior bracts 7×2mm, erect-adpressed, green, with a purple or green corniculation and pale border; capitulum 25–30mm, *usually flat*, sometimes closed, *deep yellow*; ligules *usually flat*, sometimes involute, striped red; *styles exserted*, yellow, pollen present. *Achenes* 3·0mm, *grey-brown*; *cone* 0·4mm. **Fig. 8.**

Sand-dunes. Scottish coasts; isolated localities in the Isle of Man, Anglesey, Somerset and Guernsey. Commoner and more widespread than the preceding species. 6, 52, 71, 75, 81, 82, 90, 94–96, 101, 103, 108, S. (13, S). Native.

Britain, southern Sweden and North Sea coasts. Be, Br, Da, Ho, No, Su.

The differences from the preceding species are mentioned under the latter; 12. *T. laetum* is very similar in many aspects but has quite different achenes.

Section Palustria

Section **PALUSTRIA** Dahlst., *K. svenska VetenskAkad. Handl.*, ser. 3, 6(3): 9 (1928)

Plants medium-sized, slender, smooth. Leaves often almost linear, not lobed or only shortly so. Exterior bracts ovate, adpressed, ecoriunculate, with a broad scarious border; capitulum 35–45mm, flat; ligules flat (in Britain), striped grey-violet or purple; styles exserted, discoloured (in Britain), pollen present or absent. Achenes 3.5–4.0mm, mostly smooth, somewhat oblong, straw or straw-brown; cone to 1.0mm, conical or subcylindrical. $2n = 24, 32^*, 40^*$. Obligate agamosperms. Sexuals reported by Fürnkranz (1961) from Austria in the aggregate species '*T. palustre* (Lyons) DC.' Flowering May.

Grassy fens, water-meadows etc. Throughout Europe except for high montane regions, the Arctic and the Mediterranean Islands. Absent from Az, Bl, Co, Cr, Fa, Hs, Is, Lu, Sa, Sb, Si. Outside Europe known only from Turkey and Iran.

All the species are local or rare; a number are extinct, or on the verge of extinction, including all three British species. Although many species may always have been local, drainage, and especially the change from hay-meadow to grazing-pasture, seems to have contributed significantly to the general decline of species in this section over the last 50 years.

The relationship of this section to others of the genus is obscure. Although in some features (achenes, cytology, ecology) this section shows affinities with the Spectabilia, the widespread and often disjunct distributions, leaf-morphology, and scarious, wide-bordered exterior bracts suggest a more primitive status. It is possible that the section arose during an interglacial (the last?) in the Mediterranean area through hybridisation between the paludal, but halophytic section Leptocephala van Soest with the section Orientalia Hand.-Mazz. The section seems to be a very natural one, although 32. *T. anglicum* has affinities with the section Spectabilia.

This section has been consistently misinterpreted in this country (as in Clapham, Tutin & Warburg 1962), culminating in the map of *T. palustre* in Perring & Sell (1968), which mostly refers to species of the Spectabilia.

30. *T. palustre* (Lyons) Symons, *Syn. Pl. Brit.*, 172 (1798), *non* Dahlst., *Bot. Not.*, 1905: 145 (1905), *nec T. palustre* (Ehrh.) Dahlst., *K. svenska VetenskAkad. Handl.*, ser. 3, 6 (3): 16 (1928)

Leontodon palustre Lyons, *Fasc. Pl. Cantab.*, 48 (1763)

T. limnanthes subsp. *limnanthoides* van Soest, *Acta bot. neerl.*, 14: 38 (1965)

Leaves 20–150 × 5–12mm, decumbent to erect, *linear, smooth*, mid-green; *leaf-lobes absent* or 2–3, distant, very short, deltoid, entire; petiole purple, unwinged

or winged. Scapes 40–200mm, decumbent to erect, usually purple, arachnoid above; exterior bracts 7×3 mm, *adpressed*, green, or suffused purple, *with a broad scarious border*; capitulum 40mm, flat, deep yellow; ligules flat, striped purple; stigmas scarcely exerted, discoloured, *pollen absent*. *Achenes* 4.0mm, *straw-coloured, oblong*, scarcely spinulose; cone 0.5mm. $2n = 40^*$. Obligate agamosperm. **Fig. 8.**

In hay-meadows liable to seasonal flooding; less often in calcareous flushes and margins of gravel-pits. Rare, apparently only surviving in Norfolk, Cambridgeshire, Berkshire, Hampshire and Co. Clare. There are probably less than 500 plants left in the British Isles, and the world population may well number less than 1,000. 11, (20), 22, (23), 27, (28), 29, (30, 37, 63, 82), H9. (11, H1). Native.

British Isles, the Netherlands and north-west Germany. Br, Ge, Hb, Ho.

This species is readily distinguished as it is the only one with linear leaves and lacking pollen. I am grateful to P. D. Sell for supplying the following nomenclatural note:—

Leontodon palustre was described by Lyons from Hinton Moor, Cambridgeshire. No original herbarium specimen has been traced. The original diagnosis, however, '*Leontodon (palustre)* calyce toto erecto glabro, scapo cavo uniflora' with additional description '*Folia radicalia oblonga, ad apicem latiora, acuta denticulata glabra, nervo media rubro. Scapus teres cavus unifoliorus. Calyx glaber imbricatus, squamae externae ovatae margine submembranaceae erectae; internae lineares. Receptaculum nudum. Pappus pilosus denticulatus stipitatus*' could in Britain only fit the species under discussion, which I have seen growing in the Fulbourn – Teversham Fen area which is the only remnant of a once large area of fen and moor adjacent to Cherry Hinton.

31. *T. austrinum* Hagl., *Bot. Not.*, 1946: 343 (1946)

T. palustre Dahlst., *Bot. Not.*, 1905: 145 (1905), *non* (Lyons) Symons, *Syn. Pl. Brit.*, 172 (1798)

Leaves 70–150mm, *linear-spathulate*, dull green, smooth, *not lobed, denticulate*; petiole purple, unwinged. Scapes 100–200mm, erect, dull green, arachnoid above; *exterior bracts* 5×2 mm, *erect, olive green, with a paler border*; capitulum 35mm, flat, yellow; ligules flat or involute, striped grey-violet or $\pm$ concolorous; styles exerted, *greenish, pollen present*. *Achenes* 3.5mm, *olive-brown*, spinulose above; cone 0.8mm. $2n = 32^*$. Obligate agamosperm. **Fig. 8.**

Tall grassy fens. Guernsey and Co. Galway; possibly extinct in Lancashire and Cambridgeshire. (29, 59), H16, S. (2, H1, S). Native.

North-west Europe and Switzerland; rare and scattered. Br, Da, Ga, Ge, Hb, He, Ho.

The spathulate, denticulate leaves combined with the small, greenish exterior bracts and greenish, polliniferous styles are quite characteristic.

32. *T. anglicum* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1919*, 5: 567 (1920)

Leaves 60–200mm, erect, dull green, smooth, *lobate*; leaf-lobes 2–3, short, acute, *sagittate*, entire; *petiole vivid purple*, unwinged. Scapes 50–200mm, erect, greenish, glabrous; *exterior bracts 7 × 3mm, adpressed, ovate, dark green, with a white border*; capitulum 40mm, flat, deep yellow; ligules flat, striped leaden-grey; stigmas exserted, discoloured, *pollen present*. *Achenes 3.5mm, straw-brown*, spinulose above; cone 0.8mm. **Fig. 8.**

Very local but frequent in hay-meadows liable to seasonal flooding. Cambridgeshire, Huntingdonshire, Surrey, Oxfordshire and Berkshire; extinct in Buckinghamshire. 17, 22, 23, (24), 29, 31. (6). Native.

England, the Netherlands, Germany and Switzerland. Br, Ge, Ho, He.

Although often placed in the *Spectabilia*, the smooth, slender leaves, and ovate, tightly adpressed exterior bracts seem to point unequivocally to this section. The lobate leaves and presence of pollen are diagnostic.

Section *Spectabilia*

Section **SPECTABILIA** Dahlst., *K. svenska VetenskAkad. Handl.*, ser. 3, 9(2): 5 (1930)

Section *Crocea* M.P. Chr., *Bot. Iceland*, 3(3): 255 (1942)

Section *Euspectabilia* M.P. Chr., *Bot. Iceland*, 3(3): 292 (1942)

Section *Naevosa* M.P. Chr., *Bot. Iceland*, 3(3): 303 (1942)

Section *Macrodonia* M.P. Chr., *Bot. Iceland*, 3(3): 318 (1942)

Plants usually medium-sized. Leaves rarely linear or highly dissected, often dark, hairy and spotted; petiole and mid-rib often purple. Scapes arachnoid; exterior bracts not exceeding 10mm, spreading to adpressed, usually ovate-lanceolate, never corniculate or with a broad or very distinct border; capitulum 30–50mm, usually flat; ligules nearly always flat, often striped purple or carmine; styles usually exserted, usually discoloured, pollen often absent. Achenes 3.5–5.0mm, sometimes oblong, straw or brown-coloured, often scarcely spinulose; cone not exceeding 1.0mm, conical, short; rostrum 5–10mm, often thick. $2n = 24^*$, 32^* , 40^* , 48^* . Obligate agamosperms. Flowering May–July.

Wet places, especially in upland Britain. A markedly Atlantic section, restricted to western Europe and Greenland, and showing the greatest diversity in Norway, Iceland and Scotland. Br, Da, Fa, Fe, Hb, Ho, Hs, Is, Lu, No, Rs(N), Sb, Su. 61. *T. nordstedtii* and 64. *T. adamii* occur also in Be, Ga and Ge.

This is a heterogeneous section most species of which can be divided into:—

- a. Nos. 59–65, lowland triploids and hexaploids, with smooth, unspotted, leaves and small dark achenes. These have perhaps arisen from hybridisation between the sections *Vulgaria* and *Palustria*.
- b. Nos. 36–40, upland pentaploids (Section *Euspectabilia sensu* Christiansen), with dark, spotted leaves, adpressed exterior bracts and large, oblong, straw-coloured achenes. These are of uncertain origin.
- c. Nos. 41–51, upland tetraploids (Section *Naevosa sensu* Christiansen), with dark, spotted leaves but with spreading bracts and smaller, top-shaped achenes. These may have arisen from hybridisation between the sections *Vulgaria* and *Euspectabilia*.
- d. Nos. 52–57, arctic tetraploids (Section *Crocea sensu* Christiansen), with pale leaves with green petioles, deep yellow capitula, and spreading exterior bracts. These may have arisen from either the sections *Alpina* Hagl. or *Fontana* van Soest, or as a result of hybridisation between these and species of the *Vulgaria*.

However, there are intermediates between all these groups and although they are very convenient subdivisions of this very large section they are not discrete enough for formal use.

SPECIES WITH REDDISH ACHENES (NOS. 33 AND 34)

33. *T. unguilobum* Dahlst., *Ark. Bot.*, 12(2): 57 (1912)

Leaves 50–200mm, often *yellow-green*, unspotted; leaf-lobes 4–6, *strongly re-curved, filiform-dentate*; *petiole pink*, winged or unwinged. Scapes 50–300mm, decumbent to erect, green or pink; *exterior bracts 8 × 2mm, spreading-erect, pale glaucous-green above, darker below, pink-tipped, with a white border*; capitulum 35mm, *pale yellow*; ligules striped pink; *styles inserted, yellow, pollen absent*. Achenes 3·2mm, *rust-coloured*, slightly spinulose above; cone 0·5mm, conical. $2n = 32^*$. Obligate agamosperm. **Fig. 9.**

Wet paths, rock-faces, roadsides and flushes in hilly districts. Common in the north and west; rare and perhaps introduced in the south and east. 1, 3, 6, 23, 26, 39, 42, 44, 48–50, 52, 64, 66–71, 73–75, 80, 83, 88, 90, 94–101, 103, 105, 108, 109, 111, 112, H1, 9, 16, 27. (40, H4). Native.

British Isles and Norway. Br, Hb, No.

This is perhaps the most distinctive species in the section. The highly recurved leaf-lobes, glaucous, pink-tipped and bordered exterior bracts and small, reddish achenes are all diagnostic. *T. unguilobum* has no obvious affinities to other species in the section, except for 34. *T. fulvicarpum*. It may be that they differ from the remainder in having members of the *Erythrosperma* in their ancestry.

34. *T. fulvicarpum* Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, 29: 420 (1927)

T. unguilobiforme Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1933*, 10: 475 (1934)

Leaves 100–200mm, pale green, unspotted; leaf-lobes 3–5, recurved, narrow, *straight-sided, coarsely dentate*. Scapes 30–100mm, decumbent to erect; exterior bracts 9 × 2mm, spreading, green, *unbordered and with green tips*; capitulum 40mm, mid-yellow; ligules striped violet; *styles exserted, discoloured, pollen usually absent*. Achenes 3·4mm, *cinnamon*; cone 0·7mm, slender. $2n = 32^*$. Obligate agamosperm. **Fig. 9.**

Ecologically very catholic, occurring in wet grassland, wood-borders and dune-slacks. Local; commonest in western Scotland. 3, 15, 42, 66, 67, 90, 94, 97, 99, 101, 103, 104, 106, 110–112. (16). Endemic.

T. fulvicarpum is best distinguished from the preceding by its coarsely dentate leaves and concolorous bracts. It is sometimes placed in the section *Erythrosperma*. Although the achenes are strongly reminiscent of some cinnamon-fruited species in that section (although larger) this species is coarser than any *Erythrosperma* species, and for that reason is placed here.

SPECIES WITH ERECT EXTERIOR BRACTS AND SMALL ACHENES (NO. 35)

35. *T. landmarkii* Dahlst., *Bergens Mus. Aarb. for 1923-1924*, 6: 14 (1925)

T. firmuliforme A. J. Richards, *Taxon*, 18: 561 (1969), *nomen nudum*

Leaves 50-120mm, smooth, mid-green, unspotted; leaf-lobes 4-5, *patent*, narrow, *deltoid*, acute, entire; interlobes with lobules; petiole purple, unwinged. Scapes 100-200mm, erect, green; *exterior bracts* 8 × 2mm, *spreading-erect*, dark green, *suffused purple*, *unbordered*; *capitulum* 35mm, *convex*, *mid-yellow*; ligules striped purple; styles exserted, discoloured, pollen present or *absent*. Achenes 3.0mm, warm straw-brown, spinulose above; cone 0.6mm, rather narrow. $2n = 32^*$. Obligate agamosperm. **Fig. 9.**

Stream-sides, ravines, wet cliffs, path-sides etc.; local, commonest in the Scottish Highlands. 15, 22, 23, 28, 29, 42, 55, 66-68, 71, 75, 88, 92, 96, 98, 99, 101, 103, 111, H1. (14, 20, H1). Native.

British Isles and Norway. Br, Hb, No.

T. landmarkii has rather pretty, distinctive leaves and very small achenes, similar to those of 49. *T. lainzii*, and indicating a relationship with the section *Vulgaria*.

SPECIES WITH ERECT EXTERIOR BRACTS, LARGE ACHENES AND DARK, SPOTTED LEAVES (EUSPECTABILIA) (NOS. 36-40)

36. *T. faeroense* (Dahlst). Dahlst., *Bergens Mus. Aarb. for 1923-1924*, 6: 12 (1925)

T. spectabile var. *faeroense* Dahlst. in Warming, *Bot. Faeröes*, 3: 839 (1908)

T. subeximium M.P. Chr., *Bot. Iceland*, 3(3): 294 (1942), *non* Dahlst., *ined.*, *nom. in herb.*

Leaves 50-250mm, spatulate, rough, dark green, *often spotted*, lobed or *unlobed*; leaf-lobes 2-3, *patent* or slightly recurved, *broad*, acute; petiole purple. Scapes 20-200mm, often coloured; exterior bracts 8 × 2mm, *adpressed-erect*, dark green, scarcely bordered; capitulum 40mm, bright yellow; *ligules striped carmine*; styles exserted or $\pm$ *inserted*, *yellow*, *pollen absent*. Achenes 4.0 × 1.1mm, *straw-coloured*, scarcely spinulose above; cone 0.3mm, broad. $2n = 40^*$. Obligate agamosperm. **Fig. 9.**

Wet places in hilly districts, often very common; less frequently on lowland heaths and roadsides where it is probably introduced. Ascends to 1,000m (3,300ft) in Scotland. Throughout Britain but rare in the south; Co. Kerry. 1, 3, 8, 11-14, 17, 22-24, 28, 29, 34, 35, 37-42, 44, 45, 47, 49, 52, 57-59, 61-72, 82, 83, 85, 87-90, 92, 94-101, 103-108, 110-112, H1. (66, H1). Native.

North-west Europe. Br, Da, Fa, Hb, Is, No, Su.

The dark, often spotted leaves with coloured petioles, adpressed exterior bracts, carmine ligules and large pale achenes distinguish this species from all except 37. *T. spectabile* and 38. *T. eximium*. It is best separated from the former by the few, more or less patent leaf-lobes, or entire leaves, and from the latter by the leaves, which are dull and frequently lobate, and the smaller capitula and achenes. It is the commonest upland British *Taraxacum* species.

37. *T. spectabile* Dahlst., Bot. Not., 1905: 159 (1905)

T. dilutiroseum M.P. Chr., *Bot. Iceland*, 3(3): 297 (1942)

T. crispifrons M.P. Chr., *Bot. Iceland*, 3(3): 299 (1942)

T. subspectabile M.P. Chr., *Bot. Iceland*, 3(3): 300 (1942)

T. cimbricum Wiinst. in Raunk., *Dansk Ekskurs.-Fl.*, 7th ed., 332 (1950), *sine diag. lat.*; *Bot. Tidsskr.*, 55: 40 (1959)

Leaves 50–200mm, narrowly lanceolate, rough, dark green, *often spotted*, lobed; *leaf-lobes 4–8, recurved, rather narrow*, acute; petiole purple, usually winged, at least above. Scapes 20–150mm, often coloured; *exterior bracts 8 × 2mm* (but very *variable*), adpressed-erect, dark green, scarcely bordered; capitulum 40mm, bright yellow; ligules striped carmine; *styles usually inserted, yellow, pollen absent*. Achenes 4.3 × 1.0mm, straw-coloured, scarcely spinulose above; cone 0.3mm, broad. $2n = 40^*$. Obligate agamosperm. **Fig. 10.**

Less common in the north and more dependent on base-rich water than the preceding, also local in water-meadows etc. in the south. 11–14, 17, 22, 23, 28, 39, 41, 42, 44, 45, 49, 57, 58, 62, 65–67, 69, 76, 86, 88–91, 94–96, 98, 100, 101, 105–108, 112, H1, S. (38, H1, S). Native.

North-west Europe. Br, Da, Fa, Hb, Is, No, Su.

T. spectabile is distinguished from 36. *T. faeroense* by the more numerous and more recurved leaf-lobes.

38. *T. eximium* Dahlst., Ark. Bot., 12(2): 30 (1912)

Leaves 60–200mm, *spathulate, shining, dark green, rarely spotted, ± unlobed*; *petiole bright purple*, usually unwinged. Scapes 50–200mm, *purple*; *exterior bracts 9 × 3mm, adpressed-erect, dark green*, scarcely bordered; capitulum 50mm, dark yellow; ligules striped carmine; *styles exserted, yellow, pollen absent*. Achenes 5.0 × 1.3mm, straw-coloured, scarcely spinulose above; cone ± absent. **Fig. 10.**

Local, in wet acid places in the Scottish Highlands. 85, 90, 92, 94–96, 99, 103, 106, 108. (10). Native.

North-west Europe. Br, Is, No, Su.

The differences between this species and 36. *T. faeroense* are given under the latter.

39. *T. reclinatum* M.P. Chr., *Bot. Iceland*, 3(3): 293 (1942)

Leaves 50–200mm, rough, mid-green, *usually spotted*; leaf-lobes 4–6, broad, *distal margin sigmoid*; petiole purple, winged. Scapes 100–150mm, pale; *exterior bracts* 9×2.5 mm, erect, stiff, *dull green*; capitulum 45mm, yellow; ligules striped purple; styles exserted, *discoloured, pollen absent*. Achenes 4.0×1.3 mm, *broadly spinulose above*; cone 0.6mm. **Fig. 10.**

Habitat not known. Isle of Skye and Sutherland. 104, 108. (2). Native. Scotland, Iceland and Norway. Br, Is, No.

This is a distinctive species with large, erect exterior bracts and wide achenes with broad-based spinules. The leaves closely resemble those of 42. *T. euryphyllum*, but have more strongly sigmoid lobe-margins. This Scottish plant agrees with Christiansen's description of the Icelandic species *T. reclinatum*, but it is not yet clear whether this can be regarded as the correct name. I have recently seen similar plants from Norway in Lundevall's collection at Stockholm.

40. *T. acrifolium* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, 8: 621 (1929)

Leaves 80–200mm, *very narrowly lanceolate*, rough, dark green, *usually spotted*; leaf-lobes 1–2, slightly recurved, short, dentate; *terminal lobe very long and narrow, approximately $\frac{1}{2}$ length of leaf*, entire; petiole dull purple, unwinged. Scapes 100–200mm, purplish; exterior bracts 9×2 mm, erect, stiff, dark green, $\pm$ glaucous, scarcely bordered; capitulum 40mm, deep yellow; ligules striped purple; styles discoloured, *exserted, pollen present*. Achenes 4.0mm, *straw-brown*, spinulose at apex only; cone 0.5mm. **Fig. 11.**

Habitat not known. Kintyre and Shetland. 101, 112. (2). Native. Scotland and Denmark (Jylland). Br, Da.

The leaf-shape of this species is most distinctive.

SPECIES WITH DARK SPOTTED LEAVES AND SPREADING EXTERIOR BRACTS
(NAEVOSA) (NOS. 41–51)

41. *T. calophyllum* Dahlst. in Johnston, *Addit. Fl. Orkney*, 13: 7 (1929)

Leaves 60–160mm, rough, dull green, often slightly spotted; leaf-lobes 4–6, slightly recurved, broad, *strongly dentate*; petiole dull purple, winged. Scapes 100–200mm, erect, pale; *exterior bracts* 10×2.5 mm, erect, green, scarcely bordered; capitulum 45mm, yellow; ligules striped grey-purple; styles exserted, *yellow, pollen present*. Achene characters not known. **Fig. 11.**

Habitat not known. Orkney. 111. Endemic.

This is a distinctive species with very strongly dentate leaf-lobes. It could only be confused with 51. *T. laetifrons* but this has green petioles, spreading exterior bracts and discoloured styles. It has not been found since originally collected by Johnston from the Island of Hoy in 1929.

42. *T. euryphyllum* (Dahlst.) M.P. Chr., *Bot. Tidsskr.*, **45: 154 (1940)**

T. maculigerum subsp. *euryphyllum* Dahlst., *Ark. Bot.*, **10**(11): 31 (1911)

Leaves 50–150mm, rough, *pure green, spotted*; leaf-lobes 4–6, acuminate, *distal margin sigmoid*, scarcely dentate; petiole purple, *winged*. Scapes 80–200mm, erect, pale; exterior bracts 9×2·8mm, spreading, ± glaucous, with a narrow white border; capitulum 40mm, yellow; *ligules striped red-purple*; styles exserted, discoloured, pollen present or absent. Achenes 3·5–4·0mm, dark straw-coloured, spinulose above; cone 0·7mm, rather narrow. $2n = 32^*$. Obligate agamosperm. **Fig. 11.**

In wet, rather sheltered, somewhat base-rich sites throughout Britain, but more frequent in the north. 23, 29, 39, 58, 59, 62, 66–68, 76, 77, 86, 90, 94, 98, 101, 103, 104, 107, 108, 111, 112. (22). Native.

Britain, Scandinavia and the Netherlands. Br, Da, Ho, No, Su.

T. euryphyllum is distinguished from 43. *T. maculigerum* by wider leaves, winged petioles, and longer cones to the achenes; from 39. *T. reclinatum* by less sinuate leaf-lobes, spreading exterior bracts and less densely spinulose achenes, and from 48. *T. drucei* by rougher, thicker leaves with ± acute terminal lobes. 46. *T. naevosiforme* has strongly recurved leaf-lobes, 50. *T. naevosum* very large capitula, and 45. *T. pseudolarssonii*, dark, shining leaves and longer, more acute, less sigmoid leaf-lobes.

43. *T. maculigerum* H. Lindb. f., *Acta Soc. Fauna Flora fenn*, **29(9): 35 (1907)**

Leaves 50–200mm, *narrow*, rough, *dull* or dark green, spotted; leaf-lobes 2–4, distant, patent or slightly recurved, short, acute; petiole dark purple, *unwinged*. Scapes 100–200mm, erect, pale; exterior bracts 8×2·5mm, spreading, dark green, somewhat glaucous, scarcely bordered; capitulum 40mm, yellow; ligules striped purple; styles exserted, discoloured, pollen present or absent. Achenes 3·5mm, straw-brown with rather few acute spinules above; cone 0·7mm, narrow. $2n = 32^*$. Obligate agamosperm. **Fig. 11.**

Wet places in the north, especially wet wood-margins, cliff-faces etc.; not noticeably basicolous. Fairly common, perhaps introduced into the south-east. 1, 7, 11, 19, 23, 39, 41, 42, 44, 45, 52, 59, 60, 62, 64, 66–70, 77, 83, 85, 86, 88, 90, 92, 94–99, 101, 103, 105–108, 111, 112, H28, 39. (41, H2). Native.

