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The status of *Brassica oleracea* L. subsp. *oleracea* (Wild Cabbage) in the British Isles

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ABSTRACT

The history of wild and cultivated cabbages in the British Isles is reviewed. There have been considerable fluctuations in the number and sizes of wild populations, and the species seems to be declining. Local Floras show that 'wild' sites are usually associated with the activities of man. The possible role of sea-birds in the distribution of wild cabbages is discussed. It is concluded that *Brassica oleracea*, even when growing wild on the coasts of the British Isles, should probably be considered as an introduction.

THE HISTORY OF CABBAGE IN CULTIVATION

Johnson (1862) provided an extensive history of the cabbage. The ancient Romans and Greeks cultivated three varieties (Greek legend has it that the cabbage sprung from where Zeus' sweat hit the ground). Cato mentioned that it was either boiled or eaten raw. Later, Pliny reported that cabbage was going out of favour with the lower orders, due to the quantity of oil (which was becoming more expensive) required to make it palatable (presumably it was eaten raw). He mentioned several varieties, one of which, 'Halmyridia', grew on the sea-shore and was used as a vegetable on long voyages.

It has been suggested that the Romans first brought the cabbage to Britain (Gates 1950a). Subsequently the Saxons cultivated it (their second month was called Sprout-kale), as did mediaeval religious orders. It was also apparently cultivated in eastern Fife, where it was so popular that the people of the area were known as 'kail-suppers'. As a commercial crop it may have been introduced by Sir Anthony Ashley of Dorset, as late as the 16th century.

The cabbage was also used as a medicine. Pliny recommended gouty people to live on cabbages and the water they have been boiled in. Turner (1551) mentioned the use of cabbage as a general cure for internal disorders. Gerarde (1633) similarly chronicled its healing powers. (Saarivirta, in Virtanen (1962), has shown that one of the mustard oils of cabbage has antibiotic and fungistatic activity). Thus it would appear that the cabbage has been grown in Britain for various reasons, probably since the Roman invasion.

The derivation of the cultivated cabbage is open to question. Schulz (1936) and Gates (1950b) held the view that the range of variation in the wild cabbage, *Brassica oleracea* L. subsp. *oleracea* (*B. sylvestris* (L.) Miller) is insufficient to account for all the present-day varieties, some of which have arisen through hybridisation between *B. oleracea* and other *Brassica* species. However, de Candolle (1824) and Bailey (1922) held the opposite viewpoint.

BRASSICA OLERACEA IN THE FLORA OF THE BRITISH ISLES

B. oleracea was recorded in the earliest Floras. Turner (1551) noted it growing wild at Dover, E. Kent; Gerarde (1633), who called it *B. sylvestris* ('Wild Coleworts'), saw it along the northern coast of Kent and near Colchester (N. Essex). Hudson (1762) mentioned it from Cornwall. From this period the numbers of records increased until by the beginning of the 19th century the present-day range of the species was almost covered. Watson (1847) recorded it from 12 provinces, although he considered it likely to be native in only five of these (Peninsula, Channel, Thames, S. Wales and

TABLE 1. SITING AND FIRST RECORDS OF EXTANT
BRASSICA OLERACEA POPULATIONS

Locality ¹	1st Record	Present-day ¹ relationships to habitation	Present-day ¹ agricultural relationships	Proximity ¹ of sea-bird colonies
Denbigh, v.c. 50 Llandulas	1912 Dallman (1913) J. M. Brummitt (pers. comm. 1975)	by Llandulas	?	?
Caernarvon, v.c. 49 Little Orme, Llandudno	1895	at edge of town	none	nest-site
Great Orme, Llandudno	1805 Griffith (1895) ²	extends from edge of town	none	nest-site
Pembroke, v.c. 45 Tenby	1773 Riddlesdell (1905)	within town	none	none
Glamorgan, v.c. 41 Flat Holm	? G. Ellis (pers. comm. 1975)	?	?	?
Southerndown to Nash Point	1850 Trow (1911)	none	none	none
W. Cornwall, v.c. 1 St Ives	1909	within town	none	none
Prussia Cove	1909 Davey (1909) ²	by small village	none	none
E. Cornwall, v.c. 2 Fowey	1909	at edge of town	none	nest-site
Polruan	1909	at edge of town	none	nest-site
West Looe	1909 Davey (1909) ²	within town	none	none
S. Devon, v.c. 3 Dartmouth	1882	extends from town	none	nest-site
Torquay	1882	within town	none	none
Babbacombe	1829 Kebble-Martin & Frazer (1939) ²	within town	none	nest-site
Dorset, v.c. 9 Durdle Door to Lulworth Cove	1895	none	none	nest-site
Kimmeridge Bay	1895	by small village	?	none
Winspit to St Alban's Head	1895	none	cabbage cultivated nearby	none
Handfast Point	1895 Mansel-Pleydell (1895) ²	none	cabbage cultivated nearby	nest-site
Isle of Wight, v.c. 10 Freshwater Bay	1860? Bromfield (1860) R. P. Bowman (pers. comm. 1974)	none	derelict fields	nest-site
E. Kent, v.c. 15 Kingsdown to Folkestone	1551 Turner (1551)	centred by Dover and St Margaret's Bay	derelict fields, cabbage cultivation	nest-site
Stoney Bay (Broadstairs)	1903 Pittock (1903)	within town	cabbage cultivated nearby	none

TABLE 1—*continued*.

Locality ¹	1st Record	Present day ¹ relationships to habitation	Present-day ¹ agricultural relationships	Proximity ¹ of sea-bird colonies
N.E. Yorks., v.c. 62				
Whitby	1906	within town	none	roost?
Staithes	1831	by and amongst	among derelict	nest-site
	Baker (1906) ²	village	allotments	
S. Northumberland, v.c. 67				
Tynemouth	1805	within town	none	nest-site
	Winch <i>et al.</i> (1805)			
Fife, v.c. 85				
Crail	1840	by harbour	cabbages & kale	nest-site
	G. H. Ballantyne	in village	grown nearby	
	(pers. comm. 1975)			
	Young (1936)			
Forfar, v.c. 90				
Auchmithie	1913	centred on village	cabbages grown	nest-site
	R. & M. Corstophine		close by	
	(1940 MS)			
E. Ross, v.c. 106				
Fortrose	1968	by a town?	?	?
	U.K. Duncan			
	(pers. comm. 1975)			

1. These data are based principally on personal observations

2. The reference applies to all the records for that vice-country

N. Wales) and was surprised it grew wild in so few places. Later (1870) he summed up his view as 'Denizen? . . . Coast cliffs, native? Inland only as an alien . . . Wild on the western coasts of France? - N.B. Exceedingly difficult to trace the native habitats of this plant.' Watson's earlier viewpoint has in essence remained unchanged to the present day (*cf.* Clapham 1962), although the authors of some local Floras were not entirely in agreement. It was considered a denizen or alien in Monmouth (Wade 1970), N. Somerset (Murray 1896), Dorset (Mansel-Pleydell 1895), S. Essex (Gibson 1862), E. Norfolk (Nicholson 1914), N.E. Yorks. (Baker 1906) and Fife (Young 1936). Wolley-Dod (1937) believed some E. Sussex sites to be adventive. However, it was recorded as native in E. Kent (Hanbury & Marshall 1899), S. Devon (Keble-Martin & Frazer 1939), E. and W. Cornwall (Davey 1909) and Glamorgan (Trow 1911). Trow commented 'It was almost certainly a true native with us, or at any rate indistinguishable from one,' although Watson had classed the Glamorgan plants as denizens. Trow's comment is interesting in the light of an observation by Syme (1863), who noted 'Red cabbage of neglected gardens at the sea-side pass back in a few generations to the condition of the wild cabbage.' I have made similar observations. It would seem that the wild derivatives of cultivated plants become morphologically indistinguishable from 'native' plants within a few years.

Through the Floras, much of the history of *B. oleracea* as a member of the British flora may be traced. It is immediately apparent that there was an increase in the number of records during the 19th century, which probably coincides with the increase in plant-recording at that time. This has been followed by a decline in the numbers of populations during the first half of this century. The decline is apparently continuing in most areas.