British Isles and Fennoscandia. Br, Da, Fe, Hb, No, Su.

T. maculigerum occurs further east than any other member of this section, being 'Northern Continental' rather than 'Northern Atlantic' in distribution.

It is rather surprising therefore that it is fairly common in this country. It has narrower leaves and petioles than the other species with spotted leaves and spreading exterior bracts, except 40. *T. acrifolium* which has a very long, narrow terminal leaf-lobe and longer achenes.

44. *T. praestans* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 24 (1907)

T. purpurinerve Dahlst., *Bot. Not.*, **1911**: 284 (1911), *nom. in syn.*

T. opeatolobum Dahlst. ex Lange, *Acta Bot. fenn.*, **21**: 160 (1938)

Leaves 50–170mm, smooth, mid-green, unspotted or spotted, sometimes heavily so; leaf-lobes 2–4, patent, narrow, slightly dentate; *terminal lobe rather long and relatively broad, subdivided; petiole bright purple, unwinged.* Scapes 80–200mm, erect, pale; exterior bracts 11×2.5 mm, spreading, green, scarcely bordered; capitulum 45mm, yellow; ligules striped grey-violet; styles long-exserted, *yellow, pollen present.* Achenes 3.5mm, light brown, spinulose above; cone 0.6mm, narrow. $2n = 32^*$. Obligate agamosperm. **Fig. 12.**

Wet places, especially beside roads and paths, and on wet cliffs; largely restricted to upland Britain, but not uncommon. 5, 12, 31, 45, 58–60, 66, 67, 69, 80, 88–90, 92–96, 98, 99, 101, 103, 106, 108, 110–112, H28. (28, H1). Native.

British Isles and Fennoscandia. Br, Da, Fe, Hb, No, Su.

This is another rather eastern species, although less so than the preceding. *T. praestans* is well characterised by narrow, bright purple petioles and long, subdivided terminal leaf-lobes, as well as yellow styles, abundant pollen and rather dark achenes. Forms from western Scotland can be very heavily blotched indeed, with very little green showing. Forms from the east, however, are usually unspotted, as are Scandinavian plants. It seems that an east-west cline in leaf-spotting exists in this species, although this may not be under genetic control.

45. *T. pseudolarssonii* A. J. Richards, *sp. nov.* (see p. 96)

Leaves 100–200mm, *rather smooth, shining, dark green, with red, purple or black spots*; leaf-lobes 3–5, *very regular, patent, narrow, acute, entire; petioles bright purple, unwinged.* Scapes 100–200mm, erect, pale; exterior bracts 7×2 mm, spreading, green, scarcely bordered; capitulum 45mm, convex, deep yellow; ligules striped grey-violet; styles exserted, discoloured, *pollen present.* Achenes 3.5mm, straw-brown, spinulose; cone 0.5mm. $2n = 32^*$. Obligate agamosperm. **Fig. 12.**

Calcareous flushes and stream banks. Lancashire and Co. Durham. 60, 66. (2). Endemic.

The leaf-colour and shape of this species are both distinctive.

46. *T. naevosiforme* Dahlst., *Ark. Bot.*, **12(2): 49 (1912)**

T. johnstonii Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, **6**: 744 (1923)

T. plicatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1933*, **10**: 476 (1934)

Leaves 50–200mm, rough, *dark green, spotted*; *leaf-lobes 4–7, recurved*, distal margin convex, slightly dentate; petiole dull purple, narrowly winged. Scapes 60–200mm, erect, usually dull purple; exterior bracts 10×2.5 mm, spreading, dark green, suffused purple and purple-tipped, scarcely bordered; capitulum 40mm, convex, deep yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.5mm, straw-brown, spinulose; cone 0.6mm. $2n = 32^*$. Obligate agamosperm. **Fig. 12.**

Wet grassland, cliffs etc. Commonest in northern Scotland, becoming progressively scarcer southwards. 19, 49, 66, 67, 70, 83, 88–90, 94–99, 101, 103–106, 108, 110–112. H2, 28, 29. (24, H3). Native.

British Isles and Scandinavia. Br, Hb, No, Su.

This is the only species with spotted leaves and spreading bracts that has markedly recurved leaf-lobes.

47. *T. sub simile* Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, **29: 89 (1924)**

Leaves 50–150mm, rough, mid-green, unspotted or with scattered small spots; *leaf-lobes 2–3, slightly recurved, long*, somewhat dentate; *petiole green*, winged. Scapes 50–100mm, ascending, green; exterior bracts 9×2 mm, spreading, green, unbordered; capitulum 40mm, yellow; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 3.5mm, straw-brown, spinulose; cone 0.6mm. **Fig. 12.**

Wet rocky grassland. Sutherland, Orkney and Shetland. 108, 111, 112. (3). Endemic.

T. sub simile is a characteristic, but little-known species with green leaves and 2–3, long leaf-lobes. The capitulum and achenes clearly indicate that it belongs to the *Naevisa* group.

48. *T. drucei* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, **6: 773 (1923)**

Leaves 60–170mm, *wide, smooth, glabrous, thin, usually spotted*; *leaf-lobes 2–4, broad*, slightly dentate or entire; *terminal lobe broad, entire, rounded*; petiole dull purple, winged or unwinged. Scapes 100–200mm, erect, pale; exterior bracts 8×2 mm, spreading, dull glaucous green, unbordered; capitulum 40mm, yellow; ligules striped grey; styles exserted, *yellow*, pollen present. Achenes 3.5mm, pale brown, spinulose above; cone 0.5mm. **Fig. 13.**

Wet places, especially gorges, cliffs etc., often on limestone. Northern and western parts of Britain, Ireland; local. 1, 49, 73, 90, 92, 99, 101, 108, 111, H2, 20. (9, H2). Endemic.

This is the only *Naevosa* species (with spotted leaves and spreading exterior bracts) with wide, thin leaves with rounded terminal leaf-lobes. The grey stripes to the ligules and the yellow styles are also distinctive.

49. *T. lainzii* van Soest, *Trab. Jard. bot. Univ. Santiago*, 7: 5 (1954)

A small, delicate plant. Leaves 40–100mm, erect, *spathulate, smooth, dark green, often spotted*, lobed or *unlobed*; leaf-lobes 4–5, triangular-patent, slightly dentate; terminal lobe short, often *rounded*; petiole purple, unwinged. Scapes 60–130mm, erect, narrow, pale; exterior bracts 6×2mm, spreading, green, darker outside, unbordered; capitulum 25mm, convex, deep yellow; ligules striped dark grey; styles exserted, discoloured, pollen present. *Achenes* 3·0mm, straw-brown, spinulose; cone 0·4mm. $2n = 24^*$. Obligate agamosperm. **Fig. 13.**

Wet grassland, usually on limestone. Western Scotland and western Ireland. 75, 98, 101, 103, 104, H9, 16. (5, H2). Native.
Scotland, Ireland and Spain. Br, Hb, Hs.

T. lainzii is apparently a 'Lusitanian' species with a striking disjunct distribution occurring in Spain and western parts of the British Isles (*cf* 10. *T. hispanicum*). It is of doubtful sectional affinity. The involucre and achene characters suggest the *Vulgaria*, as also does the triploid chromosome number (only 51. *T. laetifrons* and 64. *T. adamii* share this number in the *Spectabilia*) whereas the small size of all its parts is more reminiscent of the *Erythrosperma*. A relationship to the *Spectabilia* is indicated only by its Atlantic distribution and the shape, colour and particularly the spotted nature of the leaves (very rarely found outside the *Spectabilia*). It is possible that *T. lainzii* may have arisen through hybridisation between species of the *Vulgaria* and *Spectabilia*. The spotted leaves and distribution make it convenient for this species to be placed here at present; it is the only small, delicate species with spotted leaves.

50. *T. naevosum* Dahlst. in Warming, *Bot. Faerøes*, 3: 840 (1908)

A squat, robust plant. Leaves 80–200mm, *very rough, bristly, grey-green*, usually spotted; leaf lobes 5–7, *rather crowded*, patent or slightly recurved, short and broad, distal margin sigmoid, almost entire; petiole dull purple, winged. Scapes 50–180mm, thick, pale; *exterior bracts* 10–12×3mm, erect-spreading, green, scarcely bordered; *capitulum* 50–60mm, flat, mid-yellow; ligules striped purple; styles exserted, discoloured, pollen present. *Achenes* 3·7mm, straw-brown, *with thick spinules above*; cone 0·7mm, rather thick. $2n = 32$. Obligate agamosperm. **Fig. 13.**

Damp hay-meadows; locally common in northern Scotland, rare elsewhere. 62, 64, 65, 70, 90, 94, 101, 105, 108–112. (13). Native.
North-west Europe; also in Greenland where it is probably native. Br, Fa, Is, No, Su.

This is a most characteristic species with large, rough leaves, with broadly-

winged petioles, and larger involucre and capitula than any other species in this section. It is variable, especially in leaf-shape, but this is perhaps only due to environmental modification. Icelandic material, similar to forms from Scotland and Scandinavia which are here included in *T. naevosum*, have been described as separate species by Christiansen (1942). These include the following Icelandic taxa which I am not at present prepared to list as synonyms.

<i>T. akransense</i> p. 268	<i>T. armatum</i> p. 285	<i>T. asperum</i> p. 310
<i>T. atroglaucum</i> p. 307	<i>T. azureum</i> p. 267	<i>T. brachylobum</i> p. 332
<i>T. brevilobum</i> p. 309	<i>T. choodeum</i> p. 334	<i>T. cyclocentrum</i> p. 312
<i>T. latihastatum</i> p. 321	<i>T. luxurians</i> p. 335	<i>T. rhomboideum</i> p. 321
<i>T. selenophoreum</i> p. 315	<i>T. subpardinum</i> p. 306	

51. *T. laetifrons* Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, **29**: 88 (1924), *non* Hagl., *Bot. Not.*, **1934**: 20 (1934)

T. serratilobum Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, **29**: 418 (1927)

T. shetlandicum Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, **29**: 429 (1927)

T. acidodontum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 620 (1929)

Leaves 80–200mm, fairly smooth, dull, rather pale green, unspotted; leaf-lobes 3–5, *recurved, dentate*; petiole dull purple, or sometimes green, winged. Scapes 100–200mm, green; exterior bracts 9 × 2mm, spreading, green, scarcely bordered; capitulum 40mm, yellow; ligules striped purple; styles exserted, discoloured, pollen present. Achenes 3.5mm, light brown, slightly spinulose; cone 0.6mm. $2n = 24^*$. Obligate agamosperm. **Fig. 13.**

Wood margins and open woodland, less often in open fields; commoner in the north. 3, 17, 20, 22, 23, 29, 31, 34, 42, 44, 45, 60, 62, 65, 67, 68, 90, 94, 97, 99, 103, 110–112, H9, 16. (24, H2). Endemic.

This is a rather characterless species with green, unspotted leaves, recurved, dentate leaf-lobes, narrowly-winged petioles and spreading exterior bracts. As the triploid chromosome count suggests, *T. laetifrons* shows some affinities with the *Vulgaria*; it is placed here largely on account of the smallish exterior bracts and fairly large achenes.

SPECIES WITH BRIGHT GREEN, UNSPOTTED LEAVES, ORANGE-YELLOW HEADS AND SPREADING EXTERIOR BRACTS (CROCEA) (NOS. 52–57)

52. *T. croceum* Dahlst., *Bih. K. svenska Vetensk Akad. Handl.*, **26**(3): 12 (1900)

Leaves 60–160mm, *smooth, pure green, unspotted*; leaf-lobes 4 or 5, recurved, short, triangular-sagittate, nearly entire, or leaves not lobed, remotely dentate; *petiole green, winged*. Scapes 100–200mm, pale; exterior bracts 7 × 2.5mm, erect, green, with a *white border*, violet-tipped; capitulum 40mm, very deep yellow; ligules striped violet; styles exserted, *yellow, pollen usually present*. Achenes

4.0mm, slender, pale brown, spinulose at apex; cone 0.7mm, narrow. $2n = 32^*$. Obligate agamosperm. **Fig. 14.**

Rock ledges, usually north-facing, in base-rich, but rather acid localities. 600–1,100m (2,000–3,500ft) except in Glen Clova, Angus, where it descends to 300m (1,000ft). The Scottish Highlands; local. 88, 90, 92, 96, 98. (5). Native. Scotland and Lapland; not at present known from Iceland or the Faeroes, although occurring in Greenland. Br, Fe, No, Su.

The smooth, bright green leaves with green petioles, orange-yellow heads and spreading exterior bracts distinguish this species from all except nos. 53–57. From these it is separated by a combination of sagittate leaf-lobes, bordered exterior bracts and rather large, pale achenes.

53. *T. ceratolobum* Dahlst., *Ark. Bot.*, **12**(2): 12 (1912)

T. acidotum M.P. Chr., *Bot. Iceland*, **3**(3): 279 (1942)

Leaves 50–150mm, narrow, smooth, pure green, unspotted; leaf-lobes 5–8, regular, patent, short, narrow, acute, entire; petiole green, narrowly winged. Scapes 80–200mm, pale; exterior bracts 7×2 mm, erect, green, bordered; capitulum 40mm, very deep yellow; ligules striped violet; styles exserted, yellow, pollen present. Achenes 4.0mm, light brown, spinulose above; cone 0.7mm, narrow. **Fig. 14.**

Rock-ledges from 900–1,070m (3,000–3,500ft); Ben Alder (Perth) and Cairngorms. 88, 92, 94, 96. (4). Native. Scotland, Iceland and north-west Scandinavia; also in Greenland. Br, Is, No, Su.

This species is easily recognised by its bright green leaves with many regular, narrow leaf-lobes.

54. *T. cymbifolium* H. Lindb. f. ex Dahlst., *K. svenska VetenskAkad. Handl.*, ser. 3, **9**(2): 73 (1930)

T. acromaurum Dahlst. in Ostenf. & Gröntved, *Fl. Iceland Faeroes*, 146 (1934)

Leaves 50–150mm, smooth, pure green, unspotted; leaf-lobes 3–4, patent, short, $\pm$ obtuse, scarcely dentate; petiole green, winged. Scapes 50–150mm, ascending, pale; exterior bracts 7×2 mm, spreading-recurved, green, unbordered; capitulum 40mm, deep yellow; ligules striped violet; styles exserted, yellow, pollen present. Achenes 3.5mm, rust-coloured, spinulose above; cone 1.0mm, narrow. $2n = 32^*$. Obligate agamosperm. **Fig. 14.**

Rare, at 1,000m (3,200ft) in the south-west corrie of Ben Lawers, Perth, on calcareous schist. Possibly also on Ben More, Mull. 88, 103? (1). Native. Jan Mayen, northern Iceland, Scotland, northern Lapland and Bear Island; also in south-west Greenland. Br, Fe, Is, No, Sb.

This species shows a most remarkable disjunct distribution in the arctic. The Ben Lawers station is 10° latitude south of any other in Europe, and this species is a notable addition to its famous relict flora.

T. cymbifolium is the only reddish-fruited species with bright green leaves and orange-yellow heads in this country. The recurved and unbordered exterior bracts are also distinctive.

55. *T. craspedotum* Dahlst., *Bergens Mus. Aarb. for 1923-1924.*, 6: 9 (1925)

Leaves 40–100mm, *smooth, rather pale, slightly bluish-green, unspotted*; leaf-lobes 3–4, patent, short, $\pm$ deltoid, entire (–dentate); terminal lobe short, *obtuse, often rounded*; *petiole short, green, winged*. Scapes 50–100mm, erect, pale; exterior bracts 7×2 mm, spreading, green, *conspicuously bordered*; capitulum 35mm, deep yellow; ligules striped violet, styles exserted, *yellow, pollen absent*. Achenes 3.2mm, *pale brown*; cone 0.3mm. $2n = 32$. **Fig. 14.**

Acid, but base-rich rock-ledges from 900–1,200m (3,000–4,000ft) on Ben Avon, Banff, and Aonach Beag, Inverness. 94, 97. (2). Native.

Faeroes, southern Iceland, Scotland and Norway (Hordaland); local and rare. Br, Fa, Is, No.

This rare and geographically disjunct species is best recognised by its pale green leaves and deep yellow flowers, with bordered exterior bracts and no pollen. The small, pale brown achenes with short cones are very characteristic.

56. *T. pycnostictum* M.P. Chr., *Bot. Iceland*, 3(3): 266 (1942)

T. stictophoreum M.P. Chr., *Bot. Iceland*, 3(3): 262 (1942)

Leaves 50–150mm, *rough, pure green, sometimes spotted*; leaf-lobes 4–5, patent, short, entire, *distal margin usually concave-angled*; terminal leaf-lobe short, triangular, mucronate; *petiole green, winged*. Scapes 100–200mm, erect, pale; exterior bracts 9×2 mm, erect, *imbricate, stiff and thistle-like, glaucous, scarcely bordered*; capitulum 40mm, deep yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.8mm, straw-brown, spinulose; cone 0.7mm. $2n = 32^*$. Obligate agamosperm. **Fig. 15.**

Very wet ledges on calcareous schist, from 600–900m (2,000–3,000ft). Central Highlands and Mull. 88, 90, 92, 98, 103. (5). Native.

Faeroes, Iceland, Scotland. Br, Fa, Is.

Although very plastic (large cliff forms can look superficially similar to 44. *T. praestans*), this is a most characteristic species with a unique involucre. While aberrant in several respects (rough, spotted leaves, involucre), the colour of the leaves and flowers, and the achene-shape suggest that this species belongs here among the *Crocea* species rather than among the *Naevosa*.

T. stictophoreum is the correct name according to page priority, but the type specimen (at Copenhagen, C) is less satisfactory, and so *T. pycnostictum* is adopted, as this species seems to be identical to the Scottish material.

57. *T. hypochaeris* Dahlst., *Ark. Bot.*, 12(2): 40 (1912)

Leaves 50–200mm, *oblong, obtuse*, smooth, mid-green, unspotted, *not lobed, regularly though sparsely dentate*; petiole *poorly differentiated, green, winged*. Scapes 100–200mm, erect, pale; exterior bracts 9×2 mm, spreading, green, bordered; capitulum 45mm, deep yellow; ligules striped grey-violet; styles exserted, *discoloured*, pollen present. Achenes 3.5mm, straw-brown, spinulose above; cone 1.0mm, narrow. **Fig. 15.**

Habitat in this country unknown but occurring on cliffs in Norway. Coire Adair, north of Loch Laggan, Inverness. 97. (1). Native.
Southern Iceland, Scotland and south-west Norway. Br, Is, No.

One small plant collected by E. S. Marshall in 1917 appears to be this species. It obviously requires refinding.

T. hypochaeris has green, unspotted leaves of a most individual shape and deep yellow flowers. Christiansen (1942) has placed it together with some non-British species in a separate section Macrodonia. It does not, however, seem possible to differentiate *T. hypochaeris* from species of his section Crocea.

58. *T. stictophyllum* Dahlst., *Ark. Bot.*, 12(2): 38 (1912)

Leaves 80–250mm, *stiffly erect, ovate-lanceolate, rough, greyish-green*; leaf-lobes 3–4, *recurved, very long, dentate*; petiole purple, winged. Scapes 100–250mm, erect, *narrow*, pale; exterior bracts 9×2.5 mm, erect, purple-tipped, bordered; capitulum 50–60mm, yellow; ligules striped *red-purple*; styles exserted, discoloured, pollen present. Achenes 3.2×1.3 mm, *short and wide, straw-brown*, spinulose; cone 0.8mm. **Fig. 15.**

Wet, shaded rocks at low altitudes. Very local in England and Scotland. 29, 54, 60, 75, 101, 103, 109, 111, 112. (9). Native, at least in Scotland; possibly introduced in Cambridgeshire and Lincolnshire.
Faeroes, Iceland, Britain and Norway. Br, Fa, Is, No.

This is a distinctive species of uncertain affinity. The large, stiff, grey leaves, of a most individual shape, and the small achenes are most characteristic.

SPECIES WITH ERECT EXTERIOR BRACTS AND SMALL ACHENES
(THE *T. NORDSTEDTII* GROUP) (NOS. 59–65)

59. *T. caledonicum* A. J. Richards, *sp. nov.* (see p. 97)

Leaves 40–100mm, *rather smooth*, $\pm$ *glabrous*, dark green, *unspotted* or purplish; leaf-lobes 4–6, *recurved*, short, distal margin convex, $\pm$ *entire*; terminal lobe short, *rather rounded*, but with a *mucronate tip*; petiole $\pm$ *purple*, unwinged. Scapes 20–150mm, ascending-erect, pale; exterior bracts 11×3 mm, *erect, very dark purplish-green, glaucous*, red-tipped, unbordered; capitulum convex or

closed, deep yellow; ligules flat, or *sometimes involute*, short, striped purple; styles inserted, discoloured, pollen absent. Achenes 4mm, grey-brown, slightly spinulose above; cone 0.2mm. $2n = 40^*$. Fig. 15.

Wet, north- or east-facing cliffs on calcareous schist in Glen Clova, Angus, 600–700m (2,000–2,300ft). 90. (1). Endemic.

The characters of the involucre, capitulum and achenes clearly indicate that this species belongs to the *T. nordstedtii* group. At the same time it has many features of 37. *T. spectabile* and its allies (nos. 36–40); this may, however, represent an example of parallel evolution in response to upland conditions. The characteristic leaf-shape, very dark involucre, short and sometimes involute ligules, lack of pollen and grey-brown achenes are all diagnostic.

60. *T. pseudonordstedtii* A. J. Richards, sp. nov. (see p. 97)

Leaves 50–130mm, decumbent, almost glabrous, green or dark green, often suffused purple; leaf-lobes 4–6, regular, recurved, very short, usually entire; interlobes very narrow, often reduced to the mid-rib; petiole narrow, winged, with a purple mid-rib. Scapes 80–200mm, erect, purplish; exterior bracts 9×3 mm, erect, dark green, unbordered; capitulum up to 35mm, convex, deep yellow; ligules short, striped purple; styles exserted, discoloured, pollen present. Achenes 3×0.9 mm, grey-brown, shortly tuberculate above; cone 0.3mm. $2n = 32^*$. Obligate agamosperm. Fig. 16.

Calcareous flushes from 350–450m (1,200–1,500ft) in Upper Teesdale, Co. Durham. 66. (1). Endemic.

Although this species resembles 61. *T. nordstedtii* in many ways it has a very characteristic leaf-shape.

61. *T. nordstedtii* Dahlst., Ark. Bot., 10(11): 27 (1911)

Leaves 40–160mm, very variable, usually smooth, mid-green (sometimes purplish), unspotted; leaf-lobes usually 4–5, patent, triangular, obtuse, distal margin concave; petiole purple, sometimes green, usually winged. Scapes decumbent to erect, green or purplish; exterior bracts 10×3 mm, erect, dark, glaucous, unbordered; capitulum 40mm, deep yellow; ligules short, striped purple or red; styles exserted, discoloured, pollen usually present. Achenes 3.5mm, olive-brown, spinulose above; cone 0.4mm. $2n = 48^*$. Obligate agamosperm. Figs. A, 16.

Wet places throughout Britain below 450m (1,500ft), common; Ireland. Mostly confined to wet meadows in the east, but very catholic in the west, occurring on walls, banks, cliffs, roadsides and even waste ground. 1–5, 8, 10–24, 26, 28, 29, 34–42, 44, 45, 47–49, 52, 55, 57–68, 71, 83, 89, 91, 92, 95–98, 101, 103, 107, 109, 111, H1, 16, 27, 28, S. (66, H4, S). Native.

Western Europe and southern Sweden. Be, Br, Da, Ga, Ge, Hb, Ho, Hs, Lu, Su.

This species and 64. *T. adamii* are the only common *Spectabilia* species in southern and eastern England and the Midlands.

This species is very plastic for characters which are generally reliable in *Taraxacum*, such as the presence of anthocyanin in the petioles, mid-ribs and scapes; leaf-shape (Fig. A) and the presence of pollen. It is not yet clear whether all the forms represent a single genotype, although this may well be so. Significantly, several different forms of *T. nordstedtii* from Sweden, Britain, the Netherlands, France and Spain have all proved to be hexaploid, the only European species of *Taraxacum* known to be so. *T. nordstedtii* is best recognised by the erect, dark, glaucous, unbordered exterior bracts, the short ligules with reddish stripes, the olive-brown achenes (resembling those of section *Vulgaria* in shape and colour, although rather longer) and, in non-laciniate forms, the concave-angled distal margin to the leaf-lobes.