The sites of *B. oleracea* are nearly always associated with towns and villages, rather than being recorded 'near . . .' or 'between . . .'. This might suggest that it is almost exclusively associated with towns and villages. The ephemeral nature of many occurrences is equally notable; it must be presumed that short-lived populations (accounting for about one third of the total) were introduced.

Further information may be gained from a consideration of the siting and history of the present-day populations (Table 1). I have visited all the extant populations except those at Llandulas (Denbigh), Flat Holm (Glamorgan) and Fortrose (E. Ross), and I have searched for many of those

previously recorded. I have also received much excellent information from vice-county recorders concerning the locality and status of contemporary populations.

The population on the Great Orme (Caernarvon) was recorded as 'rare and local' by Griffith (1895). He gives the first record as 1805, when it was recorded from the north-east side, i.e. above Llandudno. The species is now to be found all around the seaward side of the headland. The Little Orme population (first recorded by Griffith (1895)) is probably derived from that at the Great Orme, possibly by the seeds being carried by sea-birds (see Gillham 1970). The Llandulas (Denbigh) population was first recorded in 1912 (Dallman 1913).

The population at Tenby (Pembroke) was first recorded in 1773 (Riddelsdell 1905), the present-day plants growing around and in back gardens, as well as along the neighbouring cliffs. Falconer (1848) queried whether the plants were '... Truly wild?' The very local siting in association with an old town suggests that the species may have been introduced.

B. oleracea has particularly declined in Glamorgan. In the 19th century, populations extended from Southerndown to Barry Island, including a number of towns and villages (Trow 1911), but they have now retreated westward, extending only to Nash Point. The population which became extinct most recently (probably during the 1960s) was at Barry Island (G. Ellis pers. comm. 1975).

During the 19th century there appears to have been an almost continuous series of populations along the Cornish coast from St Germans (E. Cornwall) around to St Ives (W. Cornwall) (Davey 1909), although many of these are now extinct (L. J. Margetts pers. comm. 1975). There are records dating back to the 18th century (Hudson 1762), all of which are associated with towns and villages. Again this suggests the populations are adventive.

In N. and S. Devon populations have come and gone (Kebble-Martin & Frazer 1939), although there are still large populations at Dartmouth and Babbacombe. At the former site, *B. oleracea* grew particularly around the castle (in 1882) at the edge of town, but now the population extends for some kilometres westward along the coast. This again suggests the plants are adventive.

The expansion of *B. oleracea* in Dorset is well documented. It was first recorded in 1813, on Portland, where it is now extinct. In all its other sites it was rare in the late 19th century (Mansel-Pleydell 1895). There are now extensive populations at Durdle Door to Lulworth Cove and St Alban's Head to Winspit, as well as fewer plants at several other sites. Cabbages are cultivated alongside some of these sites, suggesting a source for the wild plants.

The first record for the Isle of Wight must be pre-1616 (due to Lobel, who died in 1616), although it was not published until 1665 (Townsend 1883). Townsend interpreted a comment made by Lobel, which suggested that during Lobel's lifetime *B. oleracea* had become scarce after a former abundance. At the time of Townsend, the species was very rare, the few sitings being regarded as introductions. The only present-day population, 1 km east of Freshwater Bay (R. P. Bowman pers. comm. 1974), may be associated with a record due to Bromfield (1860) further to the east, although there is no information on this point.

The Dover (E. Kent) population is unique in that it has been recorded as growing wild for over 400 years. This population has perhaps the strongest claim to native status, yet Dover has had extensive garrisons for centuries and has been a major route for invaders. It was also one of the main areas of Saxon settlement during the early post-Roman period. Thus cabbages may have been grown here for food since 500 A.D. or earlier, and it is still a major area for cabbage cultivation. The other E. Kent population, by Broadstairs, grows very close to cabbage fields.

It should be noted that *B. oleracea* is recorded as native on the corresponding chalk cliffs of the French channel coast (Rouy & Foucaud 1895, Coste 1900), although Grenier & Godron (1848) suggested it was adventive.

The Whitby and Staithes populations (N.E. Yorks.) grow around habitation. In Whitby the plants extend up from back gardens, whilst at Staithes they grow particularly around old allotments, which, the owner tells me, have been cultivated for centuries. These populations are almost certainly introductions.

The history of the Tynemouth (S. Northumberland) population is somewhat different in that it grows around an old priory and garrison. Local folk-lore has it that cabbages were cultivated by the monks and have since become naturalized (there is a local name of 'Monk's Cabbage'). Certainly they have been recorded since 1805 (Baker & Tate 1867). If this folk-lore is true, then these plants may be ancient escapes from cultivation.

Of the series of populations that formerly grew along the north side of the Firth of Forth, all

are extinct apart from that at Crail (Fife). This latter population, first recorded in 1840 (G. H. Ballantyne pers. comm. 1974), is almost certainly introduced. It grows by the village, extending down from gardens to the shore. There appear to be some plants of very recent origin, since it is possible to identify individuals closely resembling *B. oleracea* L. var. *capitata* L. 'January King' and 'Dutch Savoy'. The Auchmithie (Forfar) population is probably also derived from garden escapes. It extends along from the village and allotments (where cabbages are still grown) to neighbouring cliffs.

Apart from the extant vice-county records, there have been populations (mainly short-lived) in Durham (Winch *et al.* 1805), E. Norfolk (Nicholson 1914), N. and S. Essex (Gerarde 1633, Gibson 1862), E. and W. Sussex (Arnold 1907, Wolley-Dod 1937), S. Hants. (Townsend 1883), N. Somerset (Murray 1896), Monmouth (Wade 1970), Westmorland (Wilson 1938) and Guernsey (Marquand 1901). McClintock (1975) reports that none of the Guernsey records has been substantiated.

B. oleracea has never been established in Ireland. It is not mentioned by Praeger (1901, 1934) or by Webb (1959), although Druce (1932) recorded it from Mid Cork and Perring & Walters (1962) from E. Cork. Hooker (1870) included Ireland in the distribution of the species.

B. oleracea is also mentioned in many Floras as a casual.

To the best of my knowledge the only extant populations of *B. oleracea* are those in Table 1, although, as Perring & Walters (1962) show, the species has been recorded from many more sites.

DISCUSSION

In the British Isles most extant populations of *B. oleracea* seem to have originated from cultivation. Other authors have similarly questioned the status of northern European populations, e.g. Hegi (1919) suggested that *B. oleracea* growing on Heligoland was introduced (it was not mentioned in a 16th century species list) and that other northern European populations were introductions. Gates (1950b) mentioned that Ascherson considered the true *B. oleracea* to be confined to the Mediterranean, the plants on the British Isles coasts being escapes from cultivation, but in contrast he (Gates 1950a,b) believed it to be native around northern European coasts.

Certainly, cabbages have grown wild in the British Isles for several hundred years. The fact that the Saxons named a month 'Sprout-kale' suggests that they cultivated cabbages. Similarly 'kail' has apparently been grown or gathered for many centuries in Fife. If *B. oleracea* was found in pre-Roman Britain then it should probably be classified as native. If, as seems likely, the Romans or Saxons brought the cabbage to the British Isles, then it is a denizen. Certainly most contemporary populations seem to be of recent and impermanent status. That wild *B. oleracea* is strongly associated with man seems to reinforce this latter point. Thus the distinction between introduced and native populations as recorded by Perring & Walters (1962) should be regarded with some caution, since the majority of these may be introductions.

However, there is a possible complication. Many of the populations are closely associated with sea-bird colonies (Table 1). There is slight evidence that *B. oleracea* seeds may be distributed by sea-birds (Gillham 1970). An increase in the population and 'civilization' of man in the British Isles over the last century has been accompanied by an increase in gull populations, particularly of the herring gull (*Larus argentatus* Pontopp.). This gull feeds on domestic rubbish and breeds on headlands and off-shore islands, often close to towns and villages. I believe the Little Orme population may have arisen by means of sea-bird dispersal. If gulls are an important factor in distribution, then the association of man and *B. oleracea* could be coincidence. The role of sea-birds is, I believe, non-proven, although they may well help in the distribution of seeds to guano-rich sites (cultivated cabbages require high nitrogen levels). If this is so, it is difficult to see why wild cabbages are so scarce and on the decrease.