62. *T. hygrophilum* van Soest, *Acta bot. neerl.*, 5: 100 (1956)

Plant small. Leaves 20–60mm, erect, smooth, pure green, unspotted; leaf-lobes 3–4, crowded, recurved, short and broad, entire; terminal lobe short, rounded; petiole short, whitish, broadly winged. Scapes 50–80mm, erect, narrow; exterior bracts 5 × 2mm, erect, green, with a clear white or rose border; capitulum 30mm, deep yellow; ligules short, striped grey-violet; styles exserted, dark, pollen present. Achenes 3.0mm, brown, spinulose above; cone 0.3mm; rostrum 5.0mm (usually 7–10mm in other species). Fig. 17.

Water meadows. Stodmarsh, Kent. 15. (1). Native.
England and the Netherlands, rare. Br, Ho.

Quite unlike any other species, *T. hygrophilum* is best known by the small, bright green leaves of a characteristic shape, and the small brown achenes with a very short rostrum.

63. *T. litorale* Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 256 (1906)

Small to medium-sized plant. Leaves 50–100mm, erect, narrow, smooth, dark green, sometimes purplish, unspotted; leaf-lobes 2–4, distant, recurved, shortly triangular, entire; interlobes filiform-dentate; petiole long, narrow, dark purple, slightly winged. Scapes 50–100mm, decumbent to erect, purplish; exterior bracts 8 × 2mm, erect, dark green, scarcely bordered; capitulum 35mm, small, deep yellow; ligules not particularly short, striped violet; styles exserted, yellow, pollen absent. Achenes 3.3mm, dark straw-coloured; cone 0.5mm. **Fig. 17.**

Meads (seasonally flooded hay-meadows) near Oxford. 22, 23. (2). Native.
England and Fennoscandia. Br, Da, Fe, No, Su.

Although this species is frequently placed in the section *Vulgaria*, it seems to me to belong in the *T. nordstedtii* group. These species all have rather small, dark achenes, resembling those of the section *Vulgaria* in shape, and erect, dark exterior bracts. They are also plants of wet places. It seems to me relatively

unimportant as to whether they are treated as *Vulgaria* or *Spectabilia* species, as long as they are treated consistently. I have chosen the latter section, although their area of distribution is more southern and eastern than is usual. There is no doubt that the group is anomalous, but it seems no more deserving of special sectional status than the *Naevisa* or *Crocea* groups. *T. litorale* is best recognised by its narrow, dark leaves, dark exterior bracts and the absence of pollen. 59. *T. caledonicum* has larger achenes of a different colour.

64. *T. adamii* Claire, *Bull. Soc. bot. Rochelaise for 1890*, **12**: 49 (1891)

T. gelertii Raunk., *Bot. Tidsskr.*, **25**: 139 (1903)

T. britannicum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1926*, **8**: 30 (1927)

T. hibernicola H. Lindb. f., *ined.*, *nom. in herb.*

T. kewense Hagl., *ined.*, *nom. in herb.*

T. subbritannicum Hagl., *ined.*, *nom. in herb.*

Leaves 50–200mm, *smooth*, dull green, *often somewhat bluish, unspotted*; leaf-lobes 3–5, patent or somewhat recurved, *triangular, distal margin straight-sided or convex*, almost entire; petiole purple, usually winged. Scapes 70–200mm, erect; *exterior bracts* 7 × 2mm, erect, *very dark green, with an indistinct white border*; capitulum 40mm, deep yellow; *ligules rather long, striped grey-violet*; styles exserted, discoloured, pollen present or absent. *Achenes* 3.2mm, *brownish*, spinulose above; cone 0.5mm. $2n = 24^*$. Obligate agamosperm. **Fig. 16.**

Wet meadows; also not infrequently in man-made habitats such as walls, pavements, gardens, gravel-pits etc.; on cliffs and ravines in the north and west. Throughout Britain, becoming scarcer in the north; Ireland. 1, 2, 6, 8, 9, 12–17, 20, 22–24, 29, 32, 39, 41, 42, 45, 49, 57–60, 62, 64, 71, 95, 99, 101–103, 111, 112, H1, 9, 16, 28, S. (36, H4, S). Native.

Western Europe and Fennoscandia. Be, Br, Da, Fe, Ga, Ge, Hb, Ho, Hs, Lu, No, Su.

T. adamii is very variable, especially in leaf-shape. Forms with recurved leaf-lobes have been named *T. britannicum*, and some contemporary authorities still recognise this species. However, *T. britannicum* is identical to *T. adamii* with regard to involucre, capitulum and achenes and in all leaf-characters except shape. The two leaf-forms can be found growing intermixed, together with all intermediates, and it is possible to change *T. britannicum* forms into *T. adamii* in cultivation. *T. adamii*, often a very attractive species, is characterised by smooth, often bluish-green leaves with a clear purple mid-rib, small brownish achenes, and characteristic erect, ovate-lanceolate, very dark and indistinctly bordered exterior bracts. It is usually placed in the section *Vulgaria* (see under 63. *T. litorale*).

64a. *T. hibernicum* Hagl., *Bot. Not.*, **1935**: 433 (1935)

Leaves 50–140mm, *smooth*, dull, *pale green*, unspotted; *leaf-lobes* 4–5, *recurved, short, distal margin convex*, lower lobes slightly dentate; petiole narrow, purple,

± unwinged. Scapes 50–150mm, ascending, pale or purplish; *exterior bracts* $7 \times 2\text{mm}$, spreading-erect, rather dark green, *bordered*; capitulum 40mm, deep yellow; ligules fairly long, striped grey-violet; styles exserted, discoloured, pollen present. *Achenes* 3.2mm , brownish, *spinulose*; cone 0.5mm. **Fig. 17.**

Wet places in western Ireland. H1, 9, 16. (H3). Endemic.

T. hibernicum is of uncertain status. It is very close to some forms that can be referred to 64. *T. adamii*, but differs from them in having paler leaves, which are narrower and possess more highly recurved leaf-lobes and rather paler involucre with slightly less erect exterior bracts. I am not yet sure whether this species merely represents the extreme western modification of *T. adamii*, or whether it is genetically distinct and deserving specific status.

65. *T. cambriense* A. J. Richards, sp. nov. (see p. 98)

Plant medium-sized, *delicate, almost glabrous, pale green*. Leaves 80–170mm, *erect, smooth*, unspotted; leaf-lobes 4–5, ± patent, *narrow*, acute, entire or slightly denticulate; petiole narrow, purple, unwinged, *mid-rib green*. Scapes 100–200mm, erect, green; *exterior bracts* $7 \times 2.5\text{mm}$, *adpressed-erect, dark green, glaucous, with a clear white border*; capitulum 40mm, yellow; ligules short, striped grey-violet; styles exserted, discoloured, pollen absent. *Achenes* $3.8 \times 1\text{mm}$, straw-coloured, slightly tuberculate above; cone 0.4mm. **Fig. 16.**

Rocks and cliffs, usually on limestone. South Wales. 41, 42, 44, 45. (4). Endemic.

This is a characteristic species, best recognised by the conspicuous borders to the exterior bracts and the absence of pollen.

Section *Vulgaria**

Section **VULGARIA** Dahlst., *Acta Flor. Suec.*, **1**: 37 (1921)

Vulgaria Dahlst. in Lindman, *Svensk Fanerogamfl.*, 560 (1918)

Section *Subvulgaria* M.P. Chr., *Bot. Iceland*, **3**(3): 331 (1942)

Section *Septentrionalia* Dahlst., *nom. in mscr.*

Plants usually robust. Leaves very variable, usually lobed, not linear, very rarely spotted, more frequently blotched dark on interlobes. Scapes arachnoid; exterior bracts 8–20 × 1–6 mm, erect to recurved, never corniculate, although sometimes with a small callus, rarely obviously bordered; capitulum 30–70 mm, yellow; ligules most commonly striped grey-violet; styles rarely yellow, pollen usually present. Achenes 2.5–3.5 mm, rather broad, straw-coloured or brownish, most commonly olive-brown, spinulose, at least above; cone rarely exceeding 0.7 mm, short, conical; rostrum 7–14 mm. $2n = 16, 17, 18, 22, 23, 24, 25, 26, 27, 28, 33$ (but nearly always 24). Sexuals, facultative agamosperms, or obligate agamosperms, nearly always the latter. Flowering April–May (occasionally March–June).

Very common plants of grassland, waste places, paths, roadsides, walls etc., usually in some way associated with man. Relatively rare in parts of northern and western Scotland and western Ireland. Throughout Europe (all except Sb).

The following comments on collection and identification have already been made in the Introduction but they are especially relevant here.

Two sets of leaves are produced each year. Only the small over-wintering leaves, which develop as the spring leaves at the time of flowering, are taxonomically reliable. The second set, which develop during the summer and are usually killed by autumn frosts, are called *status aestivalis* leaves and are taxonomically unreliable. Because of this, it is unwise to attempt the identification of species in this section after May. Plants growing in excessively shaded, trodden or exposed localities are also very difficult to identify. Only experience will allow one to judge which genotype will assume which phenotype in particular environments, and one must be prepared not to be able to name a proportion of the material. In cultivation the species are perfectly recognisable, and this will also be found to be true in most wild situations. The key, allied with the

* According to the *International Code of Botanical Nomenclature*, the section which contains the type species for the genus should bear the same name as the genus. The type species for *Taraxacum* is *T. officinale* Weber, a name which has often been used in an aggregate sense, particularly for the section *Vulgaria* (e.g. Clapham, Tutin & Warburg 1962). However, as far as I know the microspecies identity of Weber's type specimen is not known, and until this has been determined the section which should bear the name *Taraxacum* is uncertain. For the time being, therefore, the sectional name *Vulgaria* is maintained. If it should happen that Weber's type can be traced and identified, it will follow that the section to which this belongs will have to be renamed *Taraxacum*. As it is common to use the names of the sections on their own without prefacing them by 'the section', this will lead to difficulties since *Taraxacum* (referring to the section) will not readily be distinguished from *Taraxacum* (the genus).

illustrations and species descriptions, should be adequate in most cases, but experience and access to a good herbarium are particularly important in this section, which is rather more critical than the others.

SPECIES WITH GREENISH PETIOLES (NOS. 66–92)

66. *T. obtusilobum* Dahlst. ex Hagl., *Bot. Not.*, **1935**: 117 (1935)

Leaves 50–200mm, *spathulate*, *grey-green*, usually lobed; leaf-lobes (0)3–8, short, *obtusely*, entire or filiform-dentate; *petiole white* to reddish, usually winged. Scapes 100–300mm, slender, pale; exterior bracts 8×2 mm, spreading-erect, *very dark, suffused purple*; *capitulum 35mm, pale yellow*; ligules striped *red or grey*; styles exserted, discoloured, *pollen present*. Achenes 3.0mm, olive-brown. $2n = 16^*$, 17^* . Sexual. **Fig. 24.**

Known only from a road-verge near Sherburn Village, Co. Durham, in 1965 and 1967; apparently no longer there. 66. (1). Introduced. England, south-west Sweden and Denmark (Jylland). (Br), Da, Su.

This species is quite unlike any other in this section, with its entire or very blunt-lobed, grey-green leaves. It is always sexual and diploid, but it characteristically hybridises extensively wherever it occurs and some of the hybrids are triploid and agamospermous. These hybrids occurring in the presence of *T. obtusilobum* can be very taxonomically confusing. It is the only wholly sexual north European species in the genus. This, together with the remarkable leaf-shape suggest that it is a primitive species and may possibly be an interglacial relict. Taxa such as this may have hybridised with ‘ancestral agamosperms’, now placed in the section *Ceratophora* Dahlst., giving rise to present-day *Vulgaria* species.

67. *T. subcyanolepis* M.P. Chr. in Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 312 (1934)

Leaves 50–250mm, *mid-green*; leaf-lobes 3–5, recurved, straight-sided or distal margin $\pm$ convex, filiform-dentate; *petiole green, narrowly winged*. Scapes 50–250mm; exterior bracts 10×2 mm, *recurved, suffused reddish-purple*; *capitulum 45mm*; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.2mm, straw-brown. $2n = 16^*$, 17^* , 18^* , 20^* , 23^* , 24^* , 25^* , 26^* , 27^* . Sexual or facultative agamosperm. **Fig. 19.**

Closed, herb-rich grassland on limestone, and on sand-dunes. Locally common throughout the British Isles. 9, 22, 23, 25, 26, 29, 41, 48, 58, 59, 66, 67, 89, 90, 101, 107, H9, 12, 16, S. (16, H3, S). Native. North-west Europe and southern Sweden. Be, Br, Da, Ga, Hb, Ho, Su.

This species hybridises with pollen-bearing agamospermous species, although

apparently less freely than the preceding. Hybrids occur with 1. *T. brachyglossum*, 17. *T. oxoniense*, 70. *T. ancistrolobum* and 114. *T. hamatum*, but no doubt a number of others occur. They can be expected whenever *T. subcyanolepis* is found in the company of polliniferous agamosperms. The parentage of a hybrid is often difficult to establish and depends largely on knowledge of the other species present. It is the only *Vulgaria* species with green petioles and recurved, reddish-purple exterior bracts, and, with the exception of the preceding, it is the only one which has regular pollen, the grains being of uniform size which is always an indication of sexuality.

68. *T. cyanolepis* Dahlst., *Ark. Bot.*, 10(11): 40 (1911)

T. alienum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1926*, 8: 30 (1927)

Leaves 100–300mm, dark green; leaf-lobes 3–4, recurved, rather broad, distal margin convex, entire or filiform-dentate; petiole green, winged. Scapes 150–350mm, erect; exterior bracts 12×3 mm, spreading, violet-purple; capitulum 55mm, deep yellow; ligules striped red-purple; styles exserted, discoloured, pollen present. Achenes 3mm, olive-brown. $2n = 24$. Obligate agamosperm. **Fig. 19.**

Roadsides etc., especially in rather lush, tall grass; locally frequent. 12, 16, 17, 22–24, 29, 32, 34, 35, 41, 45, 49, 64, 67, 106, 111, S. (17, S). Native. Northern Europe. Be, Br, Da, Fe, Ho, No, Su.

T. cyanolepis is the only *Vulgaria* species with both green petioles and spreading, violet-purple bracts.

69. *T. sellandii* Dahlst., *Bergens Mus. Aarb. for 1923–1924*, 6: 19 (1925)

T. granvinense Dahlst., *Bergens Mus. Aarb. for 1923–1924*, 6: 25 (1925)

Leaves 100–250mm, pale green; leaf-lobes 4–5, slightly recurved, distal margin somewhat convex, upper lobes entire, lower dentate; petiole green, unwinged, or almost so. Scapes erect, 100–300mm; exterior bracts 10×2 mm, recurved, narrow, green or somewhat violet, purple-tipped; capitulum 50mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, pale brown. $2n = 24^*$, 26^* , 28^* . Obligate agamosperm. **Fig. 21.**

Road-verges and grassland; local, but commoner in the north. 9, 17, 20, 28, 29, 36, 41, 60, 62, 66, 67, 70, 95, 96, 99, 101, S. (16, S). Native. Britain, Norway and Sweden. Br, No, Su.

A rather characterless, but not unattractive species with green petioles, *T. sellandii* is best recognised by the recurved, somewhat broad leaf-lobes and the recurved, narrow and usually coloured exterior bracts.

70. *T. ancistrolobum* Dahlst., *Bergens Mus. Aarb. for 1923–1924*, **6**: 27 (1925)

Leaves 100–250mm, dull, dark green; *leaf-lobes* 2–4, *recurved, large and broad*, distal margin convex, that of the upper lobes usually filiform-dentate; *petiole green, winged*. Scapes 150–300mm, rather narrow; exterior bracts 9×2.5 mm, spreading-recurved, green or slightly suffused violet; capitulum 55mm; ligules striped red-purple; styles exserted, discoloured, pollen present. Achenes 3.0×1.4 mm (very wide), straw-brown. **Fig. 20.**

Roadsides, grassland, wood-margins; scattered, but not uncommon. 9, 12, 17, 22, 23, 29, 36, 41, 46, 59, 60, 62, 66, 67, 69, S. (15, S). Native.

Northern, north-west and central Europe. Be, Br, Da, Fe, Ga, Ge, He, Ho, No, Su.

T. ancistrolobum is characterised by having green petioles and few, large, rounded leaf-lobes. It is difficult to confuse with any other species except some forms of 78. *T. alatum*, which, however, has glaucous, pink-tipped exterior bracts, and 68. *T. cyanolepis* which has violet-purple bracts.

71. *T. sublaciniosum* Dahlst. & H. Lindb. f. in Dahlst., *Ark. Bot.*, **19**(18): 15 (1925)

T. sublutescens Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1926*, **8**: 32 (1927)

T. subexpallidum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 628 (1929)

T. surreyense Hagl., *ined., nom. in herb.*

Leaves 100–300mm, dark green; leaf-lobes 5–8, *slightly recurved*, narrow, *rather long*, at least the lower lobes dentate; *terminal lobe usually rather broad and obtuse*; interlobes with teeth and lobules; *petiole green, unwinged*, or almost so. Scapes 150–300mm, erect; exterior bracts 15×4 mm, spreading dark green; capitulum 55mm, deep yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.2mm, olive-brown. **Fig. 21.**

Waste-places, gardens, paths etc., rarely in closed communities; locally common. 9, 10, 12, 17, 20, 22–24, 29, 32–34, 39, 41, 42, 58, 60, 64, 66, 79, 101, 105, S. (22, S). Probably native.

Britain and Fennoscandia but perhaps absent from Denmark. Br, Da?, Fe, No, Su.

This is a tall, dark green species with slightly recurved, narrow leaf-lobes, green petioles and large, spreading exterior bracts.

72. *T. stenacrum* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 627 (1929)

Leaves 150–300mm, erect, mid- to dark-green; *leaf-lobes* 6–8, *patent, long, very narrow, long-dentate at base*; terminal lobe narrow, $\pm$ subdivided; petiole

narrow, green, $\pm$ unwinged. Scapes 150–300mm, erect; *exterior bracts* 15×2.5 mm, recurved, green; capitulum 50mm, yellow; ligules striped olive-brown; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. **Fig. 23.**

Waste-places, gardens, paths etc., rarely in closed communities; confined to south-central England but locally common. 9, 17, 23, 24, 29, 32. (6). Endemic.

T. stenacrum is the only green-petioled *Vulgaria* species with long, narrow, strictly patent leaf-lobes.

73. *T. inane* A. J. Richards, *sp. nov.* (see p. 98)

Leaves 150–250mm, erect, dark green; leaf-lobes 4–6, recurved, broad at base, tapering to a narrow acuminate apex with up to 7 long-filiform teeth on the distal margin; terminal lobe long, up to $\frac{1}{3}$ length of leaf, hastate-sagittate, entire; petiole rather long, green or rose, unwinged. Scapes 150–250mm, erect; exterior bracts 10×3 mm, recurved, pale green, often lightly suffused purple above, dark green below; capitulum 45mm, yellow; ligules striped grey-purple; styles exserted or $\pm$ inserted, discoloured, pollen absent. Achene characters not known. **Fig. 24.**

Rocks by the sea. Inverneill, Kintyre. 101. (1). Endemic.

This new species is only known from a single specimen collected by A. G. Kenneth in 1970. Although in principle new species should not be described from such scanty material, this plant is in fact very distinctive, lacking pollen, and with a most individual leaf-shape.

74. *T. procerum* Hagl., *Acta Horti gothoburg.*, **11**: 34 (1936)

Leaves 150–300mm, erect, dark green; leaf-lobes 4–5, slightly recurved, long, entire or filiform-dentate; terminal lobe rather long (up to $\frac{1}{2}$ length of leaf), helmet-shaped, apiculate, usually subdivided; petiole green, usually unwinged. Scapes 200–350mm, erect; exterior bracts 15×4 mm, recurved, green, or somewhat coloured; capitulum 60–70mm; ligules striped red-purple; styles exserted, discoloured, pollen present. Achenes 3.2mm, straw-brown. **Fig. 24.**

Roadside near Menmarsh, Oxfordshire; recently discovered in Lancashire. 23, 60. (2). Probably introduced, although perhaps previously confused with 71. *T. sublaciniosum* and 72. *T. stenacrum*.

Northern and central Europe. Au, (Br), Fe, Ga, Ge, He, Ho, Su.

T. procerum is best distinguished from 71. *T. sublaciniosum*, which it closely resembles, by the somewhat elongate, helmet-shaped terminal leaf-lobes. 72. *T. stenacrum* has smaller, narrower exterior bracts; 76. *T. linguatum* has an obtuse terminal leaf-lobe and shorter lateral lobes; while 75. *T. pannucium* has a much longer petiole.

75. *T. pannucium* Dahlst., *Bergens Mus. Aarb. for 1923-1924*, 6: 21 (1925)

T. protractifrons Dahlst. ex M.P. Chr. & Wiinst. in Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 308 (1934)

Leaves 150-300mm, erect, *pale green*; leaf-lobes 3-4, patent, abruptly narrowed from a wide base, dentate; *terminal lobe narrow, extenuate, sometimes subdivided*; *petiole usually long, $\frac{1}{4}$ - $\frac{1}{2}$ length of leaf, green, $\pm$ unwinged*. Scapes 150-300mm, erect; exterior bracts 12×3 mm, *erect-spreading, green*, sometimes violet-tipped; capitulum 45mm; ligules striped brown-purple; styles exserted, discoloured, pollen present. Achenes 2.8mm, straw-brown; cone 0.8mm, narrow. **Fig. 30.**

Usually in herb-rich meadows; local. 22, 23, 26, 28, 29, 55, 66, 82, 95, 112, H16, S. (10, H1, S). Native.

Northern Europe. Be, Br, Da, Fe, Hb, Ho, No, Su.

This species is best recognised by its long green petiole and rather large, erect exterior bracts.

76. *T. linguatum* Dahlst. ex M.P. Chr. & Wiinst. in Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 313 (1934)

Leaves 100-250mm, erect, pale green; leaf-lobes 3-4, slightly recurved, *lingulate, $\pm$ obtuse*, entire or dentate; *terminal lobe obtuse*; *petiole green, unwinged*. Scapes 150-250mm, erect; *exterior bracts 10×3 -4mm, spreading-erect, dark green*; capitulum 50mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. **Fig. 34.**

Waste places; local and uncommon. 16, 23, 29, 31, 57. (5). Introduced.

Northern Europe and Switzerland. Be, (Br), Da, Fe, Ga, He, Ho, Su.

Of the green-petioled species, *T. linguatum* is best known by its pale leaves with more or less entire, lingulate lobes, obtuse terminal lobes and rather short and broad exterior bracts.

There has been some taxonomic confusion in the past between *T. linguatum* and *T. pannulatiforme*, which was also described by Dahlstedt (*Rep. botl Soc. Exch. Club Br. Isl. for 1931*, 9: 563 (1932)). The type of the former comes from Sweden but most of the material in the Stockholm herbarium placed here by Dahlstedt belongs to *T. pannulatiforme*. Conversely, although the type of *T. pannulatiforme* in the Oxford herbarium comes from Britain, I have seen no other British specimens which can be referred to this species. Furthermore, the type material is, in my opinion, inadequate. Nevertheless, Scandinavian material in Stockholm referred by Dahlstedt to *T. pannulatiforme* is undoubtedly distinct from *T. linguatum* and for this we must accept *T. pannulatiforme* as the correct name, at least for the present. Paradoxically therefore, *T. pannulatiforme*, with a British type, cannot at present be accepted as British, whereas *T. linguatum*, with a Swedish type, although undoubtedly occurring in Britain, Belgium and the Netherlands (van Soest 1961, p.329; 1970, p.31) appears to be very rare in Scandinavia.

77. *T. pallescens* Dahlst., *Ark. Bot.*, 9(10): 22 (1910)

Leaves 50–150mm, ascending, *glabrous, pale yellowish-green; leaf-lobes 5–8, recurved, dentate; petiole short, green, broadly winged*. Scapes 80–180mm, erect; exterior bracts 10×3 mm, recurved, green, or somewhat suffused violet; capitulum 45–50mm, deep yellow; ligules striped violet-brown; styles exserted, discoloured, pollen present. Achenes 2.7mm, olive-grey. **Fig. 25.**

In southern England and Wales where it is largely confined to species-rich pasture; it has recently been discovered in Dunbartonshire. 20, 22, 23, 25, 29, 32, 35, 41, 45, 99, S. (10, S). Native.

Northern and central Europe. Be, Br, Da, Fe, Ge, He, Ho, No, Su.

Observations and experiments at Rothamstead Experimental Station show that this species requires a pH of over 6.5 and a high level of potassium.

The yellowish-green leaves with recurved lobes and green petioles make this a most distinctive species.

78. *T. alatum* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, 29(9): 20 (1907)

T. semiprimum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, 8: 626 (1929)

Leaves 80–250mm, erect, mid-green; leaf-lobes 3–4 (–6), patent or slightly recurved, moderately narrow to broad, distal margin $\pm$ convex and with 1 or 2 teeth; *petiole long, $\frac{1}{4}$ – $\frac{1}{2}$ length of leaf, green, winged*, sometimes narrowly so. Scapes 100–300mm, erect; *exterior bracts 12×3 mm, spreading-recurved, glaucous above, pink-tipped*; capitulum 50–60mm, yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2.8mm, olive-brown. $2n = 24^*$. Obligate agamosperm. **Fig. 20.**

Roadsides, meadows and waste places; locally very common and certainly commoner than the records suggest. 6, 7, 9, 12, 15, 17, 20, 22–24, 29, 32, 33, 41, 44, 53, 60, 62, 66, 67, 83, 99, H16, S. (22, H1, S). Native.

Northern and central Europe. Be, Br, Da, Fe, Ga, Ge, Hb, He, Ho, No, Su.

The combination of long, green, winged petioles with spreading, glaucous, pink-tipped bracts is unmistakable. The leaf-shape is very variable.

79. *T. lingulatum* Markl., *Acta Soc. Fauna Flora fenn.*, 55(5): 20 (1926), *non* Dahlst., *ined.*, *nom. in herb.*

T. aequatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, 8: 622 (1929)

T. subpallescens Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, 9: 29 (1930)

Leaves 50–200mm, spreading, dull green; leaf-lobes 3–6, patent-recurved, acute, $\pm$ abruptly narrowed from a broad base; terminal lobe shortly *attenuate*; interlobes dentate and lobulate; *petiole rather long, green or rose, winged*, sometimes narrowly so. Scapes 80–200mm, erect; *exterior bracts 14×4 mm*,

strongly recurved, glaucous above, dark green below; capitulum 55mm, deep yellow; ligules striped violet-brown; styles exserted, discoloured, pollen present. Achenes 2.7mm, straw-brown. Fig. 32.

Roadsides and grassy places. 12, 17, 20, 22, 23, 27, 29–31, 37, 62, 63, 66, 67, 82, 83, 99, 101. (18). Native.

Northern and central Europe. Be, Br, Da, Fe, Ga, Ge, He, Ho, No, Su.

T. lingulatum is a difficult plant to identify. It is perhaps best known by the long, recurved glaucous bracts. The leaf-shape, though characteristic, is not readily described. It can be distinguished from 80. *T. aequisectum* by having fewer leaf-lobes, a longer petiole, and less dentate leaves; and from 81. *T. croceiflorum* by its longer leaf-lobes and violet-brown striped ligules. Despite the similarity in name with 76. *T. linguatum*, there is little morphological resemblance between the two species.

80. *T. aequisectum* M.P. Chr. in Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 311 (1934)

Leaves 80–220mm, spreading, lobed to base, dull, rather dark green; leaf-lobes 5–8, patent or slightly recurved, *rather narrow, with 2–4 large teeth; terminal lobe rather narrow, subdivided, ± attenuate; petiole very short and winged, or absent.* Scapes 150–250mm, erect; *exterior bracts 14 × 3mm, recurved, glaucous above, dark green below; capitulum 50mm, yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2.8mm, straw-brown. Fig. 24.*

Oxford and Lancashire. 23, 60. (2) Probably introduced.

England, southern Scandinavia, Belgium and the Netherlands. Be, (Br), Da, Ho, Su.

Although closely related to the last species, *T. aequisectum* has leaves which are lobed to the base, the leaf-lobes bearing large teeth. It may have been overlooked in the past, but it is clearly rare in the British Isles and may well be introduced from the Continent.

81. *T. croceiflorum* Dahlst., *Ark. Bot.*, 9(10): 9 (1910)

Leaves 100–200mm, ascending, rather deep green; leaf-lobes 4–5, pointing forward, patent or somewhat recurved, rather short, dentate; *terminal lobe short, triangular or tripartite; petiole not exceeding $\frac{1}{4}$ length of leaf, green, winged.* Scapes 80–180mm; *exterior bracts 12 × 3mm, spreading-recurved, green ± suffused with violet, at least at tips; capitulum 45mm, orange-yellow; ligules striped red-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, pale buff. Fig. 19.*

Roadsides and grassy places; local. 9, 16, 17, 23, 36, 41, 59, 60, 67, 101, S. (10, S.). Native.

Northern Europe, introduced in Switzerland. Be, Br, Da, Fe, Ga, Ge, (He), Ho, No, Rs (B, N), Su.

The orange-yellow heads are diagnostic, otherwise it closely resembles nos. 78–80.

82. *T. lacerabile* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**: 27 (1930)

T. lacerilobum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1931*, **9**: 562 (1932)

Leaves 150–300mm, erect, rather pale green; leaf-lobes 4–7, *pointing forward* or patent, narrow, *strongly dentate*, with *patent, linear processes*; interlobes with large teeth and lobules; *petiole green, unwinged or narrowly winged*. Scapes 200–350mm, erect; *exterior bracts 15 × 5mm, erect, dark green*, paler inside; capitulum 60mm, yellow; ligules striped grey-brown; styles exserted, discoloured, pollen present. Achenes 3·2mm, straw-brown. **Fig. 22.**

Walls, gardens etc., local. South Midlands and southern England; possibly introduced in Scotland. 17, 20, 21, 23, 24, 29, 86. (7). Probably endemic.

T. lacerabile has been reported by van Soest (1961) from Belgium, but his description does not fit this species.

T. lacerabile is unmistakable, with long, pale, lacinate leaves, patent, strongly dentate, linear leaf-lobes, and very wide and long, erect exterior bracts.

83. *T. expallidiforme* Dahlst., *Ark. Bot.*, **9**(10): 18 (1910)

T. oncolobum Dahlst., *Bergens Mus. Aarb. for 1923–1924*, **6**: 26 (1925)

Leaves 70–200mm, ascending, *pale green*; leaf-lobes 4–5, *rather crowded*, usually patent ± narrowly deltoid, *not reaching to mid-rib*, entire or filiform-dentate; terminal lobe short, triangular, subdivided; petiole rather *short, pale green or white, broadly winged, mid-rib white*. Scapes 100–250mm, erect; *exterior bracts 9 × 2mm*, recurved, pale, often ± suffused with violet above, darker below; capitulum 45mm, deep yellow; ligules striped purple-brown; styles exserted, discoloured, pollen present. Achenes 2·8mm, olive-straw coloured. **Fig. 20.**

Roadsides and waste places; sometimes in gardens. Widely distributed north to central Scotland; locally frequent in southern England. 6, 9, 15–17, 20, 22–24, 29, 31, 34, 41, 60, 62, 67, 82, 83, H21, S. (18, H1, S). Native, or possibly introduced.

British Isles and Fennoscandia. Br, Da, Fe, Hb, No, Su.

T. expallidiforme is known by the narrow, patent, deltoid leaf-lobes, the broad, pale central undissected portion of the leaf, the broad, pale petiole, and the small, recurved exterior bracts. Of the local, mainly southern species, it is unusual in being otherwise confined to Scandinavia, and it may well be introduced.

84. *T. insigne* Ekman ex Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 312 (1934)

Leaves 70–200mm, ascending, *pale green*; leaf-lobes 4–7, patent or $\pm$ *pointing forward*, *short, narrow, obtuse, entire*, or with 1–2 large teeth; terminal lobe short, $\pm$ tripartite; interlobes lobulate; petiole about $\frac{1}{4}$ length of leaf, *green, winged*. Scapes 100–250mm, erect; *exterior bracts* 9×3 mm, *erect, dull green*, often violet-tipped; capitulum 45mm, yellow; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 3.2mm, straw-brown. **Fig. 19.**

Usually in dry open grassland, especially sand-dunes; less frequently roadsides and waste places. Scattered throughout Britain and locally frequent. 12, 17–20, 22, 23, 37, 45, 51, 52, 66–68, 75, 99, 101, 106. (18). Native.

Northern Europe. Be, Br, Da, Ga, Ge, Ho, No, Rs(B), Su.

T. insigne resembles the last in having pale leaves with a broad, pale central undivided region and wide, pale petiole. It differs in having narrower leaves, shorter, obtuse leaf-lobes and erect exterior bracts.

85. *T. subundulatum* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, 6: 779 (1923)

T. amphiodon Dahlst. ex Hagl., *Bot. Not.*, 1934: 3 (1934)

T. bercheriense Dahlst., *ined.*, *nom. in herb.*

Leaves 100–250mm, erect, mid-green; leaf-lobes 5–9, patent or *pointing forward*, narrow, rather short, dentate, often on both margins; *terminal lobe short, wide, subdivided*; *interlobes often with dark blotches, dentate and lobulate*; *petiole short, green, or rose at base, unwinged*. Scapes 100–300mm, erect; *exterior bracts* 12×3 mm, *spreading-erect, dark green*; capitulum 45mm, deep yellow; ligules striped grey-violet; styles exserted, discoloured, pollen always (?) present. Achenes 3.4mm, straw-brown. **Fig. 22.**

Water meadows, especially when mown for hay (meads); more rarely on lush road-verges etc. Very local but often abundant. Known only from a single station in Kent and from water meadows in the Oxford area. 16, 22, 23. (3). Native.

England and Fennoscandia. Br, Da, Fe, No, Su.

This species has a characteristic leaf-shape, short, greenish, unwinged petioles and large, erect exterior bracts. It is separated with difficulty from the next (86. *T. sublaeticolor*), which has a similar distribution and habitat requirement, by a more robust habit, leaves with shorter petioles and more lobes, and larger involucre and exterior bracts. It appears always to possess pollen in this country, but in Scandinavia it is sometimes lacking.

86. *T. sublaeticolor* Dahlst., *Ark. Bot.*, 19(18): 17 (1925)

Leaves 50–200mm, erect, mid-green; leaf-lobes 3–5, patent or *pointing forward*, narrow, rather short, entire or dentate; *terminal lobe short, wide, often subdivided*; *interlobes often with dark blotches, dentate and lobulate*; *petiole rather*

long, $\frac{1}{4}$ – $\frac{1}{3}$ length of leaf, narrow, green or rose at base. Scapes 150–250mm, erect; exterior bracts 8×2 mm, erect-spreading, dark green, sometimes suffused with violet; capitulum 40mm, deep yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.2mm, straw-brown. **Fig. 22.**

Water-meadows, especially when mown for hay (meads); rarely in other habitats. Probably restricted in the British Isles to the Thames basin. 17, 20–23. (5). Native.

England and Fennoscandia. Br, Da, Fe, No, Su.

The differences between this and the previous species are given under the latter. 87. *T. tenebricans* has a characteristic 'urn-shaped' involucre, slightly winged petioles, smaller fruits and lacks dark blotches on the interlobes; in addition there are differences in leaf-shape.

87. *T. tenebricans* (Dahlst.) Dahlst., *Ark. Bot.*, 9(10): 5 (1910)

T. officinale subsp. *tenebricans* Dahlst., *Bot. Not.*, 1905: 157 (1905)

Leaves 50–200mm, erect, mid-green; leaf-lobes 3–5, patent or slightly recurved, triangular, or sometimes narrow (but scarcely with linear processes), proximal margin dentate, occasionally entire; interlobes frequently with 1 or 2 large teeth; petiole about $\frac{1}{4}$ length of leaf, green, narrowly winged, occasionally un-winged. Scapes 100–250mm, erect; exterior bracts 7×2 mm, stiffly erect, spreading at tips giving the involucre a characteristic 'urn-shaped' appearance, dark green, sometimes suffused with purple; capitulum 30–40mm, yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2.8mm, olive-brown. **Fig. 21.**

Roadsides, grassy places etc.; local. 15, 16, 21–24, 28, 29, 32, 39, 60, 79, 82, 83, S. (14, S). Probably native only in southern England.

Britain, Belgium, the Netherlands and Fennoscandia. Be, Br, Da, Fe, Ho, No, Su.

T. tenebricans is best known by its distinctive involucre. The green-petioled leaves are very variable, particularly in size.

88. *T. tanylepis* Dahlst., *Rep. botl Exch. Club Br. Isl. for 1922*, 6: 776 (1923)

Leaves 70–150mm, erect, dull green; leaf-lobes 4–6, patent or slightly recurved, narrow, entire, or filiform-dentate; terminal lobe sometimes sagittate; petiole $\frac{1}{4}$ – $\frac{1}{2}$ length of leaf, narrow, green or somewhat coloured, unwinged. Scapes 50–170mm, ascending-erect; exterior bracts 9×3 mm, erect-spreading, dark green, bordered; capitulum 40mm; ligules striped grey-purple; styles exserted, yellow, pollen absent. Achenes 3.5mm, straw-brown; cone $\pm$ absent. **Fig. 27.**

Wet marshy ground. Shore of Loch Leven, Kinross; Bay of Skaill, Sandwick, Mainland and Sweyn Holm, Orkney. 85, 111. (2). Endemic.

T. tanylepis is a remarkable species from several points of view. Although similar to 87. *T. tenebricans* in general morphology, it lacks the characteristic involucre of that species. Further, a number of important characters (bordered exterior bracts, yellow styles, absence of pollen and achene-size and shape) are those of the *Spectabilia*, to which it may well belong. In that section it is closely related to 35. *T. landmarkii*, which, however, has usually entire leaf-lobes of a different shape, discoloured styles and smaller, browner achenes with longer cones. *T. tanylepis* is a distinctive species, but it may have been overlooked as the type material in Britain (OXF) is in very poor condition. However, an isotype at Stockholm, which I have seen, is of much better quality, and it was this specimen that convinced me that *T. tanylepis* is a good species.

89. *T. valdedentatum* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, 6: 777 (1923)

Leaves 50–200mm, spreading, dull green; leaf-lobes 3–4, rather distant, long, narrow, both proximal and distal margins dentate; petiole narrow, green, unwinged. Scapes 100–250mm, erect; exterior bracts 8×2 mm, strongly recurved, pale green, darker below; capitulum 35mm, deep yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2.8mm, olive-brown. **Fig. 20.**

Waste places, gardens etc., not common and restricted to southern England except for one Welsh record. 10, 12, 15, 17, 20, 22, 23, 37, 47. (9). Endemic.

Although characteristic, this is an undistinguished species which is best known by the rather few, long leaf-lobes, dentate on both margins, and the small, pale, recurved exterior bracts.

90. *T. spilophyllum* Dahlst., *Ark. Bot.*, 12(2): 111 (1912)

Leaves 100–250mm, spreading, dark green; leaf-lobes 3–5 (–7), rather distant, recurved, broad at base, but with characteristic fine and strongly recurved tips, sometimes with $\pm$ linear processes, distal margin of lower lobes filiform-dentate; petiole short, green, unwinged or narrowly winged. Scapes 50–150mm, erect; exterior bracts 12×3 mm, spreading-recurved, green, often suffused with purple; capitulum 50mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. **Fig. 22.**

Steep wet places, e.g. stream-banks, cliffs etc. 62, 66, 67, 84, 99, 101, H12. (6, H1).

British Isles, Norway and Sweden, Br, Hb, No, Su. Native.

Records of this species from the south of England probably represent other species with coloured petioles; however *T. spilophyllum* has almost certainly been overlooked in northern England and Scotland.

This species is distinguished by green petioles and characteristic leaf-lobes, broad at the base but with a fine, recurved apex. The specimen illustrated (Fig. 22) is atypical in lacking this latter character.

91. *T. lacinosum* Dahlst., *Ark. Bot.*, 9(10): 20 (1910)

T. naeviferum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, 6: 778 (1923)

T. tanyphyllum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1931*, 9: 565 (1932)

Leaves 50–200mm, erect, pale mid-green; leaf-lobes 3–6, *regular*, patent or slightly recurved, $\pm$ *linear*, proximal margin with long sinuous teeth above; terminal lobe narrow, entire or dentate; *interlobes narrow*, $\pm$ *parallel-sided*, with long teeth; *petiole* $\frac{1}{4}$ – $\frac{1}{3}$ *length of leaf*, *green*, narrowly winged or occasionally unwinged. Scapes 80–200mm, erect; *exterior bracts* 9×3 mm, *erect-spreading*, dark and *suffused with purple on both sides*; capitulum 55mm, deep yellow; ligules striped brown-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, straw-brown. $2n = 26^*$ (one individual only). Obligate agamosperm. **Fig. 21.**

Waste places; local but widely distributed. 12, 16, 17, 23, 29, 31, 32, 35, 39, 41, 67, 70, 83, 101, 111, S. (15, S). Probably introduced.

Britain and Fennoscandia. (Br), Da, Fe, No, Su.

T. lacinosum is a distinctive species with its narrow, green-petioled leaves with regular, linear lobes and narrow, parallel-sided interlobes, and with erect, purplish exterior bracts. *T. tanyphyllum* is recognised as a distinct species in Scandinavia; although closely related to *T. lacinosum*, Scandinavian material of *T. tanyphyllum* seems to be different, with larger leaves with longer, more recurved and more irregular leaf-lobes, and longer, spreading or recurved exterior bracts. However, the type of *T. tanyphyllum* is from Clifton, Bedfordshire (OXF), and this specimen is clearly *T. lacinosum*. A new name seems therefore to be required for the Scandinavian plant.

92. *T. cherwellense* A. J. Richards, *nom. nov.*

T. stenoglossum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, 8: 627 (1929), *non* Brenner, *Meddn Soc. Fauna Flora fenn.*, 34: 25 (1908)

Leaves 80–200mm, ascending, pale to mid-green; leaf-lobes 3–6, rather regular, patent, *linear*, $\pm$ *obtuse*, $\pm$ *entire*; terminal lobe usually tripartite; *interlobes parallel-sided*, entire or lobulate; petiole short, *green*, unwinged or very narrowly winged. Scapes 40–150mm, ascending-erect; exterior bracts 10×2 mm, *recurved*, *rather pale green*; capitulum 45mm, yellow; ligules striped grey-purple; styles exserted, discoloured, pollen absent. Achenes 2.8mm, brown. **Fig. 23.**

Gardens, paths, roadsides etc. Southern England; local and uncommon. 7, 17, 23. (3). Endemic.

This species is still to be found, though in small quantity, in the area of north Oxford from which Dahlstedt originally described it. Single records from Wiltshire and Surrey suggest that it may occur elsewhere in southern England. *T. cherwellense* has a distinctive leaf-shape that can only be confused with 91. *T. lacinosum* but this has a totally different involucre.

SPECIES WITH COLOURED PETIOLES (NOS. 93–132)

93. *T. aequilobum* Dahlst., *Ark. Bot.*, 9(10): 42 (1910)

Leaves 150–300mm, erect, mid-green; leaf-lobes 5–9, *rather crowded, regular, with divergent, linear processes*, filiform-dentate at base and on interlobes; terminal lobe often *tripartite*; petiole very variable in length, *rose-purple*, un-winged or slightly winged. Scapes 200–350mm, erect; *exterior bracts* 10 × 3mm, *recurved*, pale green above, very dark below, often purple-tipped; *capitulum* 65mm, *pale ochre-yellow*; ligules striped brown-purple; styles exserted, dis-coloured, pollen present. Achenes 3.0mm, olive-brown. $2n = 24^*$. Obligate agamosperm. **Fig. 30.**

Gardens, waste places etc. England and Wales; very local and possibly intro-duced. 12, 16, 17, 23, 37, 41, 48, 60, 66. (9).

Northern Europe and Switzerland. Be, Br, Da, Fe, He, Ho, No, Su.

T. aequilobum is best known by its narrow leaves with divergent, linear processes; 98. *T. pectinatifforme* usually has more processes, which are both longer and narrower, and lobulate leaves.

94. *T. ekmanii* Dahlst., *Ark. Bot.*, 10(6): 19 (1911)

Leaves 150–250mm, ascending, *oblong-lanceolate, wide, pale green*; leaf-lobes 2–4, patent, or slightly recurved, *broad, distal margin ± convex* and dentate; *terminal lobe broad, subdivided and crisped*; petiole short, pink, ± winged. Scapes 200–300mm, erect; exterior bracts 12 × 3mm, spreading-recurved, ± suffused with violet, paler above; capitulum 55mm, deep yellow; ligules striped violet-brown; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. **Fig. 32.**

Grassy places, roadsides etc.; scattered and locally common. 9, 12, 16, 17, 19, 20, 22, 23, 29, 34, 39, 41, 55, 60, 62, 66, 67, 75, 112, S. (19, S). Native.

Western and northern Europe, extending south-east as far as Switzerland and northern Italy. Au, Be, Br, Da, Fe, Ga, Ge, He, Ho, Hs, It, Lu, No, Rs(B), Su.

T. ekmanii is one of the more widespread species in this section. Its leaves can only be confused with those of 70. *T. ancistrolobum*, which, however, has green petioles, and with certain shade forms of other species. These latter usually show signs of etiolation (chlorosis; pale, elongated scapes and petioles; few flowers) and have more or less entire juvenile leaves.

95. *T. porrectidens* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1931*, 9: 563 (1932)

T. recurvilobum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1931*, 9: 564 (1932)
T. submucronatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1931*, 9: 565 (1932)

Leaves 150–300mm, ascending, *narrow*, pale green; *leaf-lobes 4–9, slightly recurved, short, narrow, entire or slightly dentate*; terminal lobe short, triangular; *petiole about $\frac{1}{4}$ length of leaf, red-purple, usually unwinged*. Scapes 200–300mm, erect; exterior bracts 12×2 mm, recurved, pale green above, darker below; capitulum 45mm, deep yellow; ligules striped *dark violet*; styles exserted, discoloured, pollen present. Achenes 3.2mm, straw-brown. **Fig. 26.**

Waste places, roadsides etc.; widely distributed but uncommon. 9, 11, 17, 19, 20, 24, 26, 29, 30, 41, 53, 99. (12). Endemic.

T. porrectidens is a species with narrow, pale leaves of a characteristic shape, and narrow, pale, rather long exterior bracts.

96. *T. biforme* Dahlst., *Ark. Bot.*, 9(10): 63 (1910)

Leaves 70–200mm, ascending, pale, often *yellowish green*; leaf-lobes usually 4, rather distant, *recurved, narrow, $\pm$ parallel-sided, or distal margin convex, $\pm$ entire*; terminal lobe narrow, *attenuate, $\pm$ subdivided*; *interlobes narrow, parallel-sided, entire or filiform-dentate*; petiole $\frac{1}{4}$ length of leaf, *broad, wine-coloured, unwinged or almost so*. Scapes 70–200mm, ascending-erect; exterior bracts 12×2 mm, pale green above, darker below; capitulum 50mm, deep yellow; ligules striped dark violet; styles exserted, discoloured, pollen present. Achenes 3.2mm, straw-brown. **Fig. 27.**

Roadside at Littlemore, Oxford. 23. (1). Very probably introduced. England and Fennoscandia. (Br), Da, Fe, No, Su.

This species has a very distinctive leaf-shape, which cannot be confused with any other British species. It is clearly closely related to 95. *T. porrectidens* with which it agrees in every other respect. The Scandinavian species *T. boldtii* H. Lindb. f. and *T. interruptum* Dahlst. are rather similar in leaf-shape, but differ in other characters.

97. *T. copidophyllum* Dahlst., *Ark. Bot.*, 9(10): 25 (1910)

Leaves 150–300 $\times$ 30–50mm, erect, *very narrow*, rather *dark green*; leaf-lobes 2–4, *distant, somewhat recurved, long, narrow, distal margin strongly-dentate*; *terminal lobe usually $\frac{1}{4}$ – $\frac{1}{2}$ length of leaf, narrow, entire, dentate or subdivided*; *petiole $\frac{1}{4}$ – $\frac{1}{2}$ length of leaf, narrow, purple, unwinged*. Scapes 200–350mm, erect; exterior bracts 9×3 mm, erect, rather pale green, often with a *wide but indistinct border*; capitulum 45mm, deep yellow; ligules striped *red-purple*; styles exserted, discoloured, pollen present. Achenes 3.2mm, brownish. **Fig. 34.**

Grassy places. Berkshire, Warwickshire and Jersey; rare. 22, 38, S. (2, S). Almost certainly introduced. Northern Europe. Be, (Br), Da, Fe, Ho, No, Po, Su.

This is a most distinctive species, both in leaf-shape and involucre. The only

possible confusion is with the rare *Spectabilia* species 40. *T. acrifolium*, which has a similar leaf-shape and erect exterior bracts, but the latter species is smaller and darker, usually the leaves are spotted, the involucre is much darker and the achenes are larger.

98. *T. pectinatiforme* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 30 (1907)

Leaves 100–300mm, ascending, dull green; *leaf-lobes* 6–12(–20), *pointing forward, patent or recurved, linear and entire, except for the wider base the distal margin of which is usually convex and filiform-dentate*; terminal lobe with a narrow apex, often $\pm$ *tripartite*; interlobes short, dentate and lobulate; *petiole very short, dull reddish-purple, $\pm$ unwinged*. Scapes 100–300mm, erect; *exterior bracts* 10 $\times$ 2mm, *recurved*, pale green above, darker below, sometimes suffused reddish; capitulum 50mm, pale yellow; styles exserted, discoloured, pollen present. *Achenes* 3.5mm, straw-coloured. **Fig. 23.**

Waste places etc., Somerset, Gloucestershire and Cambridgeshire; local and rare. 5, 29, 34. (3). Almost certainly introduced.

Northern and central Europe. Be, (Br), Da, Fe, Ga, Ge, He, Ho, No, Rs(B), Su.

In typical forms the leaf-shape is remarkable and quite unmistakable with many long, very narrow, linear processes. Deviating forms can approach 93. *T. aequilobum* in leaf-shape, but they always have lobules, and the base of the distal margin of the leaf-lobes is usually convex. The achenes are amongst the largest in this section.