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The structure of some *Crataegus* populations in north-eastern France and south-eastern Belgium

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ABSTRACT

There are at least three species of *Crataegus* in north-eastern France and adjoining areas: *C. monogyna* Jacq., *C. laevigata* (Poiret) DC., and *C. curvisepala* Lindman subsp. *lindmanii* (Hrabětová-Uhrová) Byatt (Byatt 1974). In some areas the first two species were found in fairly isolated populations. In large forests, populations of *C. laevigata* were found still relatively uncontaminated by *C. monogyna*. *C. curvisepala* subsp. *lindmanii*, a comparatively rare plant, was only encountered in situations where both *C. monogyna* and *C. laevigata* were also present, and it appeared to hybridise with both these species. Intermediates between *C. laevigata* and *C. curvisepala* subsp. *lindmanii* appeared similar to plants described as *C. macrocarpa* (Hegetschweiler 1840). It is suggested that such plants are hybrids and should therefore be known as *C. × macrocarpa* Hegetschw. A key to these species and intermediates is included.

INTRODUCTION

In south-eastern England, the two diploids, *Crataegus monogyna* Jacq. and *C. laevigata* (Poiret) DC., are sympatric and appear to hybridise and produce hybrid swarms (Byatt 1975). While *C. monogyna* still maintains its identity on the scarps of the chalk downs, it is very difficult to find a population of *C. laevigata* which is free from introgression from *C. monogyna*. Apparently, this has resulted from the continued destruction of the habitat of *C. laevigata*, by woodland clearance and the dissection of woodland, thus allowing the two species to come into close contact.

Hence it was decided to examine nearby areas of the Continent to see how far similar conditions prevailed, and to investigate the more complex situation which might be expected where a third species, *C. curvisepala* subsp. *lindmanii*, is also present.

It should be noted that a recent nomenclatural revision (Byatt 1974) has shown that *C. curvisepala* Lindman is the correct name for species 9, *C. calycina* Peterm., in *Flora Europaea* (Franco 1968b), where the latter name was misapplied. In consequence, subsp. 9a becomes *C. curvisepala* subsp. *lindmanii* (Hrabětová-Uhrová) Byatt and subsp. 9b becomes *C. curvisepala* subsp. *curvisepala*.

The most important point of distinction between the two subspecies of *C. curvisepala* is the position of the sepals in the mature fruit (Franco 1968a). The sepals are erect in subsp. *lindmanii* and reflexed in subsp. *curvisepala*. The subspecies also have different geographical ranges. Subsp. *curvisepala* is commonly found from Scandinavia to Yugoslavia and extends eastwards through the northern Balkans and northern Turkey as far as the Caucasus mountains, as well as to other parts of European Russia. This subspecies, which is reported to be a tetraploid, $2n = 68$ (Gladkova 1968), is markedly shade-tolerant, usually growing in deciduous woodlands or sparse pinewoods up to an altitude of 1,800 m. In contrast, subsp. *lindmanii* is confined to central and central-northern Europe and, except possibly in Sweden and Poland where it is sympatric with subsp. *curvisepala*, is apparently rare, having been recorded only occasionally in Czechoslovakia, Germany, France, Belgium, the Netherlands, Latvia and Denmark. The chromosome number is not known, but indirect evidence obtained during this investigation suggests that it is probably also a tetraploid. This lesser-known subspecies grows in woods and wood margins, but apparently not to such high altitudes as subsp. *curvisepala*.

TABLE 1. COMPARISON OF SOME CHARACTERS OF *CRATAEGUS MONOGYNA*,
C. CURVISEPALA SUBSP. *LINDMANII* AND *C. LAEVIGATA*

	<i>C. monogyna</i>	<i>C. curvisepala</i> subsp. <i>lindmanii</i>	<i>C. laevigata</i>
Axillary spines	Often frequent and may exceed 11 mm	Few, up to 11 mm	Few, up to 11 mm
Mature leaf-shape	Laciniate, often 5- to 7-lobed	Somewhat laciniate, commonly 5-lobed	Shallowly 3- to 5-lobed to $\pm$ entire
Lowest lateral leaf-sinus	In lower $\frac{1}{3}$ of leaf-blade, often extending more than $\frac{1}{4}$ to midrib	In lower $\frac{1}{3}$ of leaf-blade, extending about $\frac{1}{4}$ to midrib	In upper $\frac{1}{2}$ of leaf-blade, extending less than $\frac{1}{4}$ to midrib
Lowest lateral leaf-lobes	Acute or subobtusely, longer than broad, spreading somewhat laterally, sometimes slightly recurved towards base	Acute, longer than broad, pointing obliquely forward	Obtusely, broader than long, usually pointing obliquely forward
Hairs of vein axils of abaxial leaf surface	Present	Lower margin serrulate nearly to base	Lower margin serrate nearly to base
Stipules on leaves of old wood	Entire	Present	Absent
Pedicel + peduncle length	Usually less than 30 mm	Serrate	Serrate
Sepal length/breadth ratio	c 1:1	Usually more than 30 mm c 2:1	Usually less than 30 mm c 1:1
Sepals in mature fruit	Reflexed	Erect, connivent	Reflexed
Style or 'fruit stone' number	1	1	2-3
Hypanthium	Glabrous to villous	Villous	Glabrous
Fruit length/breadth ratio	c 1:0.85	c 1:0.6	c 1:1

TABLE 2. SUMMARY OF SITES SAMPLED

Site number	Locality	Altitude (approx.)	Soil	Community	Crataegus species and hybrids present			
					mon.	curv.	laev.	c. x l. l. x m.
2	Falmignoul, Belgium	365m	Limestone and clay, pH 6.8	Scrub on cliff and <i>Quercus</i> wood	+	-	+	-
5	Langaumburg, Moselle, France	300m	Clay, pH 6.5	Wet <i>Quercus</i> forest	-	-	+	-
12	Cernay, Haut-Rhin, France	375m	Clay, pH 5.9	<i>Betula/Quercus</i> forest	+	+	+	+
13	Mirecourt, Vosges, France	300m	Chalk marl, pH 8.0	Mixed <i>Quercus</i> wood and hedgerow	+	+	+	?
15	Goviller, Vosges, France	350m	Clay	<i>Quercus/Fraxinus/Carpinus</i> wood	+	-	+	-

+ Taxon present

- Taxon absent

? Plant most like taxon shown, but identity not certain

m., mon. - *C. monogyna*c., curv. - *C. curvisepala* subsp. *lindmanii*l., laev. - *C. laevigata*

J. I. BYATT
LANGAUMBURG



III



III



III

CERNAY



XIV



III



III



IV



XVI

MIRECOURT



III



I



VI

FIGURE 1. Representative leaves from some populations sampled.

Langaumburg: III *C. laevigata*.

Cernay: XIV *C. monogyna*; III *C. curvisepala* subsp. *lindmanii*; IV and XVI *C. laevigata*.

Mirecourt: III *C. monogyna*; I *C. curvisepala* subsp. *lindmanii*; VI *C. laevigata*.

Numbers refer to individual plants.

RESULTS

Figure 1 shows representative leaves and Table 1 summarises these and other important distinguishing characters of the three species considered in this paper. It will be seen that no single character can be used to separate them; hence several of the most clearly recognized characters have been selected and plotted on the scatter diagrams. Some characters, for example the diameter of flowers, have not been used because they are unduly affected by environmental factors or are too seasonal. The ratios obtained were multiplied by 100 to maintain whole numbers. The method of leaf-measurement was the same as explained earlier (Byatt 1975). Fig. 2 shows the locations of the five sites where plants were examined and Table 2 gives some details concerning the populations present. Fig. 3 comprises scatter diagrams of these populations and, for comparison, a scatter diagram of two English populations, one of *C. monogyna* growing outside the present area of natural distribution of *C. laevigata* (Earl's Hill, Salop) and one of a population which is the nearest to pure *C. laevigata* so far found in England (Horish Wood, W. Kent).

The Continental populations of *C. monogyna* encountered were not very extensive or well isolated from other *Crataegus* species, and were not therefore considered suitable for detailed population study.



FIGURE 2. Map showing sites sampled.

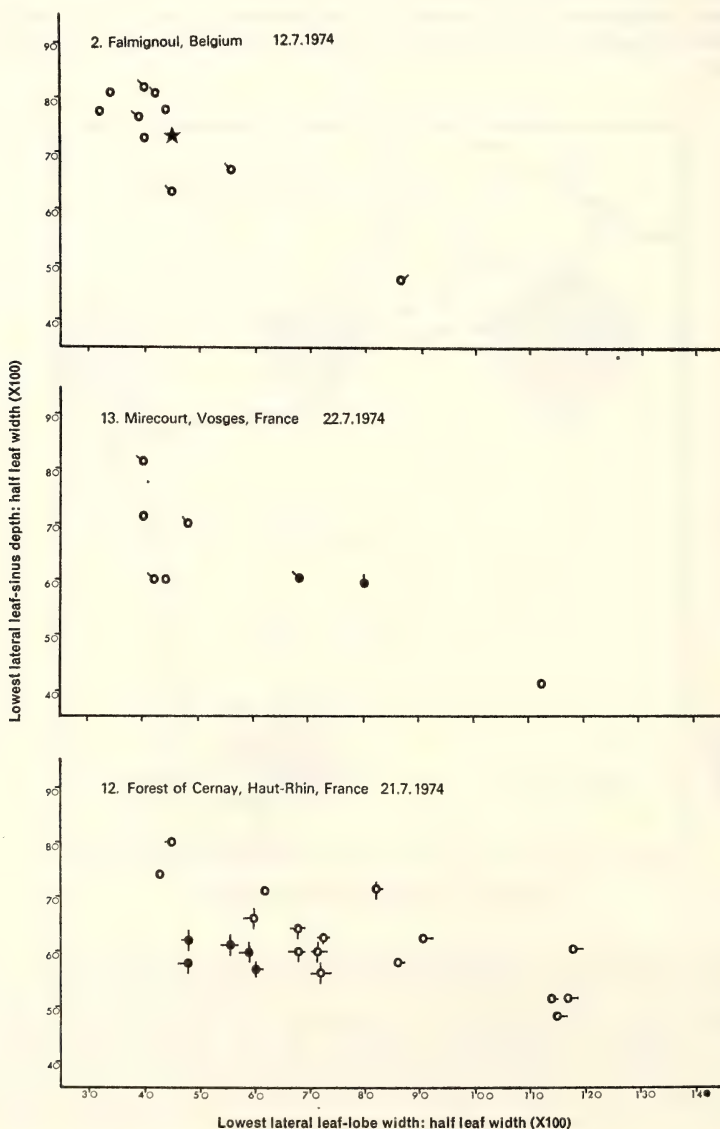
However, two good examples of woods with relatively isolated populations of *C. laevigata* were found: site 5, the forest of Langaumburg, and site 15, near Goviller. The population at Langaumburg consists almost entirely of typical plants of *C. laevigata*. No plants of *C. monogyna* were found and only one or two plants, those plotted farthest to the left on the scatter diagram, show any signs of possible introgression from *C. monogyna*. It can be seen from the scatter diagram that plants of this population have leaves with leaf-lobe: half leaf width ratios higher than those of the English populations at Horish Wood, although sinus depth: half leaf width ratios do not differ so

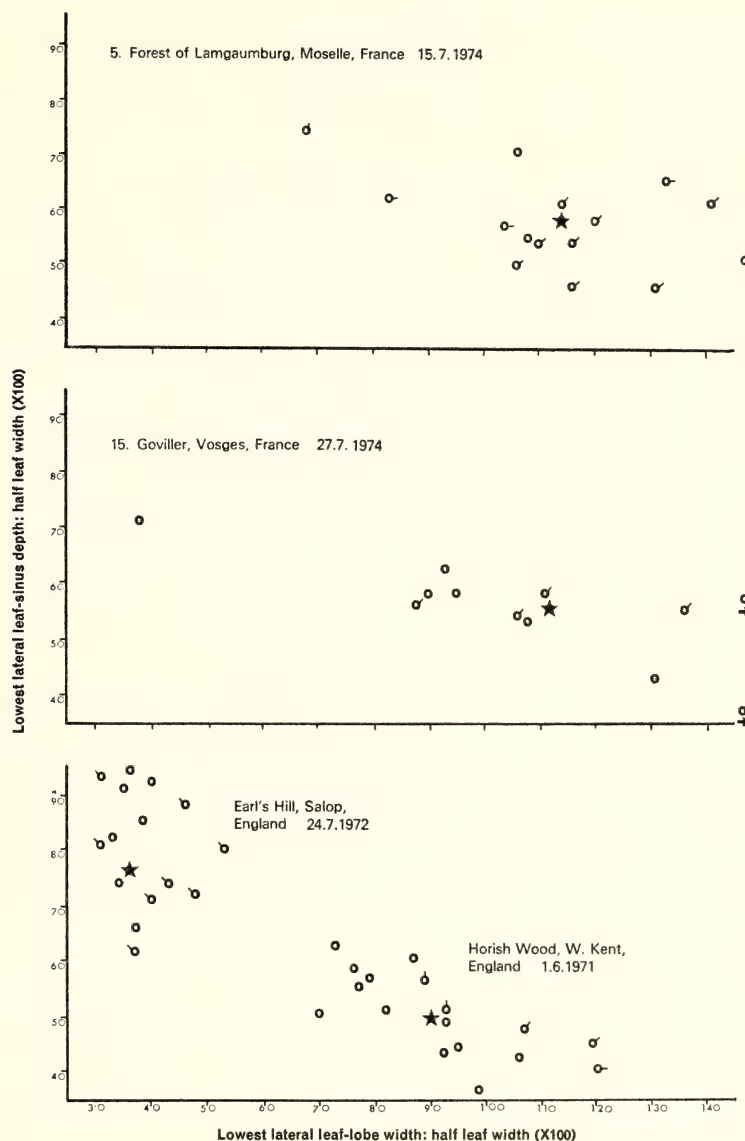
greatly. The bulk of English populations nearest to pure *C. laevigata* have most plants with leaf-lobe width: half leaf width ratios between 70 and 90, and fewer plants with higher ratios. The French populations have many plants with leaf-lobe width: half leaf width ratios above 90. The population at Goviller is similar to that at Langaumburg, the majority of the plants being *C. laevigata*, although an isolated plant of *C. monogyna* was found at the margin of the wood.

At Falmignoul, site 2, the area of woodland is very small and has *C. monogyna* growing just outside. In the wood only one plant of *C. laevigata* could be found, the others being either *C. monogyna* or plants which, although near to *C. monogyna*, are outside its normal range of variation and probably represent plants introgressed by *C. laevigata*.

No isolated populations of *C. curvisepala* subsp. *lindmanii* were found, but at site 13, near Mirecourt, and site 12, the forest of Cernay, mixed populations containing all three *Crataegus* species were encountered, together with apparent intermediates.

At Mirecourt, the plants are growing in a small copse and adjacent hedgerow. Of the plants





Key to symbols

All sites except Forest of Cernay (site 12)

Forest of Cernay (site 12)

○ Style number unknown

● Fruit breadth/length ratio less than 0.64

∩ One style

long narrow

◊ Both one and two styles

sepal

♂ Two styles

hairs in leaf-axils

⊕ high style number

◌ Both two and three styles

finely serrate,
acute leaf-lobesLines absent—
characters absent● Fruit breadth/length ratio
less than 0.64Half-lines—
characters
intermediate★ Population mean (not given where
three species present)○ Typical plant of *Crataegus monogyna*● Typical plant of *C. curvisepala*◌ Typical plant of *C. laevigata*

FIGURE 3. Scatter diagrams of populations.

in the hedgerow, three appear to be *C. monogyna* and one *C. curvisepala* subsp. *lindmanii*. In the copse one plant is clearly *C. laevigata*, another appears like *C. curvisepala* subsp. *lindmanii* but is possibly introgressed by *C. laevigata*, while two others, the plants shown farthest to the left of the scatter diagram with a sinus depth: half leaf width ratio of 60, have some characters of *C. monogyna* and some of *C. curvisepala* subsp. *lindmanii*.