99. *T. aurosulum* H. Lindb. f., *Meddn Soc. Fauna Flora fenn.*, **35**: 14 (1909)

Leaves 150–300mm, erect, dull green; *leaf-lobes* 5–7, *recurved, lower lobes broad at base tapering to narrow apex, distal margin convex and strongly dentate at base*, upper lobes long, linear, distal margin entire; petiole dull purple, narrowly winged. Scapes 150–300mm, erect; *exterior bracts* 12 $\times$ 5mm, *spreading*, green, darker below, sometimes purplish; *capitulum* 60–70mm, *yellow*; ligules striped grey-purple; styles exserted, discoloured, pollen present. *Achenes* 3.0 $\times$ 1.2mm, *plump*, straw-brown. **Fig. 28.**

Roadsides and grassy places. Widely distributed and locally common, but not recorded from Ireland. 17, 22–24, 29, 48, 60, 62, 66, 98, 101, S. (11, S). Probably native and doubtless considerably under-recorded, but nevertheless absent from large areas with apparently suitable habitats.

Northern Europe and Switzerland. Be, Br, Da, Fe, Ga, He, Ho, No, Su.

T. aurosulum is distinguished by its recurved leaf lobes with $\pm$ linear apices, large involucre and capitula and very wide exterior bracts.

100. *T. xanthostigma* H. Lindb. f., *Meddn Soc. Fauna Flora fenn.*, **36**: 5 (1910)

Leaves 100–250mm, erect, green or sometimes $\pm$ glaucous, usually with dark

blotches on the interlobes; leaf-lobes 3–5, patent, $\pm$ deltoid, distal margin dentate; terminal lobe often *large, wide*, obtuse, entire or subdivided once; petiole $\frac{1}{4}$ – $\frac{1}{3}$ length of leaf, purple, winged. Scapes 200–300mm, erect; exterior bracts 10×3 mm, recurved, pale green, darker below; capitulum 45mm; ligules striped grey-purple; styles exserted, *yellow in fresh and dried condition*, pollen present. Achenes 3.0mm, straw-brown. **Fig. 18.**

Roadsides and grassy places; chiefly in southern England and the Channel Isles but recently discovered in Northumberland. 17, 22, 23, 26, 29, 67, S. (6, S). Possibly introduced.

Native in Fennoscandia; less common in north-west and central Europe where it is probably introduced. Be, Br, Da, Fe, Ge, He, Ho, No, Rs(B), Su.

This species is most readily recognised by its yellow styles. It is separated from 88. *T. tanylepis* and 107. *T. duplidens* by having pollen, and from these and 130. *T. primum* by the distinctive leaf-shape.

101. *T. mucronatum* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 24 (1907)

T. latispina Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1922*, **6**: 780 (1923)

T. atomarginatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 623 (1929), *nomen nudum*, non H. Lindb. f., *Sched. Pl. Finland. Exsicc., Helsingfors*, **21–42**: 118 (1944)

Leaves 150–300mm, erect, dull green; leaf-lobes 3–5, patent or slightly recurved, tapering from a rather broad base to a *fine, acuminate apex*, entire or with 1 or 2 long teeth near the base of the distal margin; terminal lobe rather short, triangular; petiole purple, winged or scarcely so. Scapes 200–300mm, erect; exterior bracts 12×2.5 mm, spreading to recurved, suffused with purple; capitulum 45mm, deep yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, straw-brown. **Fig. 31.**

Roadsides and grassy places, usually in some shade; local in the Thames valley area. 17, 22–24. (4). Native.

England, Finland and southern Sweden. Br, Fe, Su.

It is remarkable that this local species should occur as a native in a small area of southern England and nowhere else outside Fennoscandia. There seems little doubt that the British plant is correctly identified. Dahlstedt and Lindberg have both assigned British material to this species, and I can find no difference between British and Scandinavian plants. *T. mucronatum* occurs in fairly natural habitats in a limited area in Britain and, apart from its geographical isolation, there is no reason to doubt that it is native. It is best known by the characteristic leaf-shape and rather long and narrow, purplish exterior bracts.

102. *T. dilatatum* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 22 (1907)

Leaves 100–250mm, spreading (to erect), dull, *somewhat yellowish-green*; leaf-

lobes 2-5, rather distant, recurved, long and acute, distal margin with small and large teeth; leaf-margins, especially of interlobes, sometimes blackish; terminal lobe rather narrow, subdivided; interlobes with long, broad-based, filiform teeth; petiole about $\frac{1}{4}$ length of leaf, purple, winged. Scapes 50-200mm, spreading to erect; *exterior bracts* $15 \times 2-3\text{mm}$, spreading to recurved, pale green above, darker below; *capitulum* 60-70mm, *deep yellow*; ligules very long, striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2.8mm, olive-brown. **Fig. 34.**

Roadsides and grassy places; widespread but local, though probably overlooked; not recorded from Ireland. 7, 11, 13, 22, 23, 25, 29, 31, 32, 35, 39, 59, 60, 62, 66, 67, 75, 79, 91, 105, 112, S. (21, S). Native.

Northern Europe, extending into southern France and Germany. Be, Br, Da, Fe, Ga, Ge, Ho, No, Rs(B), Su.

This is the only species combining the following characters: only 2-5 recurved leaf-lobes, long, narrow, recurved exterior bracts and a capitulum of over 60mm diameter. Yet it is not a distinctive species being readily confused with other species, in particular with the following three (nos. 103-105) from which it is best known by the large capitulum.

103. *T. cordatum* Palmgr., *Acta Soc. Fauna Flora fenn.*, **34**(1): 12 (1910)

T. amblycentrum Dahlst., *Ark. Bot.*, **10**(11): 37 (1911)

Leaves 100-200mm, spreading to erect, *rather pale, pure green*, lacking dark markings; leaf-lobes 3-5, patent, or usually slightly recurved, narrowly triangular, acute, distal margin usually somewhat concave, lower part of distal margin filiform-dentate; terminal lobe triangular, entire; petiole dull red, narrowly winged. Scapes 100-200mm, erect; exterior bracts $10 \times 3\text{mm}$, spreading, suffused with violet, or pale green above, darker below; capitulum 45mm, deep yellow; ligules striped red-purple; styles exserted, discoloured, pollen present. Achenes 3mm, olive-brown. $2n = 23, 24^*$. Obligate agamosperm. **Fig. 33.**

Road-verges and grassy places; rather common and doubtless under-recorded. 16, 17, 20, 22-24, 27, 29, 32, 48, 52, 58, 60, 62, 66, 67, 75, 83, 101, 103, 106, H9, S. (21, H1, S). Native.

Northern and western Europe. Be, Br, Da, Fe, Ga, Ge, Hb, Ho, Hs, No, Rs(B), Su.

Experiments at Rothamsted suggest that *T. cordatum* grows best in high-yielding pastures with a low pH (*c* 5) and high potassium levels.

T. cordatum is an attractive but nevertheless not a very distinctive species. With the exception of the next species, 104. *T. adsimile*, it is best distinguished from species with a similar leaf-shape by the pure green, unmarked leaves. *T. adsimile* has more recurved leaf-lobes with straight or convex distal margins.

104. *T. adsimile* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 622 (1929)

T. connexum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**: 26 (1930)

T. subsagittipotens Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**: 26 (1930)

Leaves 100–200mm, erect, *dark, pure green*; leaf-lobes 3–6, recurved, acute, *distal margin straight* or $\pm$ convex, *entire* or $\pm$ dentate; terminal lobe triangular, sometimes attenuate, subdivided; *petiole $\frac{1}{4}$ – $\frac{1}{2}$ length of leaf, dull purple*, narrowly winged. Scapes 100–200mm, erect; exterior bracts 10×2.5 mm, spreading to recurved, often suffused with purple; capitulum 40mm; ligules striped violet-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. **Fig. 31.**

Waste-places, gardens, paths etc. Scattered but very local in England and Wales; Ayrshire. 12, 20–24, 26, 29, 39, 40, 45, 75. (12). Endemic.

Although stated in the type description to have yellow stigmas, the type specimens of *T. subsagittipotens* do in fact have discoloured stigmas, as do specimens of *T. adsimile*. I have only recently established the fact that these two species and also *T. connexum* are conspecific. Most previous determinations of British material have been under *T. subsagittipotens*.

This species is best recognised by the dark, pure green leaves, the regular, recurved, triangular leaf-lobes, purplish exterior bracts and rather small capitula.

105. *T. longisquameum* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 21 (1907)

T. sagittatum Dahlst., *Ark. Bot.*, **10**(11): 49 (1911), *non* H. Lindb. f., *ined.*, *nom. in herb.*

Leaves 70–200mm, decumbent to erect, *dark green, with purple blotches on the interlobes*; leaf-lobes 3–5, *slightly to strongly recurved, triangular, acute, $\pm$ straight-sided* and dentate, often on both margins; terminal lobe narrowly triangular-acute, subdivided; petiole $\frac{1}{4}$ length of leaf, purple, unwinged or almost so. Scapes 100–230mm, erect; exterior bracts 10×2 mm, recurved (to spreading), pale green above, darker below, sometimes suffused with purple; capitulum 45mm, yellow; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. $2n = 24^*$. Obligate agamosperm. **Fig. 29.**

Grassy places, roadsides etc. Locally common throughout much of the British Isles. 9, 17, 19, 20, 22–24, 29, 32, 35, 39, 41, 47, 48, 51–53, 55, 58, 60, 62, 99, 101, 108, H16. (24, H1). Native.

Northern Europe extending south to Switzerland. Be, Br, Da, Fe, Ge, Hb, He, Ho, No, Rs(B), Su.

Experiments at Rothamstead Experimental Station suggest that *T. longisquam-*

eum grows best in rather high-yielding pastures of pH 5–7, and low calcium levels.

T. longisquameum is best known by the few, triangular, recurved leaf-lobes, dark purplish interlobes and rather long, narrow exterior bracts. It is an early flowering species.

106. *T. dahlstedtii* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 27 (1907)

T. densiflorum M.P. Chr. in Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 315 (1934), non Brenner, *Meddn. Soc. Fauna Flora fenn.*, **33**: 75 (1907)

Leaves 70–200mm, *mid- or pale, pure green*; leaf-lobes 4–6, patent, or slightly recurved, narrow and rather short, the base decurrent and usually dentate; *terminal lobe longer*, usually *dentate or subdivided*; *petiole narrow, vivid crimson-purple*, unwinged. Scapes 100–250mm, erect; *exterior bracts 12 × 2mm, recurved, pale green above*, darker below; capitulum 40mm, pale yellow; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 3.0mm, straw-brown. $2n = 24^*$, 27^* . Obligate agamosperm. **Fig. 31.**

Grassy places, roadsides etc. Widespread and locally common; not recorded from Ireland but certainly considerably under-recorded. 15, 17, 19, 22, 23, 26, 27, 29, 35, 36, 38, 39, 45, 49, 59, 60, 62, 66, 68, 75, 90–92, 94–96, 99, 105, 106, S. (29, S). Native.

Northern Europe. Be, Br, Da, Fe, Ga, Ge, Ho, Is, No, Rs(B, N), Su.

This is a rather common, characteristic and attractive species, most readily identified by the pale, pure green leaves, the narrow, vivid petioles and the rather large subdivided terminal leaf-lobe.

107. *T. duplidens* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 38 (1907)

Leaves 50–180mm, narrow, dull, rather dark green; leaf-lobes 3–6, *recurved, short, acute*, distal margin somewhat *convex*, with *one tooth*; *terminal lobe very small*, triangular; petiole purple, unwinged or narrowly winged. Scapes 70–200mm, ascending to erect; *exterior bracts 9 × 2mm, recurved, pale, often glaucous above*, dark below; capitulum 40mm, convex, deep yellow; ligules striped grey-violet; styles exserted, *yellow in fresh and dried condition, pollen absent*. Achenes 2.8mm, brown. $2n = 24^*$. Obligate agamosperm. **Fig. 18.**

Waste places, gardens, walls, paths etc. Widely distributed but local; not recorded from Ireland. 3, 12, 17, 20, 23–25, 27, 29, 31, 41, 45, 62, 67, 86, 95, 98, S. (17, S). Probably native.

Northern Europe extending south to Switzerland; introduced in Iceland. Be, Br, Da, Fe, Ga, Ge, He, Ho, (Is), No, Rs(B, N), Su.

With the exception of the very rare 88. *T. tanylepis*, this is the only species in this section without pollen and with yellow styles. *T. tanylepis* differs in having narrow, patent leaf-lobes.

THE *T. HAMATUM* GROUP (NOS. 108-118)**108. *T. melanthoides* Dahlst., *Bot. Not.*, 1935: 309 (1935)**

T. melanthoides Dahlst. ex Hagl., *Bot. Not.*, 1934: 389 (1934), *nomen nudum*

Leaves 50–180mm, spreading to erect, *pale, bluish-green*; leaf-lobes 3–5, slightly recurved, *rather short*, distal margin and interlobes dentate, the latter usually with *black or purple blotches*; terminal lobe longer, $\pm$ *helmet-shaped*, dentate below; petiole purple, narrowly winged. Scapes 100–250mm, ascending to erect; *exterior bracts* 12×4 mm, recurved, *purplish* above, dark green below; capitulum 45mm, deep yellow; ligules striped dark purple-brown; styles exserted, discoloured, pollen present. Achenes 3.0mm, brown. **Fig. 28.**

Water meadows, especially when mown for hay (meads) but less fertile than those in which the other Thames Valley mead species are found (85. *T. subundulatum*, 86. *T. sublaeticolor*, 109. *T. tamesense* and 110. *T. fulgidum*). Only definitely known from the Thames Valley, the R. Blackwater, north Hampshire and Jersey. 12, 22, 23, 29?, S. (4, S). Native.

England, southern Scandinavia, the Netherlands and Belgium. Be, Br, Da, Ho, No, Su.

This is the only member of the *T. hamatum* group with the combination of pale bluish leaves, blotched interlobes and purplish exterior bracts.

109. *T. tamesense* A. J. Richards, *sp. nov.* (see p. 98)

Leaves 40–150mm, erect, dark green, *with irregular purple blotches, especially on the interlobes*; leaf-lobes (0)2–3, recurved, *very short, wide, acute or $\pm$ obtuse*, upper lobes entire on distal margin; petiole $\frac{1}{3}$ – $\frac{1}{2}$ length of leaf, *bright purple*, unwinged. Scapes 100–150mm, erect, slender; *exterior bracts* 8×2 mm, *spreading to erect*, dark green, *suffused with purple*; capitulum 35mm, deep yellow; ligules striped *purple*; styles exserted, discoloured, pollen present. Achenes 3.0mm, straw-brown. **Fig. 27.**

Water-meadows mown for hay (meads); only known from Pixey Mead, Oxford and by the R. Blackwater, north Hampshire. 12, 23. (2). Native.
England and Fennoscandia. Br, Da, Fe, No, Su.

This is a most attractive little species with purplish leaves, bright purple petioles, and erect exterior bracts. With the two next species, 110. *T. fulgidum* and 111. *T. haematicum*, this species may represent a link with the section *Spectabilia*, with which all the *T. hamatum* group seem to have affinities.

110. *T. fulgidum* Hagl., *Bot. Not.*, 1938: 504 (1938)

Leaves 80–200mm, spreading to erect, *pale, pure green, sometimes with dark spots or blotches on the interlobes*; leaf-lobes 2–3, $\pm$ patent, rather short,

triangular, distal margin strongly toothed; *terminal lobe rounded, entire above*; *petiole* $\frac{1}{4}$ – $\frac{1}{2}$ *length of leaf, shining, bright purple, winged*. Scapes 100–250mm, erect, rather slender, purple, at least at the base and below the capitulum; *exterior bracts* 10×3 mm, *spreading to erect, stiff, dark green below, paler above*, often purple-tipped; capitulum 50mm, deep yellow; ligules striped brown-purple; styles exserted, discoloured, pollen present. Achenes 3.5mm, olive-straw coloured. **Fig. 27.**

Water-meadows mown for hay (meads) in the Oxford area. 23. (1). Native. England, Fennoscandia, the Netherlands and Belgium. Be, Br, Da, Fe, Ho, No, Su.

Although this species may eventually be found on other meads, especially in the Thames Valley, it is unlikely to have been extensively overlooked as it is very distinctive.

T. fulgidum has strong affinities with the section *Spectabilia* to which it may well belong. In this section it particularly resembles 42. *T. euryphyllum* but differs in having a rounded terminal leaf-lobe. 48. *T. drucei* has smaller, paler exterior bracts, grey stripes to the ligules and yellow styles. In the section *Vulgaria*, *T. fulgidum* is readily recognised as the only species with rounded terminal leaf-lobes and with spreading to erect exterior bracts. The leaf spots (when present), very bright purple petioles and large achenes are also diagnostic.

111. *T. haematicum* Hagl. in Hagl. & Morander, *Svensk bot. Tidskr.*, **31**: 347 (1937), *sine diag. lat.*

T. haematopus Dahlst. in Lindman, *Svensk Fanerogamfl.*, 563 (1918), *non* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 25 (1907)

T. haematopodides H. Lindb. f., *Acta bot. fenn.*, **17**: 18 (1935), *nomen nudum*

Leaves 80–100mm, *spreading to erect*, dark, pure green, *usually with dark blotches on the interlobes*; leaf-lobes 4–5, patent or slightly recurved, narrowly triangular, distal margin $\pm$ concave, entire or filiform-dentate; terminal lobe small, triangular; *petiole* $\frac{1}{4}$ – $\frac{1}{2}$ *length of leaf, bright purple, unwinged*. Scapes 50–200mm, erect, often purplish at base; *exterior bracts* 10×3 –4mm, *spreading, rather dark green below, pale above, often purplish, especially at tips and margins*; capitulum 40mm, deep yellow; ligules striped brown-purple; styles exserted, discoloured, pollen present. Achenes 3.2mm, olive-brown. $2n = 24$. Obligate agamosperm. **Fig. 34.**

Water meadows mown for hay (meads); rarely in other wet, lowland sites. Valleys of the Blackwater, north Hampshire, and Thames; Wicken Fen, Cambridgeshire; Isle of Man and Ayrshire. 12, 22, 23, 29, 71, 75. (6). Native. Northern and central Europe. Be, Br, Da, Fe, Ge, He, Ho, It, No, Su.

This species is the commonest of the 'mead species', both in Britain and elsewhere. It shares with 109. *T. tamesense* and 110. *T. fulgidum* strong affinity with the section *Spectabilia*. It is best known by the long, narrow, bright purple petioles, and leaf-lobes with a concave distal margin.

There is a problem with the name *T. haematicum* Hagl. as it uses *T. haematopus* Dahlst. in Lindman as the basionym, and it is not clear whether the latter is a later homonym or a misinterpretation of Lindberg's species. Assuming the former, the name can stand, but if the latter is correct a new name will have to be found. For the present, the name *T. haematicum* is retained until the original material can be consulted and a Latin diagnosis drawn up.

112. *T. christiansenii* Hagl. in Hylander, *Förteckn. Skand. Växter* (Lund Bot. För.), 1: 157 (1941)

T. marginellum M.P. Chr. in Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 306 (1934), non H. Lindb. f., *Acta Soc. Sci. fenn.*, nov. ser. B, 1(2): 171 (1932)

Leaves 150–250mm, spreading to erect, *dull, dark green*; leaf-lobes 4–5, recurved, triangular, distal margin usually somewhat convex, entire or filiform-dentate; petiole about $\frac{1}{4}$ length of leaf, dull purple, narrowly winged. Scapes 150–300mm, erect; exterior bracts 12×3 mm, spreading to recurved, *dull, somewhat glaucous green, with a clear white border about half as wide as the green centre*; capitulum 45mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, straw-brown. $2n = 24$. Obligate agamosperm. **Fig. 33.**

Grassy places, roadsides etc. Dorset, Lancashire, Yorkshire and Argyllshire. 9, 60, 62, 98. (4). Very probably introduced.

Britain, Scandinavia, the Netherlands and Belgium. Be, (Br), Da, Ho, No, Su.

In leaf characters this species is intermediate between 113. *T. bracteatum* and 114. *T. hamatum*. It is readily distinguished from both by the smallish, pale, spreading exterior bracts with wide, hyaline borders.

113. *T. bracteatum* Dahlst., *Ark. Bot.*, 19(18): 11 (1925)

Leaves 100–250mm, spreading to erect, dull, mid-green, sometimes with a few dark blotches on the interlobes; leaf-lobes 3–5, *slightly recurved*, rather short, broadly triangular, distal margin usually somewhat convex, entire or filiform-dentate; terminal lobe medium-sized, triangular; petiole purple, unwinged, at least at the base. Scapes 50–200mm, erect, often reddish; *exterior bracts* 10×3 mm, erect, the outermost smaller 5×1 mm, spreading or recurved, dark green outside, paler within, *often somewhat reddish*, all unbordered; capitulum 45mm; ligules striped purple; styles exserted, discoloured, pollen present. Achenes 3.5mm, straw-coloured. $2n = 24^*$. Obligate agamosperm. **Fig. 29.**

Grassy places, roadsides etc.; widely distributed throughout Britain but rather uncommon. 3, 10, 17, 22, 23, 38, 41, 57, 60, 62, 66–68, 90, 96, 103, 111, S. (17, S). Probably native.

Northern and central Europe. Be, Br, Da, Fe, Ga, Ge, He, Ho, No, Su.

T. bracteatum can be separated from all except 114. *T. hamatum* by leaf

characters and the large achenes. The latter species usually has more strongly recurved and more convex leaf-lobes, and darker, more glaucous exterior bracts.

114. *T. hamatum* Raunk., *Dansk Ekskurs.-Fl.*, 2nd ed., 255 (1906)

T. pseudohamatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1931*, 9: 564 (1932), *pro parte*

Leaves 80–300mm, decumbent to erect, dull, dark green, sometimes suffused purple; leaf-lobes 3–5, recurved, triangular, rather short, acute or *sometimes obtuse*, distal margin convex, entire or filiform-dentate; terminal lobe variable, usually rather small and triangular; petiole $c \frac{1}{4}$ length of leaf, dull purple, unwinged, at least below. Scapes 100–300mm, erect; *exterior bracts $c 11 \times 3$ mm, erect to spreading, very dark, glaucous green outside, somewhat paler within, the outermost not noticeably narrower, unbordered*; capitulum 50mm, deep yellow; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 3.5mm, straw-coloured. $2n = 24^*$. Obligate agamosperm. **Fig. 28.**

Grassy places, roadsides, scrub, waste-land, gardens, rocky places etc. Locally common in the south, very common and usually the most abundant species in lowland northern England and Scotland except the extreme north and west; apparently absent from Ireland. 1, 3, 7, 12, 15–17, 19–24, 29, 32, 35, 36, 38, 39, 41, 45, 49–51, 55, 57, 58, 60, 62, 64, 66–70, 75, 77, 83, 86, 88, 90, 96, 98, 99, 101, 102, 106, 108, 112, S. (49, S). Native.
Northern Europe. Be, Br, Da, Fe, Ga, Ge, Ho, No, Su.

T. hamatum is best separated from the remainder of this group of species (nos. 108–118) by the large achenes and erect, dark, glaucous exterior bracts. Although plastic, it is a distinctive species which can often be recognised at a glance by its leaf-shape.

115. *T. hamatiforme* Dahlst. in Lindman, *Svensk Fanerogamfl.*, 583 (1918)

T. hamatifrons Dahlst. in Johnston., *Trans. Proc. bot. Soc. Edinb.*, 29: 302 (1926)

Leaves 80–200mm, spreading to erect, dull green, sometimes with dark blotches on the interlobes; leaf-lobes 3–5, somewhat *recurved*, rather short, triangular, acute, distal margin convex, or sometimes straight on the lower lobes, lower lobes often with filiform teeth; terminal lobe triangular; petiole purple, unwinged, or winged above. Scapes 80–200mm, ascending to erect; *exterior bracts 10×3 mm, spreading, dark green below, paler and somewhat glaucous above, unbordered*; capitulum 45mm, deep yellow; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 3.0mm, straw-brown. $2n = 23^*, 24^*, 25^*, 26^*, 27^*$. Obligate agamosperm. **Fig. 29.**

Grassy places, roadsides, hedgebanks etc., more rarely in waste places. Locally common in Britain; in Ireland only known from Co. Kerry, but perhaps more

widespread. 1, 3, 11, 12, 15–18, 22–24, 26, 28, 29, 39, 41, 44, 45, 48, 49, 54, 58, 60, 62, 67, 75, 96, 98–101, 107, 111, H1, S. (33, H1, S). Native.
Northern Europe. Be, Br, Da, Fe, Ga, Ge, Hb, Ho, Hs, No, Su.

Experiments at Rothamstead Experimental Station demonstrate a preference for poor pastures with a pH of about 5, and low nitrogen and phosphorus levels.