At Cernay there is a strip of *C. monogyna* scrub, including some hybrids, adjoining the forest. The population inside the forest consists mainly of plants which are either *C. curvisepala* subsp. *lindmanii*, with a long, narrow fruit and a single style (plotted on the scatter diagram near to 60 on both the horizontal and vertical axes), or apparent hybrids of this subspecies with *C. laevigata*. The latter have either two-styled or a mixture of one-styled and two-styled fruits, and, having a leaf-lobe width: half leaf width ratio between 65 and 90, are mostly grouped on the scatter diagram nearer to *C. curvisepala* subsp. *lindmanii* than to *C. laevigata*. The plants shown on the scatter diagram with a leaf-lobe width: half leaf width ratio greater than 80 have some or all of the characters of *C. laevigata*. Also, a few plants growing near the wood-margin have a mixture of *C. monogyna* and *C. curvisepala* subsp. *lindmanii* characters.

A test for viability was made on the pollen from a small number of plants from Cernay which were intermediate between *C. curvisepala* subsp. *lindmanii* and *C. laevigata*. Although some samples had a low pollen viability, others showed a viability of over 90%.

Chromosome numbers were also determined in root-tips of five seedlings collected from the middle of the forest at Cernay. Of these, two had a chromosome number of $2n = 52$ and three of $2n = 34$. These are discussed later.

DISCUSSION

The difference between the leaf-lobe width: half leaf width ratios of plants of *C. laevigata* from English and French populations may be the result of their prolonged isolation and consequent divergence, but another possible explanation is the gradual disappearance of the more extreme leaf-forms in England owing to widespread hybridization with *C. monogyna*. Plants in English populations which appear to be hybrids, since they show intermediate characters, have leaves with leaf-lobe width: half leaf width ratios frequently up to 90 but only very rarely beyond this value. In France, where isolating factors between the two species appear to be operating more effectively and the chances of hybridization are less, plants of *C. laevigata* have leaves with higher ratios.

The presence of these comparatively uncontaminated populations of *C. laevigata* appears to be related to the size of the woodlands in which this species occurs. Only a single plant referable to *C. laevigata* was found in the small woodland at Falmignoul, the rest of the population consisting mainly of *C. monogyna* or plants closely resembling that species. Thus, this population is similar to many found in south-eastern England where suitable habitats for *C. laevigata* are also limited. In contrast, the populations of *C. laevigata* examined at both Langaumburg and Goviller occur within large forest areas and in consequence are more or less isolated from and uncontaminated by *C. monogyna*.

Another factor which may have an effect on the continued existence of relatively pure populations of shade-tolerant species such as *C. laevigata* is the extent and nature of roads through the forests. For example, at Horish Wood, W. Kent, the survival of the *Crataegus* population nearest to *C. laevigata* so far found by the author in England is threatened not only by the nearby occurrence of native *C. monogyna* but also by the building of a motorway that now bisects the wood, since the wide, open bank of this road has been planted with a hedge of a cultivated variant of *C. monogyna* and it also provides a suitable habitat for the natural establishment of this species close to the existing population of *C. laevigata*. Insufficient time has elapsed for changes to be apparent so far, but the final destruction of this *C. laevigata* population in the future seems inevitable, although its survival may be extended through the maintenance of suitable habitats in the wood itself, because no coppicing, tree-felling or path-clearing has taken place in recent years.

A similar situation is found in the forest of Cernay, which has been divided by a dual carriageway with wide, cleared areas on either side. Although no hedgerows have been planted, clearance has been followed by the natural establishment of a population of *C. monogyna*. The forest of Langaumburg

burg is also divided by a main road but this appears to have had little effect on the *Crataegus* present. It is a single carriageway without footpaths; the forest-trees grow to their full height right up to the road and no *Crataegus* was found growing at its margins. Therefore, it can be reasonably concluded that, as a result of the continued spread of man's activities, *C. laevigata*, at least in its present form, will only survive for a limited time in Europe unless it is possible to conserve large areas of woodland well isolated from *C. monogyna*.

Populations where not two but three species of *Crataegus* are growing in close proximity are also of great interest. The mixing of *C. curvisepala* subsp. *lindmanii* with *C. laevigata* does not depend upon man's activities to the same extent as does that of *C. monogyna* and *C. laevigata*, because they have very similar habitat preferences, both being shade tolerant and able to grow in sparse woodland. Most of the intermediates in the small copse at Mirecourt appear to be hybrids between *C. monogyna* and *C. curvisepala* subsp. *lindmanii*. At Cernay similar intermediates occur only near the margin of the forest, whereas those commonly found within the forest appear to be hybrids between *C. curvisepala* subsp. *lindmanii* and *C. laevigata*. This situation may have arisen because the whole of small areas of woodland tends to be marginal, with resultant penetration of *C. monogyna* and its hybrids, but in much larger areas the margins form a less important part of the whole and only the true woodland species survive within.

On the scatter diagrams of the sample from Cernay (Fig. 3), the group of plants with characters intermediate between *C. curvisepala* subsp. *lindmanii* and *C. laevigata* is nearer to the former than to the latter. This raises the question whether *C. curvisepala* subsp. *lindmanii* exists here as a pure taxon or whether all plants represented by the central group on the diagram should be considered as a single variable taxon. However, there is a marked tendency for single styles to be associated with long, narrow fruits with erect sepals, and this agrees with the original description of the species by Lindman (1904, 1918). Such one-styled plants also tend to group together on the scatter diagram, well away from *C. laevigata*.

C. laevigata is a diploid species (Gladkova 1968, Byatt 1976), but, as *C. curvisepala* subsp. *curvisepala* is known to be a tetraploid (Gladkova 1968), it is probable that subsp. *lindmanii* is also a tetraploid. Some evidence in support of the view that these are the parental species of the intermediates is provided by the near triploid chromosome numbers of two of the seedlings growing under such plants at the forest of Cernay. It is very likely that they are progeny of the mature intermediates which, in spite of probably being triploids, have a high pollen fertility and show every sign of producing a normal crop of fruit. As has been shown in closely related species of other genera (Vardi 1971, 1974), triploids are not necessarily completely sterile.

This last population may also help to elucidate the confusing published descriptions of *C. macrocarpa* Hegetschw., a species originally described from Switzerland (Hegetschweiler 1840). A very similar plant, *C. calycina* Peterm., which in *Flora Europaea* (Franco 1968b) was the name wrongly applied to *C. curvisepala*, was later described from the Leipzig area of Germany (Petermann 1849), but it is now considered to be conspecific with *C. macrocarpa* (Hrabětová-Uhrová 1968, Byatt 1974).

The flowers of both these plants were described as having variable style numbers. The illustration in Petermann's *Flora* shows a long, narrow fruit without styles but with erect sepals, similar to those occurring on both one-styled and two-styled flowers of plants at Cernay. Existing Petermann herbarium specimens (LAU, S) have flowers with two styles, and leaves with many characters of *C. curvisepala*. Flowering specimens (herb. A. Roubal, PRC) from populations near Kladno in Czechoslovakia, where they were apparently growing near *C. laevigata*, also show many features of *C. curvisepala*; of the ten specimens (with one exception), those with a single style were determined by Roubal as *C. curvisepala* and those with a higher number of styles as *C. macrocarpa*. This character seems an insufficient foundation for a specific distinction, especially as there is no spatial separation between the taxa, and those plants with flowers having the higher number of styles are most likely hybrids between *C. curvisepala* and *C. laevigata*, with a tendency to favour *C. curvisepala* in their conspicuous vegetative features, as do the plants at Cernay. Many other herbarium specimens from different areas of Europe also show this combination of features of *C. curvisepala* and *C. laevigata*. In some examples the leaf-lobe width: half leaf width ratio is intermediate between that of the two species. Such specimens are usually named either *C. macrocarpa* Hegetschw. or *C. × schumacheri* Raunk., a name applied in *Flora Europaea* (Franco 1968b) to hybrids between *C. laevigata* and *C. curvisepala*. *C. × schumacheri* was described from Denmark

by Raunkiaer (1933), and the labelling of intermediate plants in herbaria as *C. macrocarpa* or *C. × schumacheri* depends largely on the locality, those from nearer Switzerland carrying the former name and those from nearer Denmark the latter.