T. hamatiforme is in the most critical area of the *T. hamatum* group, for 116. *T. marklundii*, and the non-British species *T. kernianum* van Soest, *T. atrovirens* Dahlst. and *T. atactum* Sahlin & van Soest are all separable only with difficulty. The taxonomy of these is far from clear, and it is doubtful if it will ever be entirely satisfactory. Genotypes assigned to these species are evidently rather successful in western Europe and selection for single genotypes seems not to have occurred. All the genotypes examined are agamospermous and in any one area individuals tend to be relatively uniform. *T. marklundii* differs from *T. hamatiforme* in leaf-shape, the lobes being longer, more recurved and more strongly dentate and, characteristically, the terminal lobe is small with an acuminate apex; the exterior bracts are usually purplish.

116. *T. marklundii* Palmgr., *Acta Soc. Fauna Flora fenn.*, **34**(1): 20 (1910)

T. hamiferum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 625 (1929), *pro parte*

T. subhamatum M.P. Chr., *Bot. Tidsskr.*, **43**: 238 (1935), *nomen nudum*

T. subhamatum M.P. Chr., *Dansk bot. Ark.*, **9**(2): 26 (1936)

Leaves 50–200mm, spreading to erect, dull green, often dark and sometimes suffused with purple; leaf-lobes 4–5 (–6), *recurved*, rather narrow, *distal margin convex*, usually filiform-dentate, and sometimes with 1–2 large teeth; *terminal lobe small*, triangular, *acuminate*; interlobes sometimes with dark blotches, dentate; petiole dull purple, usually winged. Scapes 50–200mm, ascending to erect; *exterior bracts* 10 × 2.5mm, *spreading*, purple above, dark green suffused with purple beneath, unbordered; capitulum 45mm; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 3.0mm, straw-brown. $2n = 24^*$. Obligate agamosperm. **Fig. 26.**

Grassy places, especially roadsides and poor pastures. The commonest and often the only species of poor or overgrazed pasture in England, and very under-recorded; much more local in Scotland; in Ireland only recorded from Co. Galway, but very probably widespread. 3, 9, 12, 17, 19, 20, 22–24, 26, 28, 29, 31, 39, 41, 45, 46, 52, 58, 60, 62, 66, 67, 96, 98, 99, 101, 106, H16, S. (28, H1, S). Native.

Northern and western Europe. Be, Br, Da, Fe, Ga, Ge, Hb, Ho, Hs, Lu, Rs(B), Su.

Experiments at Rothamstead Experimental Station indicate a preference for poor pastures with a pH of 5–7 and low mineral content, apart from nitrogen. This species is closely related to 115. *T. hamatiforme* and 117. *T. latisectum*. The latter is best known by the larger terminal leaf-lobes and the small, pale, recurved exterior bracts. 118. *T. oblongatum* has a somewhat different leaf-

shape and paler leaves, while 119. *T. maculatum* has pure green, heavily blotched leaves. *T. marklundii* appears to flower a few days in advance of other *Vulgaria* species.

117. *T. latisectum* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 26 (1907)

T. subdilatatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1927*, **8**: 309 (1928), *nomen nudum*

Leaves 100–300mm, erect, dull, mid-green; leaf-lobes 3–6, *slightly recurved, broadly triangular*, distal margin usually somewhat *convex*, entire or filiform-dentate; terminal lobe *small*, triangular, *narrow on early leaves, larger and obtuse on later leaves*, entire; *interlobes unblotched*, entire; petiole dull purple, winged. Scares 100–350mm, erect; *exterior bracts 9 × 2mm*, spreading to *recurved, pale, uniformly green and somewhat glaucous above*, darker below, unbordered; capitulum 45mm; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 2·8mm, straw-brown. **Fig. 29.**

Grassy places; local but probably under-recorded due to confusion with 115. *T. hamatiforme*. 22, 23, 28, 29, 41, 45, 60, 99, 101, H1, 16, S. (9, H2, S). Native. British Isles and Fennoscandia. Br, Da, Fe, Hb, No, Su.

The leaves of *T. latisectum* resemble those of large, broad-lobed forms of 115. *T. hamatiforme*, although neither of the two types of terminal lobe occurring in *T. latisectum* is found in that species. *T. hamatiforme* is also characterised by larger, darker and less glaucous exterior bracts.

118. *T. oblongatum* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**: 27 (1930)

T. hamiferum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 625(1929), *pro parte*

T. perhamatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**: 28 (1930)

T. pseudohamatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1931*, **9**: 564 (1932), *pro parte*

T. fusciceps Hagl., *Bot. Not.*, **1938**: 505 (1938)

Leaves 50–200mm, erect, mid-green, or even *yellowish*; leaf-lobes 3–5, *recurved, distal margin usually convex* and filiform-dentate; *terminal lobe longer than adjacent lateral lobes, often entire, obtuse, minutely apiculate, with a convex margin*; petiole deep pink, unwinged or narrowly winged. Scares 100–250mm, erect; *exterior bracts 9 × 2·5mm, spreading to recurved, suffused with purple above*, very dark green below; capitulum 35–40mm, strongly convex; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2·8mm, straw-brown. $2n = 24^*$. Obligate agamosperm. **Fig. 26.**

Grassland, especially fertile, damp pastures. Scattered in England and Wales; Arran, Channel Isles. 1, 9, 20, 22–24, 31, 41, 44, 45, 62, 66, 100, S. (13, S). Probably native.

Britain, Sweden, Finland and the Netherlands; possibly also in Norway. Br, Fe, Ho, No?, Su.

There has been some difficulty over the identity and correct name of this species. It has been known for some time that Haglund's *T. fusciceps* was the same as material earlier described from Britain as *T. oblongatum*. Unfortunately, the holotype of the latter at Oxford is heterotypic, comprising poor material which may be the same as *T. fusciceps*, as well as *T. obliquilobum*. However, the isotype at Stockholm is clearly *T. fusciceps*, as is the other material at Oxford collected in the same year from Notley Abbey, Buckinghamshire and named by Dahlstedt *T. oblongatum*. There is no doubt therefore that the two names are synonymous. Owing to the earlier confusion, the synonym *T. perhamatum*, for which the type locality is also Notley Abbey, has previously been used for British material.

T. oblongatum is a species with rather pale leaves and recurved exterior bracts suffused with purple; the leaf-shape is usually distinguishable from allied species.

119. *T. maculatum* Jordan, *Pug. Pl. Nov.*, 117 (1852)

T. atripictum Markl. ex Pettersson, *Memo. Soc. Fauna Flora fenn. for 1933-1934*, 10: 221 (1935), *nomen nudum*

T. atripictum Markl., *Acta bot. fenn.*, 23: 91 (1938)

Leaves 80-250mm, decumbent to erect, *pure green, blotched with purple on the interlobes and often elsewhere*; leaf-lobes 3-6, *recurved, distal margin convex* and usually with large teeth, occasionally also dentate on the *proximal margin* and interlobes; *terminal lobe small, triangular, obtuse-apiculate*; *petiole dark red*, unwinged or narrowly winged, mid-rib also usually a *distinctive dark red*. Scapes 20-180mm, ascending to erect, *often scarcely $\frac{1}{2}$ length of leaves at anthesis*, although sometimes exceeding the leaves later; *exterior bracts 9×2 mm, recurved, pale, glaucous green* above, dark green below, sometimes suffused with purple; capitulum 50mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. **Fig. 28.**

Roadsides and grassy places. Uncommon and confined to England and south Wales. 9, 12, 17, 20, 22-24, 41, 45, 62, 67, S. (11, S). Probably native. Britain and Fennoscandia; possibly also in France. Br, Fe, Ga?, No, Su.

T. maculatum is best known by the combination of green, dentate leaves with purple or black interlobes, a red petiole and mid-rib, recurved leaf-lobes and rather small, recurved exterior bracts. It is commonly found in flower 1-2 weeks before most *Vulgaria* species.

120. *T. fasciatum* Dahlst. in Sernander *et alia*, *Bot. Studier till. F. R. Kjellman*, 172 (1906)

T. sublatissimum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, 9: 28 (1930)

Leaves 100-250mm, spreading to erect, mid-green *with blackish interlobes*; leaf-lobes 3-5, pointing forward, patent or recurved, narrowly triangular, entire, or, like the interlobes, with long, filiform teeth; *terminal lobe subsagittate*,

often abruptly narrowed near the middle; petiole dull reddish purple, winged. Scapes 100–300mm, erect; exterior bracts 14×4 mm, recurved, crowded, $\pm$ imbricate, broad, pale green above, dark green below, sometimes somewhat suffused with purple; capitulum 50mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2.8mm, olive-brown. $2n = 24$. Obligate agamosperm. Fig. 30.

Grassy places, roadsides, waste places; scattered throughout Britain but rather uncommon. 6, 12, 20, 22, 23, 27, 29, 32, 34, 39, 60, 62, 67, 82, 83, 96, 106, 109, S. (18, S). Possibly native.

Northern Europe. Be, Br, Da, Fe, Ge, Ho, No, Rs(B), Su.

T. fasciatum is very common throughout most of its range and is one of the commonest species in Scandinavia. Its relative scarcity in Britain may be due to its apparent dislike of Atlantic conditions (it is absent from south-west England, Wales, and Ireland), but it may be introduced.

This species is best recognised by its involucre of wide, imbricate, pale green exterior bracts. The dark interlobes, variously directed leaf-lobes and the shape of the terminal lobe are also characteristic.

121. *T. duplidentifrons* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, 8: 624 (1929)

T. duplidentiforme Dahlst. ex Druce, *Rep. botl Soc. Exch. Club Br. Isl. for 1927*, 8: 308 (1928), *nomen nudum*

T. raunkiaerii Wiinst. in Raunk., *Dansk Ekskurs.-Fl.*, 5th ed., 303 (1934)

Leaves 50–200mm, spreading to erect, dull green, without dark markings; leaf-lobes 3–5, patent or slightly recurved, rather short and broadly triangular, tapering abruptly to an acute or acuminate tip, distal margin usually filiform- and triangular-dentate; terminal lobe triangular, acute, usually entire; petiole dark red (—purple), usually winged, mid-rib dark reddish. Scapes 50–200mm, ascending to erect; exterior bracts 9×2.5 mm, spreading, pale green above, darker green below; capitulum 40mm; ligules striped grey-violet; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. $2n = 24^*$. Obligate agamosperm. Fig. 32.

Grassy places, especially on well-drained, base-rich soils. Locally common on sand-dunes, limestone grassland etc. especially in the north and west. 17, 20, 22, 23, 26, 28, 29, 31, 38, 41, 48, 57, 60, 62, 66, 67, 69, 75, 95, 96, 98, 101, 111, 112, S. (24, S). Native.

Northern Europe. Be, Br, Da, Fe, Ga, Ge, Ho, No, Su.

This species is most readily recognised by the dull, dentate, broad-lobed leaves and the small, spreading exterior bracts. The petiole and mid-rib are of a characteristic dull, ruby-red colour.

122. *T. hemipolyodon* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 625 (1929)

Leaves 150–300mm, erect, dull green; leaf-lobes 5–7, *irregularly arranged*, patent or nearly so, *narrow*, but not differentiated into broad base and linear process, *both lobe-margins and interlobes dentate* with a *variety of tooth types and lobules*; *terminal lobe broad*, $\pm$ *obtuse*; petiole dull purple, usually winged. Scapes 150–300mm, erect; *exterior bracts* 14×4 mm, *erect - spreading*, *pale glaucous green inside*, dark green outside; capitulum 50mm; ligules striped violet-grey; styles exserted, discoloured, pollen present. Achenes 3.2mm, straw-brown. **Fig. 32.**

Waste places; rare, in southern England, the south Midlands and Yorkshire. 7, 17, 20, 22, 23, 35, 62. (7). Endemic.

T. hemipolyodon is a characteristic species with large, strongly dentate leaves and large, erect exterior bracts. It has apparently no close relatives and its scarcity suggests that it is a relict species rather than one of recent origin.

123. *T. obscuratum* Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1929*, **9**: 27 (1930), *non* Hagl., *Bot. Not.*, **1934**: 26

Leaves 100–250mm, spreading to erect, *dull, dark green*; leaf-lobes 3–6, patent, short, *broad*, triangular, *rather regularly dentate on the distal margins and the interlobes*; terminal lobe acute or *subobtuse*, *dentate and often subdivided*; petiole dull purple, unwinged or narrowly winged, mid-rib dark green. Scapes 150–300mm, erect, narrow; *exterior bracts* 10×2 –3mm, *erect to spreading*, *pale green inside*, very dark green outside; capitulum 45mm; *ligules striped purple*; styles exserted, discoloured, pollen present. Achenes 3.5mm, straw-brown, *rugose throughout*. **Fig. 25.**

Wood margins and woodland glades; rarely in other habitats. Very local, in England and Scotland. 15, 20, 23, 29, 62, 66, 67, 90, 99, 101. (10). Endemic.

Experiments at Rothamstead suggest that it is confined to areas with a pH of about 5, with very low levels of calcium, magnesium and sodium.

This is an unmistakable species with regularly dentate lateral and terminal leaf-lobes, and rather small, erect, very dark, exterior bracts. The large, rugose achenes are particularly diagnostic, and the combination of coloured petiole and green mid-rib is unusual. Like 122. *T. hemipolyodon*, it has no close relatives and this may be another relict endemic species.

124. *T. parvuliceps* H. Lindb. f., *Meddn Soc. Fauna Flora fenn.*, **36**: 5 (1910)

T. officinale var. *lacerum* Brenner, *Meddn Soc. Fauna Flora fenn.*, **32**: 98 (1906), *non T. lacerum* Greene, *Pittonia*, **4**: 230 (1901)

T. officinale **laceratum* Brenner, *Meddn Soc. Fauna Flora fenn.*, **33**: 90 (1907)

T. laceratum (Brenner) Brenner, *Meddn Soc. Fauna Flora fenn.*, **35**: 179 (1909), *nomen nudum*

Leaves 50–200mm, spreading to erect, dull green; leaf-lobes 3–4, irregularly arranged, patent or slightly recurved, variable in width, *distal margin and interlobes strongly dentate*; terminal lobe variable, usually somewhat dentate; *petiole dull reddish*, unwinged or narrowly winged. Scapes 100–250mm, erect, narrow; *exterior bracts* $10 \times 1.5\text{--}2\text{mm}$, *strongly recurved*, pale green above; *capitulum* 30mm; ligules striped grey-violet; styles exserted, discoloured, *pollen absent*. Achenes 2.8mm, straw-brown. **Fig. 18.**

Waste places; throughout Britain but very local. 3, 22, 29, 41, 48, 79, 99. (7). Probably introduced.

Northern Europe; probably widely introduced. (Be), (Br), Da, Fe, (Ga), Ge, No, Rs(B), Su.

T. parvuliceps is readily recognised as it is the only species apart from 73. *T. inane* to have discoloured styles and no pollen; in addition the delicate habit, red petioles, highly dentate leaves and small capitula are all characteristic. It has only been recorded on a few occasions in Britain, and it seems to be both scattered and sporadic in its appearance. It is likely to be native only in Fennoscandia and the Baltic area for only there can it be said to be fairly frequent and persistent.

Although most Scandinavian workers now regard Brenner's taxon as synonymous with *T. parvuliceps*, Lindberg himself (Brenner 1909, p.179) redetermined all Brenner's original material, most of it as *T. pallidulum* H. Lindb. f. Since I have not seen this material I am here adopting the generally accepted view.

125. *T. polyodon* Dahlst., *Ark. Bot.*, 9(10): 56 (1910)

T. ardisodon Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, 8: 623(1929)

Leaves 50–200mm, spreading, dark green, usually with black or dark purple blotches on the interlobes; *leaf-lobes* 5–6, *patent or slightly recurved, rather short, triangular, distal margin and interlobes strongly dentate*, less frequently so on the proximal margin and the terminal lobe; terminal lobe small, triangular, subdivided on outer (early) leaves, often much larger on inner (later) leaves; petiole dark purple, narrowly winged. Scapes 50–200mm, erect, equalling leaves; exterior bracts $10 \times 2\text{mm}$, spreading to *recurved*, pale green above, darker below, sometimes suffused with purple; capitulum 50mm; ligules striped purple; styles exserted, discoloured, pollen present. Achenes 3.2mm, olive-brown. $2n = 21, 22, 23, 24^*, 48$ (*gigas*). Obligate agamosperm, or, exceptionally, facultative agamosperm. **Fig. 33.**

Grassy places, roadsides etc. Locally common throughout Britain; not yet recorded from Ireland but doubtless considerably under-recorded. 3, 15–17, 19, 20, 22–24, 28, 29, 32, 34, 39, 41, 60, 66, 67, 75, 77, 82, 84, 90, 95, 99, 101, 112. (27). Native.

Northern Europe. Be, Br, Da, Fe, Ga, Ge, Ho, No, Rs(B), Su.

T. polyodon is best distinguished from the other highly dentate species with coloured petioles by the dark interlobes and recurved exterior bracts. 119.

T. maculatum is similar but flowers earlier, has more recurved, convex-margined leaf-lobes, shorter scapes and purple exterior bracts. It also has more vivid leaves.

126. *T. reflexilobum* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 31 (1907)

T. reflexifolium Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1926*, **8**: 32 (1927), *nomen nudum*

Leaves many, 50–200mm, decumbent to erect, dull, dark green; leaf-lobes 6–8, strongly recurved, narrow, distal margin strongly dentate; terminal lobe small, narrow, $\pm$ sagittate, acute, usually entire; interlobes narrow, often with dark blotches, strongly dentate; petiole violet-purple, unwinged. Scapes 80–200mm, erect; exterior bracts 10×2 mm, spreading to recurved, pale green above, dark green below, often suffused with purple; capitulum 40mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 2.5mm, straw-brown. **Fig. 33.**

Grassy places, roadsides etc. Scattered throughout England and Scotland, but frequent in some localities and perhaps under-recorded. 22, 23, 25, 29, 55, 62, 75, 83, 94, 106. (10). Probably native.

England, Scotland, Finland and Sweden. Br, Fe, Su.

Like 101. *T. mucronatum*, this is another remarkable instance of a local Scandinavian species appearing in Britain. Both Dahlstedt and van Soest have assigned British material to this species, and I too can find no significant differences between British and Scandinavian material. Although it may possibly be adventive in Britain, the relatively natural habitats in which it occurs, and its frequency in some areas argues against this. *T. reflexilobum* has very distinctive narrow, dark leaves with black interlobes, and many narrow, recurved leaf-lobes. It is clearly allied to 125. *T. polyodon*, which has fewer, broader, less recurved leaf-lobes, larger teeth and larger achenes. The achenes of *T. reflexilobum* are among the smallest in the genus.

127. *T. crispifolium* H. Lindb. f., *Acta Soc. Fauna Flora fenn.*, **29**(9): 27 (1907)

T. polylobum Dahlst. ex Hagl., *Bot. Not.*, **1934**: 382 (1934), *nomen in syn.*

Leaves many, 50–200mm, decumbent, narrow, dark green, interlobes usually unblotched; leaf-lobes 4–8, short, crisped from a broad base, abruptly narrowed to form a $\pm$ patent, or somewhat recurved, short, narrow to linear process, distal margin convex; terminal lobe small, subsagittate, entire; petiole dull, reddish-purple, winged. Scapes 50–150mm, recurved, decumbent to erect, usually somewhat purplish; exterior bracts 8×2 mm, dark green below, paler above, often suffused with purple; capitulum 35mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.2mm, olive-brown. **Fig. 26.**

Grassy places, especially old, well managed, wet pastures. Widespread but very

scattered; probably under-recorded. 9, 12, 17, 20, 22–24, 39, 44, 62, 67, 95, 106, H16. (13, H1). Native.

Northern Europe and Switzerland; not recorded from France or Germany. Be, Br, Da, Fe, Hb, He, Ho, No, Su.

Experiments at Rothamstead Experimental Station indicate that it prefers well-manured, fertile pastures with a low pH of between 5 and 6.

T. crispifolium is best known by the many dark, narrow leaves and the characteristic shape of the leaf-lobes. These are highly crisped, and of the species bearing linear processes *T. crispifolium* has by far the shortest. It is clearly related to 126. *T. reflexilobum*, which has quite different leaf-lobes and much smaller achenes, and to 128. *T. canoviride*, which has grey leaves and longer linear processes.

128. *T. canoviride* H. Lindb. f. ex Puolanne, *Memo. Soc. Fauna Flora fenn. for 1931–1932*, **8**: 147 (1933), *Sched. Pl. Finland. Exsicc., Helsingfors*, **21–42**: 118 (1944), *diag. lat.*

T. canoviride H. Lindb. f. ex Florstr., *Acta Soc. Fauna Flora fenn.*, **39**(4): 72 (1914), *nomen nudum*

Leaves many, 50–200mm, *decumbent* to erect, *crisped*, grey-green, unblotched; leaf-lobes 4–6, $\pm$ patent, *linear*, *often widening slightly at the subobtuse apex*, *widening abruptly at the extreme base*; terminal lobe tripartite, middle process linear, widening at the subobtuse apex; interlobes narrow, with large teeth and lobules of varying size; petiole dull violet, narrowly winged. Scapes 50–180mm, decumbent to erect; exterior bracts 10×3 mm, spreading to recurved, $\pm$ *valvate*, *forming a neat 'ruff'*, pale above, darker below, usually suffused with purple; *capitulum* 35mm; ligules striped grey-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, warm straw-brown. **Fig. 30.**

In old, well managed, wet pastures; local and rare, apparently confined to the south Midlands. 20, 22, 23, 26. (4). Native.

Northern Europe extending southwards to Switzerland. Be, Br, Da, Fe, Ge, He, Ho, No, Rs(B), Su.

At Rothamstead Experimental Station it is restricted to pastures with a pH of between 5 and 6, low in cations, but well-manured and highly productive.

This is the only *Vulgaria* species with crisped, grey-green, lacinate leaves, violet petioles and swollen, subobtuse tips to the lobes. The subvalvate involucre, similar to that found in the Scandinavian *T. piceatum* Dahlst., is also diagnostic.

129. *T. obliquilobum* Dahlst., *Ark. Bot.*, **9**(10): 46 (1910)

T. similatum Dahlst., *Rep. botl Soc. Exch. Club Br. Isl. for 1928*, **8**: 626 (1929)

T. tenuisquamum Dahlst. ex Hagl., *Acta Horti gotoburg.*, **11**: 39 (1936)

T. unguiculosum H. Lindb. f. & Palmgr. in Palmgr., *Acta Soc. Fauna Flora fenn.*, **34**(1): 4 (1910)

Leaves 80–200mm, *decumbent* to erect, dull, olive-green, *narrowly oblong*, unblotched; leaf-lobes 4–5, recurved, short, filiform-dentate, often with larger teeth or lobules; *terminal lobe subdivided*; interlobes with large teeth and lobules; petiole dull, red-purple, winged. Scapes 80–200mm, ascending to erect; *exterior bracts* $10 \times 1.5\text{mm}$, *recurved*, pale green above, darker below, sometimes suffused with purple; capitulum 45mm; ligules striped brown-purple; styles exserted, discoloured, pollen present. Achenes 3.0mm, olive-brown. **Fig. 31.**

Waste places etc.; southern England, scattered and rare. 17, 22, 24. (3). Introduced.

Northern Europe extending southwards to Switzerland; often common. Be, (Br), Da, Fe, Ga, Ge, He, Ho, No, Rs(B), Su.

T. obliquilobum is best known by its olive-green, oblong leaves with rather ill-defined lobes and long, narrow, recurved exterior bracts. 106. *T. dahlstedtii*, with a rather similar leaf-shape and narrow, recurved exterior bracts, has bright purple, unwinged petioles. 124. *T. parvuliceps*, with a similar involucre, has quite different leaves, and lacks pollen. Although common on the continent, there are only three records of *T. obliquilobum* in Britain, all from ruderal habitats, and it seems very likely that it is a casual.

130. *T. privum* Dahlst., *Ark. Bot.*, 10(6): 7 (1911)

Leaves 100–250mm, erect, pale to mid-green, sometimes with dark blotches on the internodes; *leaf-lobes* 4–5, *rather crowded, recurved, triangular, margins $\pm$ straight*, entire or somewhat dentate; terminal lobe triangular; *petiole rose-pink, sometimes partially or scarcely coloured*, broadly-winged. Scapes 200–350mm, erect, far exceeding leaves; *exterior bracts* $15 \times 4\text{--}5\text{mm}$, spreading, pale green above, darker below; capitulum 50mm; ligules striped grey-purple; *styles pure yellow when fresh, pale straw-coloured when dry, pollen present*. Achenes 3.0mm, straw-coloured, *plump*. **Fig. 18.**

Roadsides and grassy places; very local in England and Wales. 12, 21, 23, 29, 31, 32, 34, 35, 41, 60, 66, 70. (12). Probably native.

England and Wales, Fennoscandia and the Baltic, the Netherlands and Belgium. Be, Br, Da, Fe, Ho, No, Rs(B), Su.

This species is related to nos. 102–105, and should perhaps be placed there. In particular, 104. *T. adsimile* has leaves of a very similar shape, but these are dark green and lack dark interlobes. *T. privum* differs from all these in the very long and broad exterior bracts, the yellow styles, and the plump, straw-coloured achenes, and for these reasons it has been placed here.