The strongest evidence for considering *C. macrocarpa* as a distinct species is Hegetschweiler's original description of the fruit, which is followed in *Flora Europaea* (Franco 1968b). He described the fruit as large with five protuberances at its base. If *C. curvisepala* is one of the parents, the fruit might be expected to be large, but the presence of protuberances at the base of the fruit has been considered diagnostic for several European species. My own investigations of herbarium specimens have shown that such protuberances occur fairly frequently in plants otherwise typical of *C. curvisepala*. One of the most typical examples of *C. curvisepala* subsp. *lindmanii* at Cernay shows this feature clearly, while another plant with intermediate characters also has protuberances. Therefore, it appears that this character is not an adequate basis for distinguishing *C. macrocarpa* as a separate species.

Some of the plants at Cernay agree well with descriptions in various Floras of *C. macrocarpa* Hegetschw. This fact, together with evidence from herbarium specimens from other parts of Europe, suggests that plants known as *C. macrocarpa* Hegetschw. are probably of hybrid origin. Cinovskis (1971) came to a similar conclusion. In the absence of convincing evidence that such plants form a distinct species, they are probably better designated as *C. × macrocarpa* Hegetschw.

It will be seen from the scatter diagrams based on the assortment of some selected characters in mixed populations that the precise identification of individual plants may be difficult. Therefore an attempt has been made below to construct a key incorporating those characters which have been found most useful in practice. However, where hybridization is suspected, it is necessary to look at as many characters as possible, since individual plants may have an unusual assortment of characters. Although the identification of the majority of plants will be quite straightforward, a few may prove very difficult to determine with any degree of certainty. Quite apart from the normal variation encountered in the parent species, some plants may be the result of more complex hybridization than it is possible to allow for in a key only dealing with distinct species and their obvious intermediates. The hybrid binomials used in the key refer to the following:

- C. × macrocarpa* Hegetschw. = *C. curvisepala* × *C. laevigata*
C. × heterodonta Pojark. = *C. curvisepala* × *C. monogyna*
C. × media Bechst. = *C. laevigata* × *C. monogyna*

1. Leaves with at least some acute, finely serrate lobes; fruit breadth/length ratio usually less than 0.75
 2. Styles 1-2 or 2; lowest lateral sinus about midway along leaf, occasionally lower *C. × macrocarpa*
 2. Styles always 1; lowest lateral sinus in lower half of five-lobed leaves
 3. Leaf-lobes finely serrate to base; sepals twice as long as broad *C. curvisepala*
 3. Leaf-lobes serrate only in distal half; sepals not much longer than broad *C. × heterodonta*
1. Leaves without acute, finely serrate lobes; fruit breadth/length ratio greater than 0.75
 4. Leaf-lobes entire or with a few teeth; main lateral veins curving downwards; lowest lateral leaf sinus more than half way to mid-vein; style 1 *C. monogyna*
 4. Leaf-lobes distinctly serrate; main lateral veins straight or curving upwards; lowest lateral leaf sinus not more than half way to mid-vein; styles at least sometimes more than 1
 5. Leaf-lobes coarsely serrate in distal half; main lateral veins straight; lowest lateral leaf sinus about half way to mid-vein; styles usually 1-2 *C. × media*
 5. Leaf-lobes coarsely serrate ± to base; main lateral veins curving upwards; lowest lateral leaf sinus less than half way to mid-vein; styles 2 or 2-3 *C. laevigata*

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Nomenclature, comparison and distribution of *Vulpia membranacea* (L.) Dumort. and *V. fasciculata* (Forskål) Samp.

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ABSTRACT

Vulpia membranacea (L.) Dumort. *sensu lato* comprises two species, *V. membranacea sensu stricto*, a western Mediterranean diploid hitherto usually known as *V. longiseta* (Brot.) Hackel, and *V. fasciculata* (Forskål) Samp., a circum-Mediterranean tetraploid hitherto usually known as *V. membranacea* or *V. uniglumis* (Aiton) Dumort. Reasons for the application of the name *V. membranacea* to the diploid taxon are given, and the characters and geographical distribution of the two species detailed. Only the tetraploid occurs in the British Isles, where it is frequent in the south and west but scarcer and diminishing in the east; full details are given of its past and present records in eastern Britain.

INTRODUCTION

The plant usually known as *Vulpia membranacea* (L.) Dumort. (formerly *V. uniglumis* (Aiton) Dumort.) must be regarded in Britain as a typical member of the Mediterranean Element, although Matthews (1937) included it in his Oceanic Southern Element. In Britain, which is at the northern limit of its range, it has a predominantly south-western distribution (Fig. 1), which is continued southwards along the Atlantic seaboard to Spain and Portugal, and extends eastwards throughout almost the whole of the Mediterranean region as far as Syria and Israel (Fig. 2). The only anomaly in this typical Mediterranean pattern is in Ireland, where it occurs only on the eastern and south-eastern coasts, from Louth to eastern Waterford.

The chromosome number of this taxon, so far as is known, is always tetraploid ($2n = 28$), for we believe that the diploid and hexaploid counts in the literature are all either errors or cases of mistaken identification (Stace & Cotton 1974, Cotton & Stace 1976). The diploid counts ($2n = 14$) refer to a closely related taxon, *V. longiseta* (Brot.) Hackel, which has been frequently confused with the tetraploid or considered conspecific with it.

Chromosome counts reported by Stace & Cotton (1974) and Cotton & Stace (1976) comprise six diploid counts of *V. longiseta* (1 from France, 2 from Spain and 3 from cultivated sources) and 40 tetraploid counts of *V. membranacea* (10 from England, 5 from Wales, 5 from Ireland, 2 from the Channel Isles, 1 from Corsica, 1 from Cyprus, 3 from France, 1 from Greece, 2 from Italy, 1 from Yugoslavia, 1 from Crete, 1 from Libya, 3 from Sicily, 1 from Spain and 3 from cultivated sources). In addition there are 4 reliable, localized diploid counts in the literature for *V. longiseta* (from France and Portugal) and 12 reliable, localized tetraploid counts for *V. membranacea* (from Corsica, Crete, France and Portugal) (Cotton & Stace 1976). To these should be added one more recent count of ours:

V. membranacea. Holme-next-the-Sea, W. Norfolk, v.c. 28, England, R. P. Libbey & C. A. Stace 1975, LTR. $2n = 28$.

Localities in the British Isles from which chromosome counts have been made are indicated in Fig. 1.

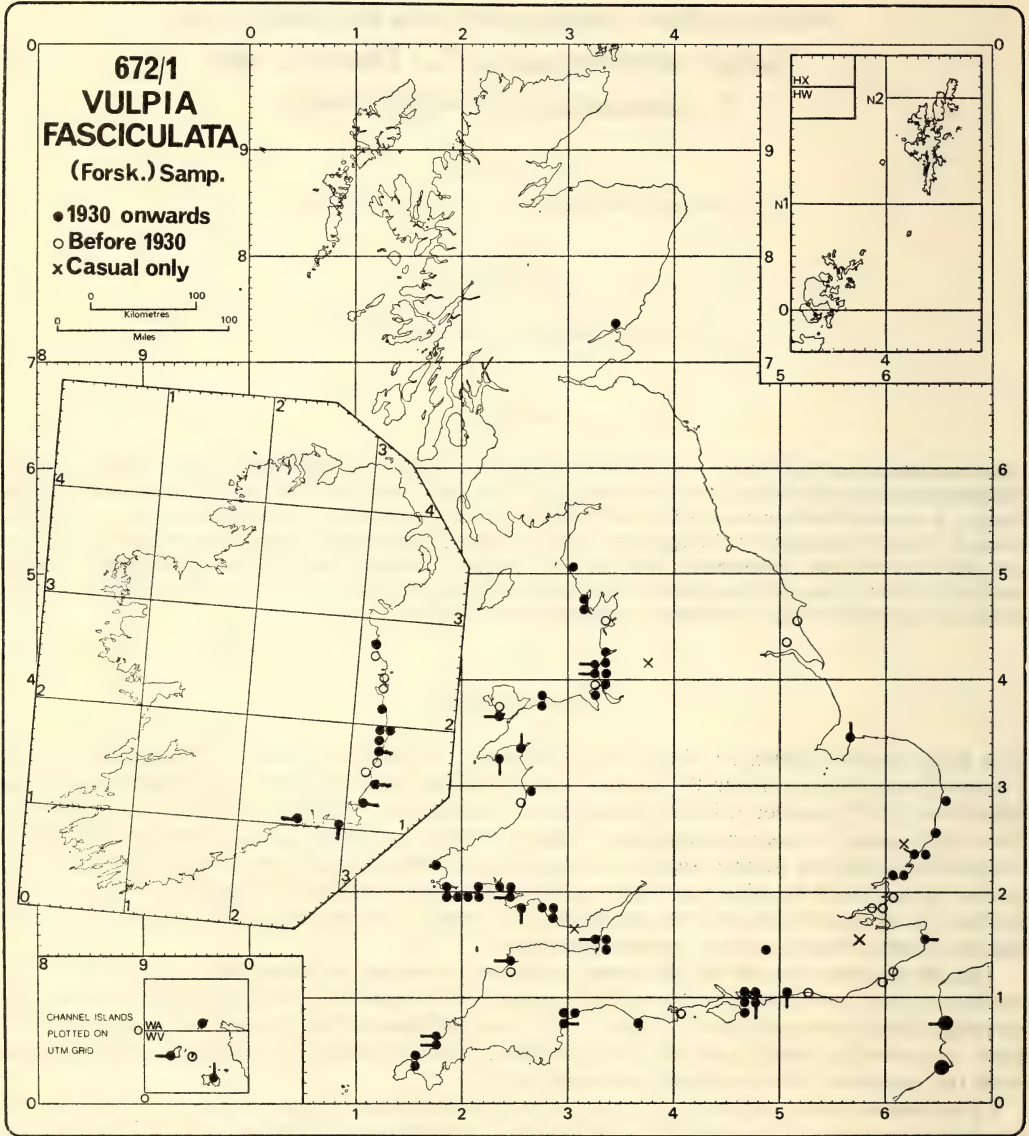


FIGURE 1. Distribution in the British Isles of *Vulpia fasciculata*, compiled by the Biological Records Centre partly from data supplied by the authors. Two extant localities of *V. membranacea sensu stricto* in France are also shown (large dots). Localities from which chromosome counts have been made are marked with a short vertical or horizontal line.

In this paper we wish to set out the differences between the diploid and tetraploid, in terms of both their structure and distribution. Moreover, examination of the type specimen of the basionym of *V. membranacea* in LINN has shown that this name should in fact be applied to the diploid, not to the tetraploid as above, and we therefore wish also to clarify the nomenclatural situation.

NOMENCLATURE

Vulpia membranacea (L.) Dumort. is based upon *Stipa membranacea* L., which was one of only 11 species to appear as Addenda to Volume 1 of *Species Plantarum* (p. 560). The species was referred to as species 4 of the genus *Stipa* (there being three species in the main text, p. 78), and was given the diagnosis 'membranacea. 4. STIPA pedicellis dilatis membranaceis. Habitat in Hispania. Loeffling.' Being a totally new species, with no synonyms, it was also provided with over three lines of description, but neither this nor the diagnosis are sufficient to distinguish between diploid and tetraploid *V. membranacea sensu lato*; in fact neither would be adequate to determine the genus. There is in LINN, however, the unequivocal holotype of *Stipa membranacea*, labelled '4. membranacea' in Linnaeus' handwriting and with the annotation '*Festuca est uniglumi proxima*' by J. E. Smith. On the reverse of the sheet Linnaeus has written 'Hispania Loeffl.' It is number 94/9 of Savage's Catalogue. This well-preserved specimen is undoubtedly the diploid taxon, with glabrous ovaries (see below), and it is therefore the western European diploid which must bear the name *V. membranacea* (L.) Dumort. Thus the plants hitherto usually known as *V. longiseta* must be called *V. membranacea*, and the tetraploids (including all those in the British Isles) hitherto usually known as *V. membranacea* cannot bear this name. The correct name for the tetraploid is *V. fasciculata* (Forskål) Samp. (published in 1913), which is based on *Festuca fasciculata* Forskål (published in 1775), originally an Egyptian plant ('Alexandriae'). Although we have not seen the type of *F. fasciculata*, there can be no doubt that it refers to the tetraploid because Egypt is well outside the known range of the diploid (Fig. 2).

TABLE 1. LIST OF SYNONYMS OF *VULPIA FASCICULATA* AND *V. MEMBRANACEA**VULPIA FASCICULATA* (Forskål) Samp., *Lista Esp. Herb. Port.*, 24 (1913)

- Festuca fasciculata* Forskål, *Fl. Aegypt.*, 22 (1775)
Lolium bromioides Hudson, *Fl. Angl.*, 2nd ed., 55 (1778)
Festuca uniglumis Aiton, *Hort. Kew.*, 108 (1789)
Bromus hordeiformis Lam., *Tabl. Encycl. Méth. Bot.*, 1: 195 (1791)
Festuca madritensis (L.) Desf., *Fl. Atl.*, 1: 91 (1798)
Vulpia maritima S. F. Gray, *Nat. Arr. Brit. Pl.*, 2: 124 (1821)
Mygalurus uniglumis (Aiton) Link, *Enum. Hort. Berol. Alt.*, 1: 147 (1821)
Festuca hordeiformis Wulfen ex Steudel, *Nomencl. Bot.*, 337 (1821)
Vulpia uniglumis (Aiton) Dumort., *Obs. Gram. Belg.*, 101 (1824)
Vulpia fontanesii Parl., *Pl. Nov.*, 50 (1842)
Distomomischus subuniglumis Dulac, *Fl. Hautes Pyr.*, 92 (1867)
Vulpia bromioides auct.
Vulpia membranacea auct.

VULPIA MEMBRANACEA (L.) Dumort., *Obs. Gram. Belg.*, 100 (1824)

- Stipa membranacea* L., *Sp. Pl.*, 560 (1753)
Festuca pyramidata Link in Schrader, *Journ. für die Bot.*, 2(4): 315 (1800)
Festuca longiseta Brot., *Fl. Lusit.*, 1: 115 (1804)
Festuca agrestis Loisel., *Fl. Gall.*, 2nd ed., 1: 87 (1828)
Vulpia linneana Parl., in *Giorn. bot. ital.*, 1 (2, 1): 346 (1844)
Festuca linneana (Parl.) Steud., *Syn. Pl. Glum.*, 1: 303 (1854)
Vulpia longiseta (Brot.) Hackel, *Cat. Gram. Portug.*, 24 (1880)
Vulpia agrestis (Loisel.) Duval-Jouve, in *Rev. Sci. nat.*, sér. 2, 2: 49 (1880)
Vulpia membranacea var. *agrestis* (Loisel.) Gautier, *Cat. rais. Fl. Pyr.-Or.*, 448 (1898)
Vulpia uniglumis var. *longiseta* (Brot.) Husnot, *Gram.*, 67 (1898)
Festuca uniglumis var. *longiseta* (Brot.) Ascherson & Graebner, *Syn. Mitteleur. Fl.*, 2: 552 (1901)
Vulpia pyramidata (Link) Rothm., in *Reprim nov. Spec. Regni veg.*, 52: 270 (1943)
Vulpia membranacea var. *longiseta* (Brot.) Maire ex Cuénod, *Fl. Tunis.*, 136 (1954)
Vulpia bromioides auct.

Although the nomenclatural implications of the above facts have not previously been properly followed up, we are by no means the first to have noticed that the Linnaean type of *Stipa membranacea* differs from the widespread maritime plant (the tetraploid). The first to have stated this unequivocally appears to be Parlatores, who in 1845 renamed the Linnaean (diploid) plant, super-

fluously, *Vulpia Linneana* Parl. Dumortier had earlier (in 1824) made the new combinations *V. membranacea* and *V. uniglumis* in the same publication, but he did not make it clear whether he considered them two distinct taxa. The subject has been discussed in more detail by Henrard (1937).