131. *T. orcadense* Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, 29: 304 (1926)

T. tanylepioides Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, 29: 303 (1926)

T. perlaciniatum Dahlst. in Johnston, *Trans. Proc. bot. Soc. Edinb.*, 29: 421 (1927)

Leaves 50–200mm, spreading to erect, $\pm$ *shining, dark green*; leaf-lobes 2–4, patent or slightly recurved, *broad* and short, triangular at least on the outer (older) leaves, margins usually straight, entire or with a few large teeth; *terminal lobe about twice the length of lateral lobes, broad, $\pm$ rounded*, usually *apiculate and entire*; petiole deep purple, unwinged or winged. Scapes 40–200mm, erect, often shorter than leaves; *exterior bracts 10×2.5 mm, spreading-erect, dark green outside*, paler inside, often suffused with purple; capitulum 50mm; ligules striped brown-violet; styles exserted, discoloured, pollen present. Achenes 3.5mm, straw-brown. **Fig. 25.**

Grassy places; known only from Mainland and Cava, Orkney, where it seems to be frequent, and from Mainland and Fetlar, Shetland. 111, 112. (2). Endemic.

Although this species keys out with 110. *T. fulgidum*, it is not very similar, having dark green leaves of a different shape. However, while not belonging to the *T. hamatum* group (nos. 108–118), it shares with those species an affinity with the section *Spectabilia*. Indeed, *T. orcadense* might well be regarded as being related to 44. *T. praestans* and 50. *T. naevosum*, from both of which it may be distinguished by the sub-rounded terminal leaf-lobe, and to 48. *T. drucei*, which has paler, thinner leaves and a paler, more delicate involucre. The type description of *T. orcadense* mentions spotted leaves, but none of the known specimens shows this character. *T. tanyleptoides* is the correct name on page priority, but Johnston's type material is poor and inadequate. Although some specimens may be of *T. orcadense*, I have decided to adopt the less confused and more generally used name *T. orcadense*.

132. *T. cophocentrum* Dahlst., Rep. botl Soc. Exch. Club Br. Isl. for 1928, 8: 624 (1929)

Leaves 150–300mm, erect, dull, dark green; *leaf-lobes 1–3, broad, triangular*, margins $\pm$ straight, distal margin dentate; *terminal lobe about $\frac{1}{4}$ length of leaf, broad, rounded, entire* or dentate below; petiole dull purple, narrowly winged. Scapes 150–300mm, erect, rather narrow; *exterior bracts 9×2 mm, spreading to recurved*, dark green below, paler above, usually somewhat purplish; capitulum 45mm; ligules striped brown-purple; styles exserted, discoloured, pollen present. Achenes 3.5mm, straw-coloured. **Fig. 25.**

Grassy places, especially wood-margins and scrub. The south Midlands and south-east England; very local. The records from Jersey are uncertain. 16, 20–24, 32, S? (7, S?). Endemic.

This is another of the endemic species which are more or less confined to the south Midlands (*cf* nos. 72, 82, 92, 122 and 123). *T. cophocentrum* is readily recognised by the large, dark leaves with few, broad leaf-lobes and a large rounded terminal lobe. The scapes and involucre are disproportionally small. It is most likely to be confused with 94. *T. ekmanii*, which, however, never has rounded terminal leaf-lobes. Owing to difficulties with Dahlstedt's handwriting, Druce refers to this species as *T. caphocentrum* and *T. caphnocentrum* in addition to *T. cophocentrum*.

Latin diagnoses of new species

(The illustrations are not necessarily of holotype material)

***Taraxacum acutum* A. J. Richards, sp. nov.** (no. 22, p. 37, fig. 6)

Planta humilis, tenella. Folia erecta vel patentia, $\pm$ glabra, obscure viridia, ad 60mm longa; lobi laterales 4–5, angusti, acuti, recurvati, margine inferiore grosse 1-pluridentata; interlobia dentata; lobus terminalis angustus, integer; petiolus viridis vel purpureus, exalatus. Scapi folia aequantes vel paullo superantes, virides, pilosi. Squamae involucri exteriores *c* 6mm longae, 2mm latae, patentes, supra pallide virides subtus obscuriores, haud corniculatae, vel marginatae. Calathium diametro 20–30mm, convexum, saturate luteum, ligulis subtus stria violacea notatis; styli exserti, sordidi, polliniferi. Achenium 3·0mm longum, 0·9mm latum, griseo-stramineum, in tertio parte superiore grosse muricatum, ceterum laeve, in pyramidem cylindricam 0·7mm longam abrupte abiens; rostrum 7mm longum, tenue; pappus albus.

Species sectionis *Erythrosperma* H. Lindb. f., a *T. simile* Raunk. praesertim squamis involucri exterioribus obscuris patentibus et foliorum lobis lateralibus recurvatis differt.

HOLOTYPE: British Isles, Hertfordshire, Therfield Heath, GR 52/332.395, 15/5/1969, A. J. Richards (OXF)

***Taraxacum placidum* A. J. Richards, sp. nov.** (no. 24, p. 37, fig. 6)

Planta mediocris. Folia erecta, pallide viridia, nitida, fere glabra, in horto usque ad 200mm longa, angusta; lobi laterales, 5–8, patentes, breves, deltoidei, ad basin sat lati sed in apicem acutam attenuati, margine superiore denticulata vel integro, denticulis numerosis acuminatis; lobus terminalis brevis, acutus, integer; petiolus integer, anguste alatus, cum nervo mediano vivide purpureus. Scapi folia aequantes, apicem et basin versus purpurei, sub involucrio araneoso-pilosi. Squamae involucri exteriores 7mm longae, 3mm latae, patentes, supra pallidae et $\pm$ glaucae, subtus atrovirentes, albo-marginatae, callum parvum ferentes. Involucrum breve, angustum. Calathium magnum, ad 50mm diametro, planum, flavum, ligulis subtus stria argenteo-grisea notatis; styli exserti, flavi, polliniferi. Achenium 3·5mm longum, 0·8mm latum, griseo-brunneum, superne breviter tuberculatum, ceterum laeve, in pyramidem cylindricam 0·8mm longam abrupte abiens; rostrum 8mm longum, tenue; pappus albus. $2n = 24$. Agamosperma. Species sectionis *Erythrosperma* H. Lindb. f.

HOLOTYPE: Spain, Galicia, Vigo, Baleo, 4/1966, D. W. Shimwell (OXF)

***Taraxacum pseudolarssonii* A. J. Richards, sp. nov.** (no. 45, p. 51, fig. 12)

Planta mediocris. Folia 100–200mm erecta, obscure viridia, nitida, valde atro-

purpureo- vel rubro-maculata; lobi laterales 3–5, patentes, angusti, acuti, integri; petiolus clariter purpureus, exalatus. Scapi 100–200mm, erecti, pallidi. Squamae involucri exteriores 7mm longae, 2mm latae, patentes, virides, vix marginatae. Calathium ad 45mm diametro, obscure flavum, ligulis subtus stria violaceo-grisea notatis; styli exserti, sordidi, polliniferi. Achenium 3.5mm longum, 0.9mm latum, brunneo-stramineum, ad apicem spinulosum, ceterum laeve, in pyramidem conicam brevem (0.5mm longam) subabrupte abiens; rostrum sat tenue, 11mm longum; pappus albus. $2n = 32$. Agamosperma. Species sectionis *Spectabilia* Dahlst.

HOLOTYPE: British Isles, Co. Durham, Langdon Beck Hotel, Upper Teesdale, steeply shelving banks of the Langdon Beck and Sand Syke, GR 35/852.310, 10/6/1965, *A. J. Richards* (OXF)

***Taraxacum caledonicum* A. J. Richards, sp. nov.** (no. 59, p. 57, fig. 15)

Planta mediocris, fere glabra, colore atrata, saepe pruinosa. Folia 40–100mm, erecta vel decumbentia, atro-viridia, immaculata; lobi laterales 4–6, subhamati, recurvati, supra valde convexa, interdum ad marginem superiorem sigmoidea, fere edentata; lobus terminalis minimus, obtusus sed mucronatus; petiolus brevis, subexalatus, alis integris, cum nervo mediano purpurascens. Scapi foliis duplo breviores vel folia superantes, pallidi. Squamae involucri exteriores 11mm longae, 3mm latae, erectae, laeves, atratae, glaucescentes, vix marginatae, apice rubescentes. Calathium saturate luteum, convexum vel nunquam vere expansum, ligulis brevibus subtus stria purpurea notatis; styli inclusi, sordidi, epolliniferi. Achenium 4mm longum, 1mm latum, griseo-brunneum, superne sparse spinulosum, ceterum laeve, in pyramidem conicam brevem (0.2mm longum) sensim abiens; rostrum 7–9mm longum sat crassum; pappus albus. $2n = 40$. Agamosperma.

Species sectionis *Spectabilia* Dahlst.

HOLOTYPE: British Isles, Angus, Clova, Glen Doll, mica-schist cliffs by the Burn of Fialzioch, GR 37/236.773, 2/6/1966, *A. J. Richards* (OXF)

***Taraxacum pseudonordstedtii* A. J. Richards, sp. nov.** (no. 60, p. 58, fig. 16)

Planta mediocris, fere glabra. Folia 50–130mm decumbentia, viridia vel atro-viridia, interdum purpureo-suffusa, semper immaculata; lobi laterales 4–6, brevissimi, regulares, recurvati, saepissime integri; interlobia angustissima, saepe e costa sola constantia; petiolus angustus, cum nervo mediano purpureus exalatus. Scapi folia conspicue superantes, purpurascens. Squamae involucri exteriores 9mm longae, 3mm latae, erectae, laeves, atrovirides, immarginatae. Calathium convexum, saturate luteum, ultra 35mm diametro raro attingens, ligulis brevibus subtus stria purpurea notatis; styli exserti, sordidi, polliniferi. Achenium 3mm longum, 0.9mm latum, griseo-brunneum, superne breviter tuberculatum, ceterum laeve, in pyramidem conicam brevem (0.3mm longum) sensim abiens; rostrum 7mm longum sat crassum; pappus albus. $2n = 32$. Agamosperma.

Species sectionis *Spectabilia* Dahlst.

HOLOTYPUS: British Isles, Co. Durham, Upper Teesdale, Langdon Beck Hotel, base-rich flushes by the Sand Syke from GR 35/830.308 to 850.310, 16/6/1966, *A. J. Richards* (OXF)

Taraxacum cambriense A. J. Richards, **sp. nov.** (no. 65, p. 61, fig. 16)

Planta mediocris, tenella, fere glabra, pallide viridis. Folia 80–170mm, erecta, pallide viridia, immaculata; lobi laterales 4–5, $\pm$ patentes, angusti, acuti, integri vel paullo denticulati; petiolus angustus, purpureus, exalatus; nervus medianus viridis. Scapi folia superantes, viridia. Squamae involucris exteriores 7mm longae, 2.5mm latae, adpressae-erectae, laeves, atrovirides, glaucae, conspicue albomarginatae. Calathium *c* 40mm diametro, planum, flavum, ligulis brevibus subtus stria griseo-violacea notatis; styli exserti, sordidi, epolliniferi. Achenium 3.8mm longum, 1mm latum, stramineum, ad apicem leviter tuberculatum, ceterum laeve, in pyramidem conicam brevem (0.4mm longam) subabrupte abiens; rostrum 7mm longum, sat tenue; pappus albus. Species sectionis *Spectabilia* Dahlst.

HOLOTYPUS: British Isles, Pembrokeshire, the Nab Head, St Brides, GR 14/790.111, 4/5/1969, *T. A. W. Davis* no. 69/1188 (OXF)

Taraxacum inane A. J. Richards, **sp. nov.** (no. 73, p. 66, fig. 24)

Planta subgrandis. Folia 150–250mm, erecta, obscure viridia; lobi laterales 4–6, recurvati, ad basin sat lati sed in apicem acutam attenuati, margine superiore denticulata, denticulis ad 7, acuminatis angustissimis; lobus terminalis longus, ad tertiam partem foliae, integer, hastate-sagittatus; petiolus sublongus, viridis vel roseus, exalatus. Scapi folia aequantes. Squamae involucris exteriores 10mm longae, 3mm latae, recurvati, supra pallidae vel purpurascentes, subtus atrovirentes, emarginatae. Calathium ad 45mm diametro, flavum, ligulis subtus stria purpureo-grisea notatis; styli exserti vel inclusi, sordidi, epolliniferi. Achenium ignotum. Species sectionis *Vulgaria* Dahlst.

HOLOTYPUS: British Isles, Kintyre, Inverneill shore, GR 16/85.82, 10/5/1970, *A. G. Kenneth* no. 5070 (OXF)

Taraxacum tamesense A. J. Richards, **sp. nov.** (no. 109, p. 82, fig. 27)

Planta subhumilis, subtenella. Folia 40–150mm, erecta, obscure viridia, interdum purpurascentes vel purpureo notata, in interlobis vel alibi; lobi laterales 2–3, brevissimi, lati, recurvati, acuti vel $\pm$ obtusi, integri vel inferiore dentati; lobus terminalis angustus, acutus vel subobtusus; petiolus foliis 2–3-plo brevior, vivide purpureus exalatus. Scapi folia valde superantes, erecti, angusti, purpurei. Squamae involucris exteriores 8mm longae, 2mm latae, patentes-erectae, atrovirides, purpureo suffusae, emarginatae. Calathium saturate luteum, *c* 35mm

diametro, ligulis subtus stria purpurea notatis; styli sordidi, polliniferi. Achenium 3·0mm longum, stramineo-brunneum, ad apicem tuberculatum, in pyramidem conicam subbreve (0·6mm) subabrupte abiens; rostrum 7mm longum, sat tenue; pappus albus.

Species sectionis *Vulgaria* Dahlst.

HOLOTYPE: British Isles, Oxfordshire, Oxford, Pixey Mead, GR 42/484.095, 7/5/1970, *A. J. Richards* (OXF)

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Sources of Material

The following herbaria were consulted during the preparation of this work: Aberystwyth **ABS**, Bangor **UCNW**, Birmingham **BIRM**, British Museum **BM**, Cambridge **CGE**, Cardiff **NMW**, Copenhagen **C**, Dublin **TCD**, Durham University Herbarium, Edinburgh **E**, Kew **K**, Leiden **L**, Lancaster University Herbarium, Liverpool **LIV**, **LIVU**, Oxford **OXF**, Stockholm **S** and Swansea University College Herbarium, as well as the private herbaria of C.-F. Lundevall, J. L. van Soest, H. Øllgaard, S. Nordenstam, F. le Sueur and U. K. Duncan.

In addition, material was sent in connection with work on the following county Floras: Buckinghamshire, Channel Islands, Cheshire, Durham, Glamorgan, Hampshire, Kent, Oxfordshire, Rutland, Shetland, Sussex and Warwickshire.

References

- CHRISTIANSEN, M. P. (1942). The *Taraxacum* flora of Iceland, in ROSENVINGE, L. K., *et alia*, ed. *The Botany of Iceland*, 3 (3).
- CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. (1962). *Flora of the British Isles*, 2nd ed. Cambridge.
- DANDY, J. E. (1969). *Watsonian vice-counties of Great Britain*. London.
- FÜRNKRANZ, D. (1961). Cytogenetische Untersuchungen an *Taraxacum* im Raume von Wien. 2, Hybriden zwischen *T. officinale* und *T. palustre*. *Öst. bot. Z.*, **108**: 408–415.
- FÜRNKRANZ, D. (1966). Untersuchungen an Populationen des *Taraxacum-officinale*-Komplexes in Kontaktgebiet der diploiden und polyploiden Biotypen. *Öst. bot. Z.*, **113**: 427–447.
- GUSTAFSSON, Å. (1937). The occurrence of a sexual population within the apomictic *Taraxacum vulgare* group. *Bot. Not.*, **1937**: 332.
- HAGLUND, G. E. (1935). Some *Taraxacum* species from Ireland and Wales cultivated in the Botanical Garden in Lund. *Bot. Not.*, **1935**: 429–438.
- HANDEL-MAZZETTI, H. VON (1907). *Monographie der Gattung Taraxacum*. Leipzig & Vienna.
- HANSEN, K. (1961). Vascular Plants in the Faeroes. *Dansk bot. Ark.*, **24**: 112–117.
- HOFSTEIN, C. G. VON (1954). *Studier över släktet Taraxacum med särskild hänsyn till gruppen Vulgaria i Skandinavien*. Stockholm.
- LUNDEVALL, C.-F. (1962). Skandinaviska Halvöns, Östfennoskandias och Danmarks *Taraxaca*. (Preliminär Förteckning). *Publ. Riksherbarium Stockholm*.
- PERRING, F. H. & SELL, P. D., ed. (1968). *Critical Supplement to the Atlas of the British Flora*. London.
- PERRING, F. H. & WALTERS, S. M., ed. (1962). *Atlas of the British Flora*. London.
- RAUNKIAER, C. (1906). *Dansk Ekskursions-Flora*, 2nd ed. Copenhagen.
- RICHARDS, A. J. (1968). *The Biosystematics of Taraxacum*. Ph.D. thesis. University of Durham.
- RICHARDS, A. J. (1970a). Eutriploid facultative agamospermy in *Taraxacum*. *New Phytol.*, **69**: 761–774.
- RICHARDS, A. J. (1970b). Hybridisation in *Taraxacum*. *New Phytol.*, **69**: 1103–1121.
- RICHARDS, A. J. (1970c). Observations on *Taraxacum* sect. *Erythrosperma* Lindb. f. in Slovakia. *Acta Fac. Rerum nat. Univ. comen.-Botanica*, **18**: 81–120.
- SAARSOO, B. & HAGLUND, G. E. (1962). Ölands *Taraxacum*-flora. *Ark. Bot.*, ser. 2, **4**: 515–560.
- SOEST, J. L. VAN (1955). *Taraxacum* sectio *Vulgaria* Dt. in Nederland, 1. *Acta bot. neerl.*, **4**: 82–107.
- SOEST, J. L. VAN (1958). *Taraxacum* sectio *Erythrosperma* Dahlstedt em. Lindberg f. in North-America. *Acta bot. neerl.*, **7**: 627–628.
- SOEST, J. L. VAN (1961). Les *Taraxacum* de Belgique, 2. (Section *Vulgaria*). *Bull. Jard. bot. État Brux.*, **31** (3): 319–389.
- SOEST, J. L. VAN (1965). *Taraxacum* section *Palustria*. *Acta bot. neerl.*, **14**: 15–6

- SOEST, J. L. VAN (1966). A catalogue of *Taraxacum* section *Erythrosperma* Dt.em.Lb. *Publ. Rijksherbarium Leiden*.
- SOEST, J. L. VAN (1969). Die *Taraxacum*-Arten der Schweiz. *Veröff. geobot. Inst., Zürich*, **42**: 1-250.
- SOEST, J. L. VAN (1970). Atlas of leaf-shapes of *Taraxacum* species from the Netherlands. *Publ. Rijksherbarium Leiden*.
- SØRENSEN, TH. (1958). Sexual chromosome aberrants in apomictic *Taraxaca*. *Bot. Tidsskr.*, **54**: 1-22.
- TUTIN, T. G., *et alia*, ed. (1964). *Flora Europaea*, **1**. Cambridge.
- WENDELBO, P. (1959). *Taraxacum gotlandicum*, a Pre-Boreal Relic in the Norwegian Flora? *Nytt Mag. Bot.*, **7**: 161-167.



FIGURE 1.

- | | |
|--|---|
| 1. <i>T. brachyglossum</i> (Dahlst.) Dahlst. (p. 27) | 2. <i>T. argutum</i> Dahlst. (p. 28) |
| 3. <i>T. lacistophyllum</i> (Dahlst.) Raunk. (p. 29) | 4. <i>T. rubicundum</i> (Dahlst.) Dahlst. (p. 29) |



FIGURE 2.

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FIGURE 3.

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FIGURE 4.

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FIGURE 5.

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FIGURE 6.

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23. *T. degelii* Hagl. (p. 37)

22. *T. acutum* A. J. Richards (pp. 37, 96)
24. *T. placidum* A. J. Richards (pp. 37, 96)



FIGURE 7.

25. *T. pseudolacistophyllum* v. Soest (p. 38)
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26. *T. canulum* Hagl. (p. 38)
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FIGURE 8.

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FIGURE 9.

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 35. *T. landmarkii* Dahlst. (p. 47)

34. *T. fulvicarpum* Dahlst. (p. 46)
 36. *T. faeroense* (Dahlst.) Dahlst. (p. 47)

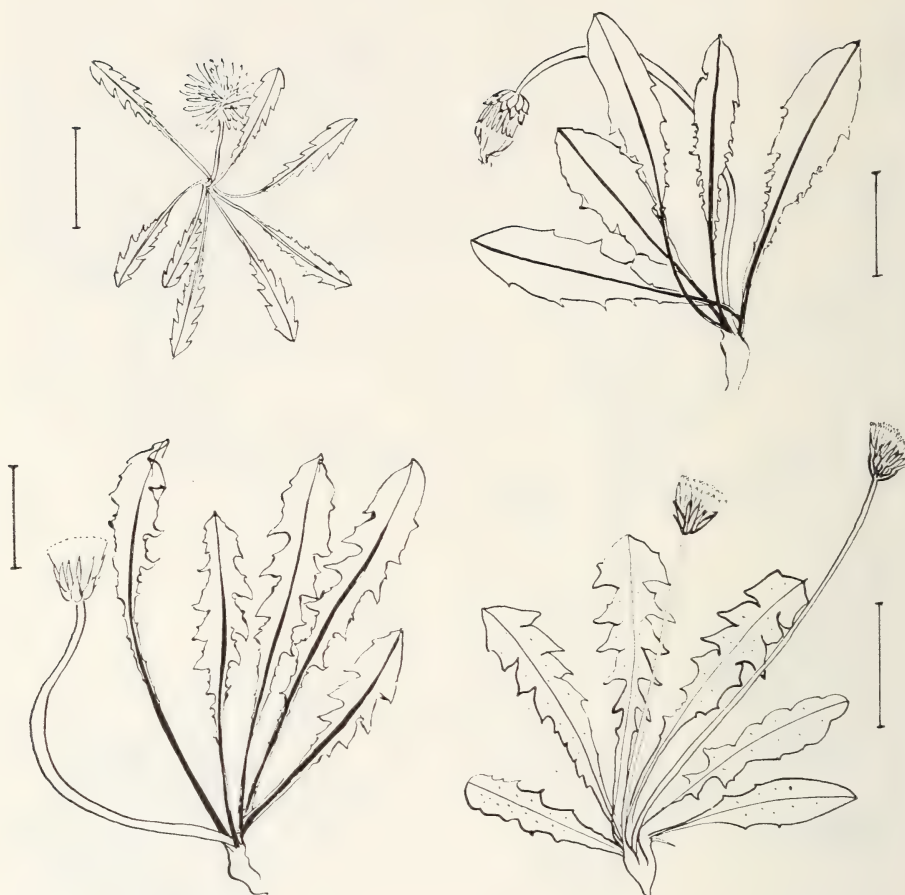


FIGURE 10.

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38. *T. eximium* Dahlst. (p. 48)

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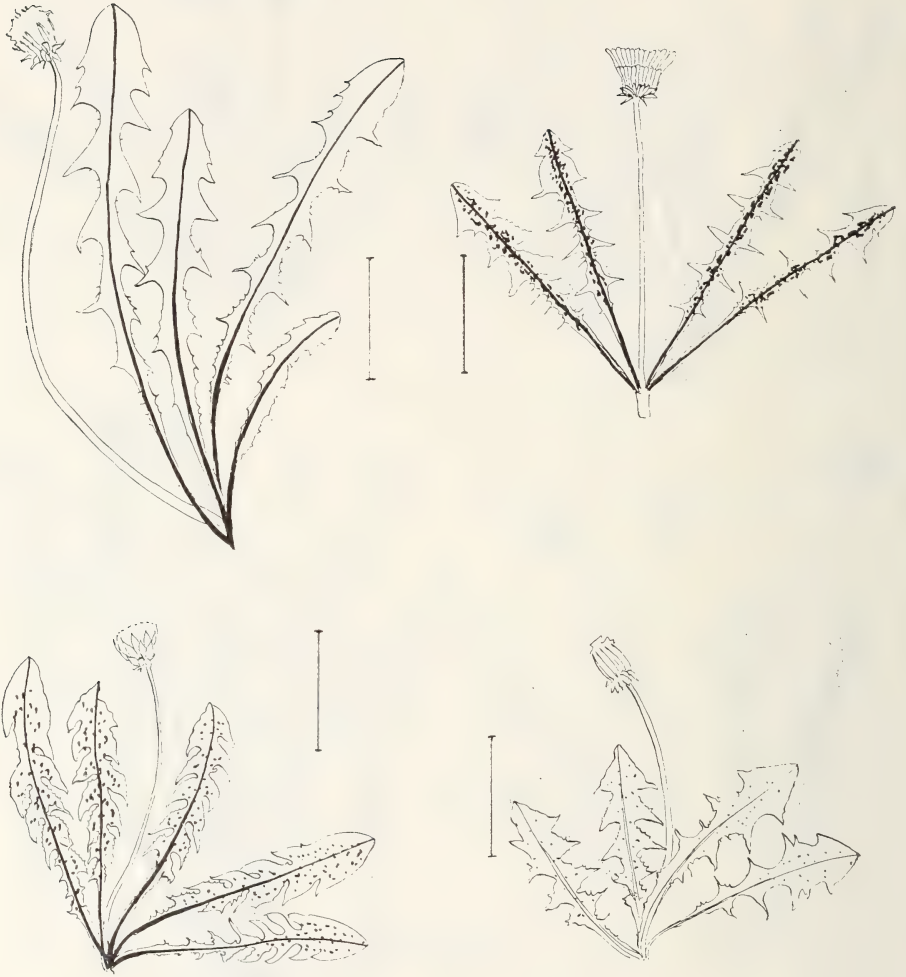


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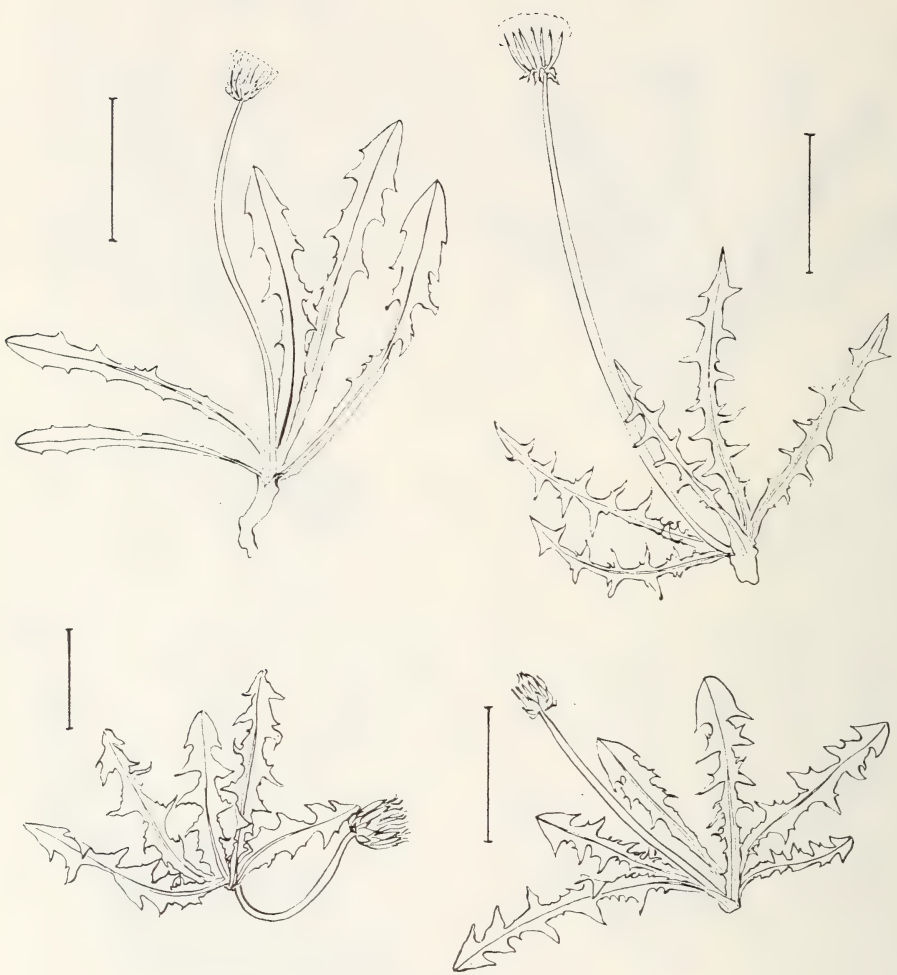


FIGURE 14.

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FIGURE 15.

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58. *T. stictophyllum* Dahlst. (p. 57)

57. *T. hypochaeris* Dahlst. (p. 57)
59. *T. caledonicum* A. J. Richards (pp. 57, 97)



FIGURE 16.

60. *T. pseudonordstedtii* A. J. Richards (pp. 58, 97) 61. *T. nordstedtii* Dahlst. (p. 58)
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FIGURE 18.

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FIGURE 19.

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FIGURE 20.

- | | |
|--|---|
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| 83. <i>T. expallidiforme</i> Dahlst. (p. 70) | 89. <i>T. valdedentatum</i> Dahlst. (p. 73) |

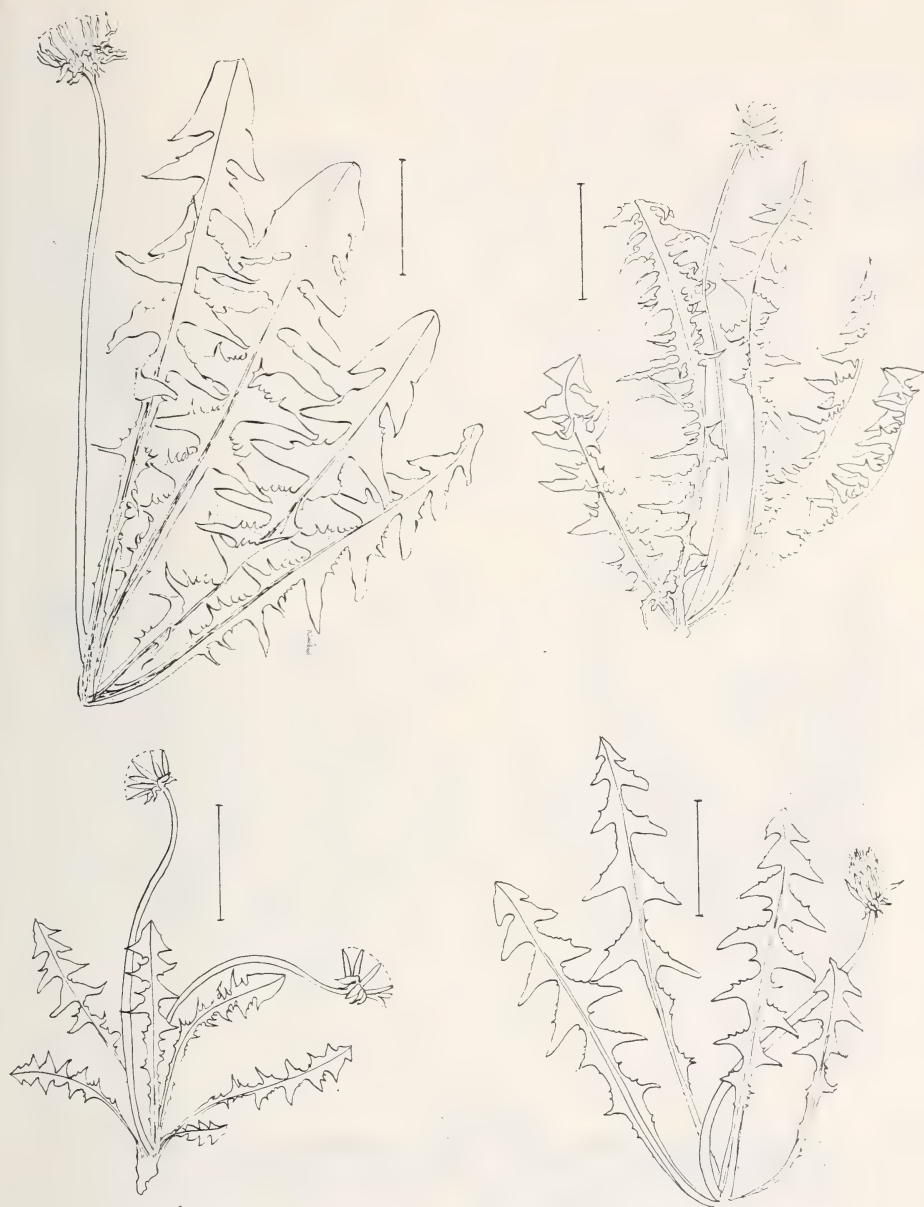


FIGURE 21.

71. *T. sublacinosum* Dahlst. & H. Lindb. f. (p. 65)
 87. *T. tenebricans* (Dahlst.) Dahlst. (p. 72)

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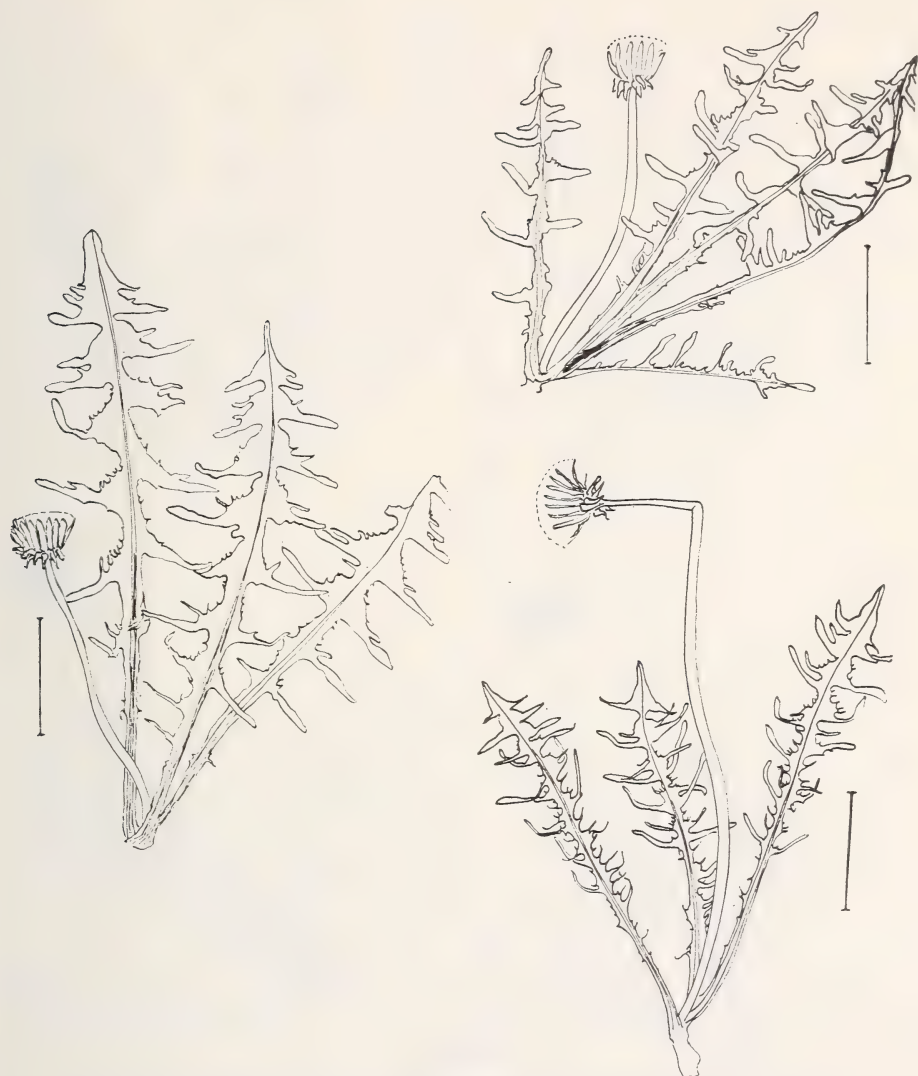


FIGURE 23.

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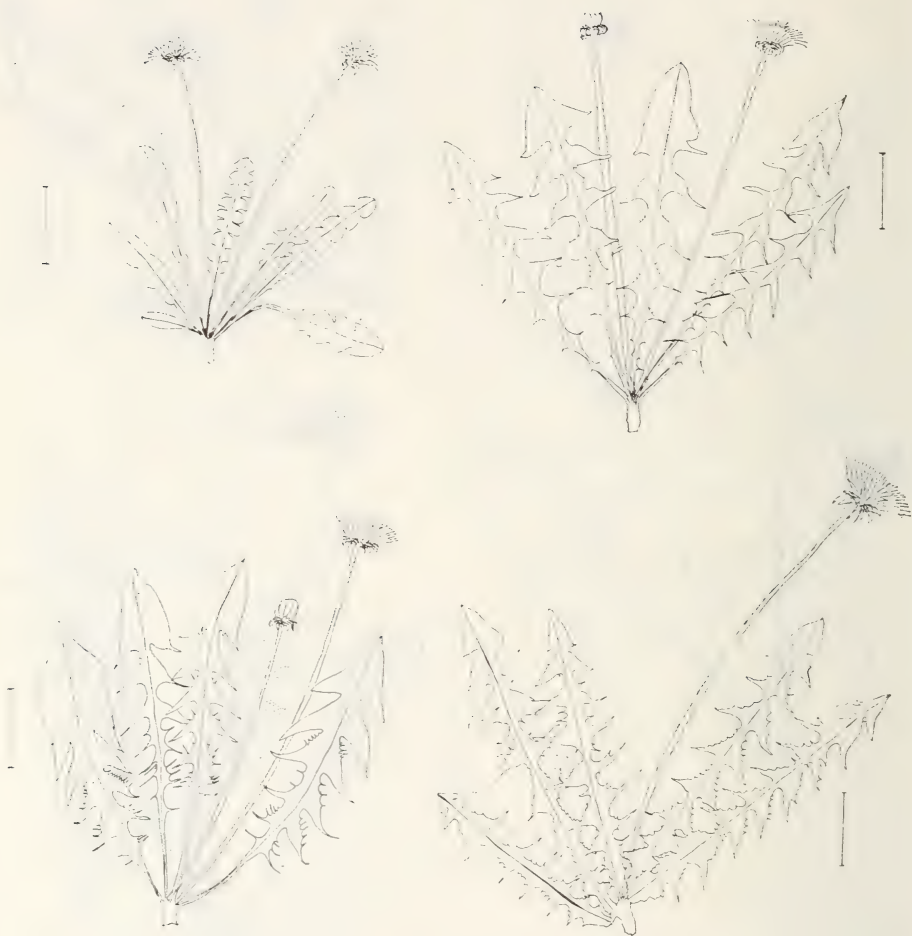


FIGURE 24.

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FIGURE 25.

- | | |
|---|---|
| 77. <i>T. pallescens</i> Dahlst. (p. 68) | 132. <i>T. cophocentrum</i> Dahlst. (p. 95) |
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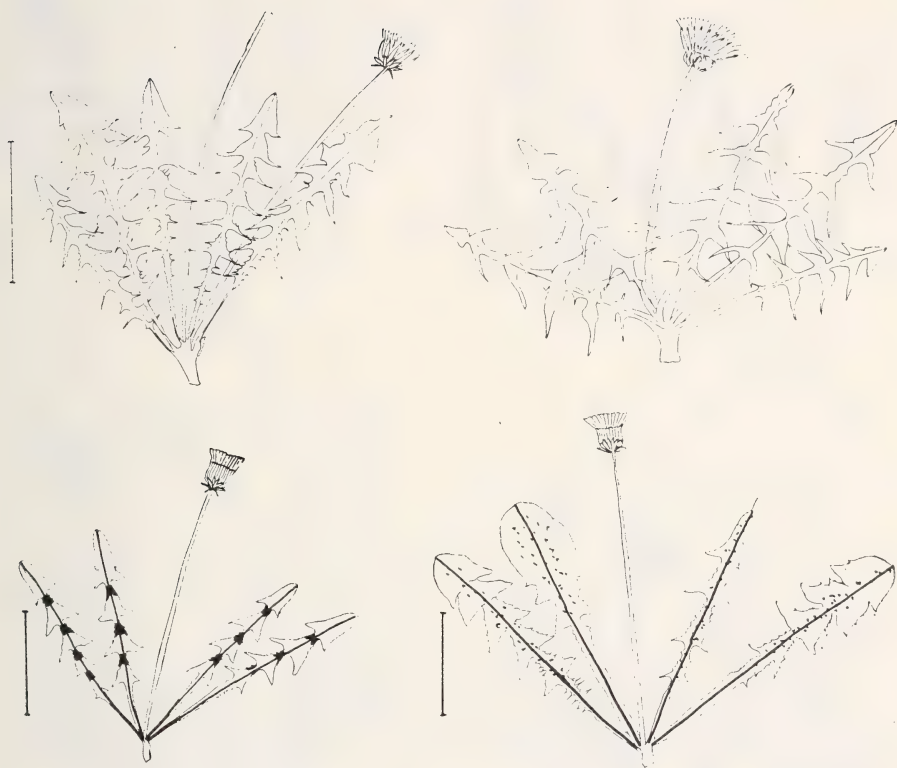


FIGURE 27.

88. *T. tanylepis* Dahlst. (p. 72)
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FIGURE 30.

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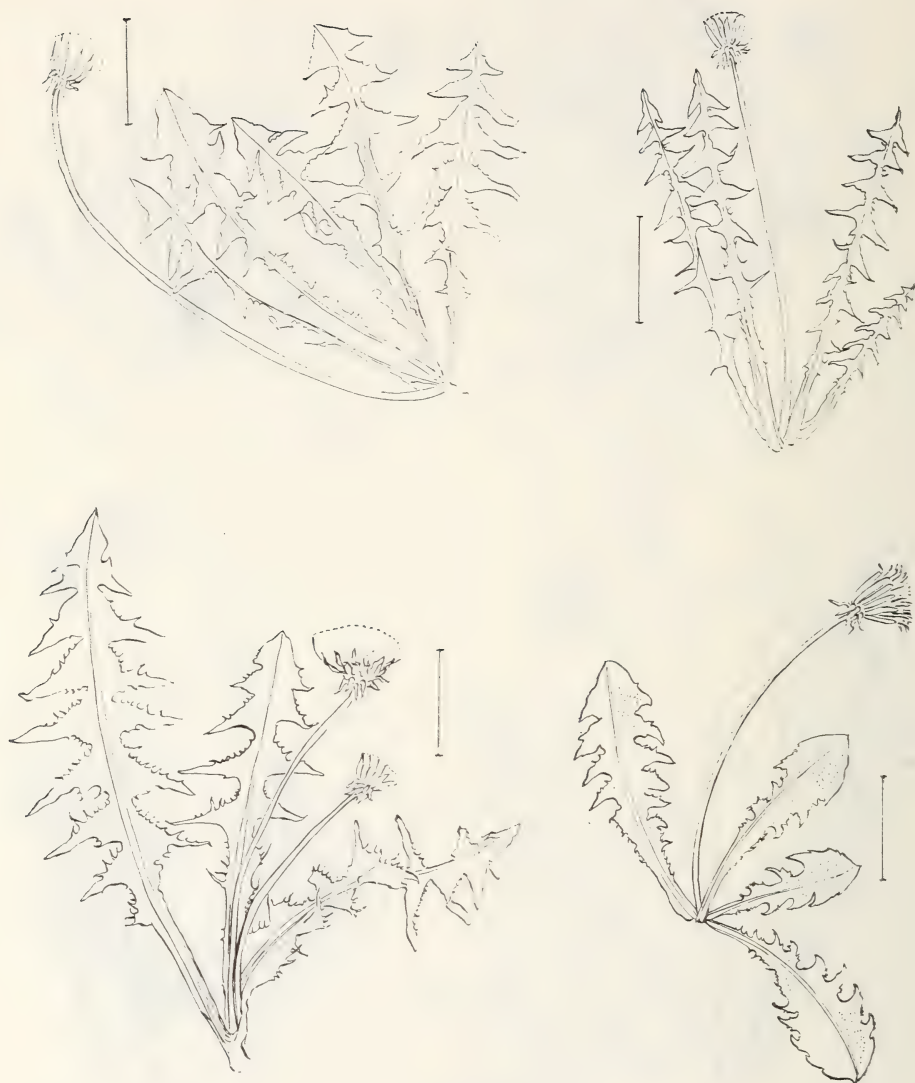


FIGURE 32.

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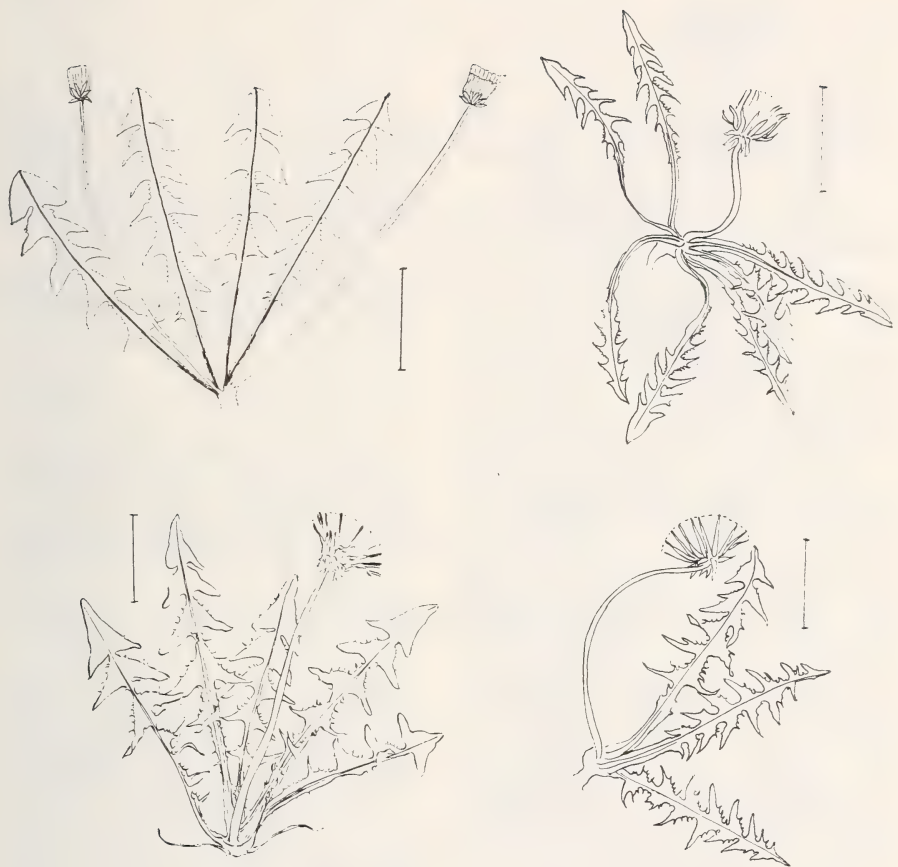


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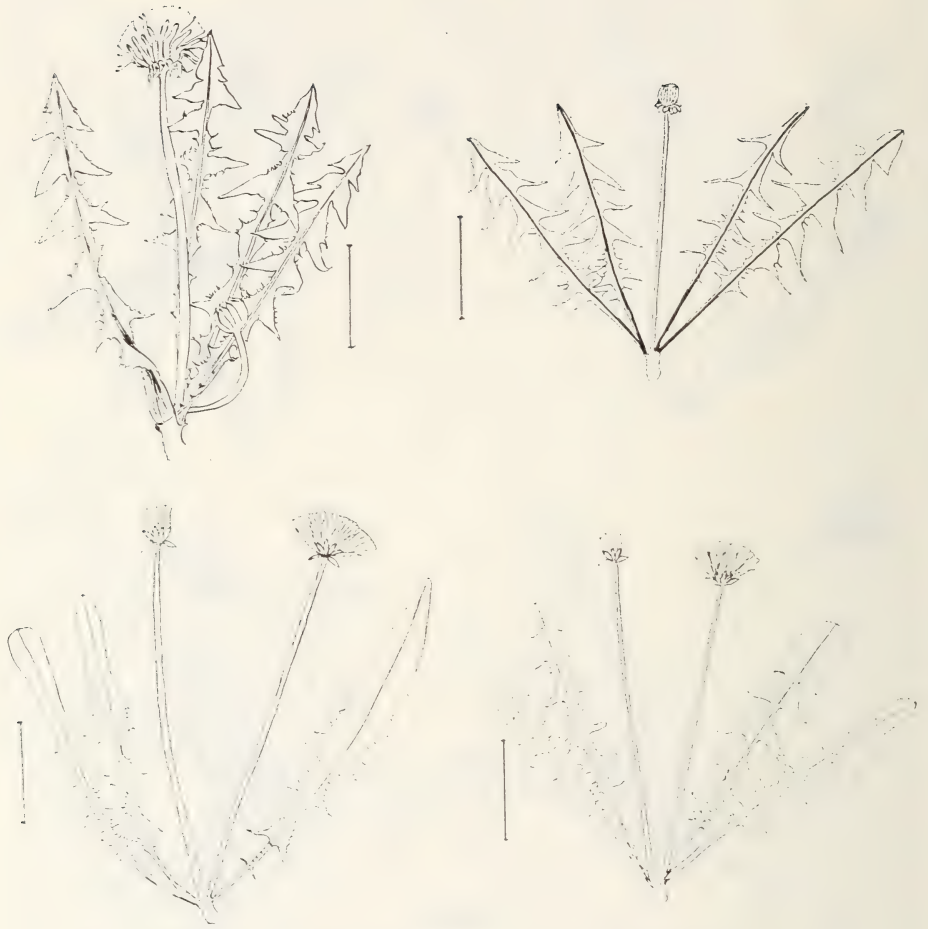


FIGURE 34.

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