Throughout the rest of this paper we shall refer to the diploid as *V. membranacea* and the tetraploid as *V. fasciculata*. The synonymy of these two species is given in Table 1.

COMPARISON OF *VULPIA MEMBRANACEA* AND *V. FASCICULATA*

The two taxa can be separated in flower or fruit by the pubescence of the ovary or caryopsis, which in *V. membranacea* is quite glabrous but in *V. fasciculata* is hairy at the apex. These hairs can be seen quite easily in all cases with a strong hand-lens or dissecting microscope, but care has to be taken to avoid confusion with the hair-like stigmatic processes which often remain in a coiled heap at the apex of the caryopsis, even when it is ripe. The hairs may arise from the distal one fifth of the ovary at flowering, but when the caryopsis is ripe they are confined to a small apical bulge which, together with the styles, is easily knocked off dried specimens during examination. Apart from such minor practical problems we have found the hairy or glabrous ovary or caryopsis to be absolutely correlated with chromosome number (Cotton & Stace 1976). We have no hesitation in recognizing the two taxa, which differ in morphology, chromosome number, ecology and geographical distribution, as distinct species.

All other characters which may be used to separate the two species are not absolutely reliable, but a combination of several of the following is usually sufficient for identification:

1. Inflorescence more slender and more exerted from the topmost leaf-sheath in *V. membranacea*.
2. Spikelets and lemmas longer in *V. fasciculata*: lemmas 8–18mm in *V. fasciculata*; 7–14.5mm in *V. membranacea* (excluding awns).
3. Lower glume longer in *V. membranacea*: 0.2–3mm in *V. membranacea*; 0.1–2.5mm in *V. fasciculata*.
4. Palea longer in *V. fasciculata*: 6.5–11mm in *V. fasciculata*; 4.5–7mm in *V. membranacea*.
5. Stomata longer in *V. fasciculata*: 26–41 μ m in *V. membranacea*; 33–59 μ m in *V. fasciculata*.
6. Abaxial leaf epidermis with slightly longer and wider long-cells and slightly longer and more frequent short-cells in *V. fasciculata*.
7. Adaxial leaf epidermis with hairs in the bulliform-cell region of *V. fasciculata* but not in that of *V. membranacea*.

Despite claims by others to the contrary, we have never seen a spikelet of either species in which the lower glume is completely lacking, although it is sometimes only visible under a dissecting microscope. Hackel (1880) and Camus (1943), as well as others, emphasized differences in the ease and regularity of disarticulation of the inflorescence at maturity in the two species, but we have been unable to confirm any such differences. In both species (unlike other British species of *Vulpia*) the inflorescence disarticulates at the base of each spikelet pedicel as well as below each fertile floret. Hence the dispersal units are a mixture of whole spikelets (both with and without pedicels according to Camus, although in our experience the latter situation is rare and irregular), single fertile florets, and single fertile florets together with the rest of the sterile apical florets.

It is impossible to uphold the two varieties of *V. fasciculata* proposed by Camus (1943): *V. membranacea* var. *occidentalis* A. Camus from Atlantic coasts of France, and var. *meridionalis* A. Camus from Mediterranean coasts of France and Italy; the former with a shorter awn on the upper glume. Gatherings from Britain show the full range of awn-length given by Camus, and, moreover, there is often wide variation in one gathering. Paunero (1964) found the same in Spain.

DISTRIBUTION

The world distribution of *V. fasciculata* has been outlined above and is shown in Fig. 2. As far as we can tell it is nearly always a maritime or sub-maritime species, and it rarely occurs as a casual



FIGURE 2. World distribution of *Vulpia fasciculata* (coastlines with heavy continuous line and cross-hatched inland areas) and *V. membranacea sensu stricto* (area within dotted line).

plant in the situations in which several other species of *Vulpia* are so frequently found. We can confirm the existence of native inland localities only in the Middle East, e.g. near Cairo, c 150 km from the coast, and near Jerusalem, c 50 km from the coast.

Paunero (1964) listed 20 specimens of *V. fasciculata* from mainland Spain, of which all but two, from Chinchilla, Albacete (BA) (c 125 km from the coast) and Cuatro Vientos, Madrid (MAF) (c 300 km from the coast), are coastal. It is possible that these two gatherings are of casual specimens, but as we have not seen them it is also possible that they are *V. membranacea*. In Britain there is a single inland locality in which *V. fasciculata* may be native: on the sandy margin of Frensham Great Pond, Surrey, v.c. 17, A. Melderis 1958 (*vide* Biological Records Centre), J. E. Lousley 1960 (*herb.* J. E. L.) (c 45 km from the coast). There appear to be no recent records, and it seems likely that the species was introduced there.

On the Continent, *V. fasciculata* is not known further north than the département Manche in north-western France, due east of the Channel Islands and well south of Britain. In Britain it is very much more frequent on the western and south-western coasts than on the eastern and south-eastern ones (Fig. 1), where, moreover, it appears to be diminishing. On the southern coast of England it is locally plentiful in suitable localities as far east as Littlehampton Golf Course, W. Sussex, v.c. 13, but it is extremely local further east and for this reason we have documented all coastal localities known to us east of the mouth of the River Arun at Littlehampton:

W. Sussex, v.c. 13.

1. Shoreham, GR 51/2.0, W. Borrer (Borrer 1842). Not seen since.

E. Sussex, v.c. 14.

1. Camber sands, GR 51/9.1, Miss K. Pickard & Lady Davy (Wolley-Dod 1937). Never authenticated and not seen since, despite many searches.

E. Kent, v.c. 15.

1. Littlestone, GR 61/0.2, 1900, Lady Davy (*in litt.* ad Biological Records Centre). Also unauthenticated and like the last record must be considered doubtful; possibly casual occurrences.

2. Sandwich sand-dunes, GR 61/3.5. Still present in rather small quantity. In many herbaria. Evidently its status has changed little for over a century (*cf.* Hanbury & Marshall 1899).

S. Essex, v.c. 18.

1. Sandy places near the sea, Southend, GR 51/8.8, E. Forster (Gibson 1862). Not seen since.

2. South Shoebury Common, west of Shoeburyness, GR 51/9.8, C. Parsons (Gibson 1862). Not seen since.
 3. Foulness, GR 61/0.9, c 1850, C. Parsons, STD (*vide* S. T. Jermyn *in litt.* 1973). Not seen since.
- N. Essex, v.c. 19.
1. West Mersea, GR 62/0.1, G. S. Gibson (Gibson 1862). Not seen since, but previously reported there by S. Dale near the start of the eighteenth century (Gibson 1862).
 2. Colne Point, St Osyth beach and Lee-over-Sands, near St Osyth. In many herbaria. Known here for many years and still frequent over a wide area in GR 62/0.1 and GR 62/1.1, S. T. Jermyn (*in litt.* 1973, Jermyn 1975).
 3. Parkeston Quay sidings, GR 62/2.3, casual with rubbish and other aliens, 1964, S. T. Jermyn (*in litt.* 1973, Jermyn 1975).
- E. Suffolk, v.c. 25.
1. Landguard Common, south of Felixstowe, GR 62/2.3, 1777, S. Goodenough (Hind 1889). About 40 plants in one small area, P. J. O. Trist & C. A. Stace, 1975.
 2. Felixstowe Ferry Golf Course, north of Felixstowe, on the south side of the River Deben estuary, GR 62/3.3. 'Quite abundant' here before the Second World War, F. W. Simpson (*in litt.* 1973), and present at least until 1970, P. G. Lawson (*in litt.* 1975), but not seen since then despite several searches. This may be the locality referred to by W. M. Hind, Churchill Babington & Lady Blake (Hind 1889).
 3. Bawdsey, on the north side of the River Deben estuary, GR 62/3.3, 1969 and 1973, F. W. Simpson (*in litt.* 1975). Possibly still there, though the area has been much eroded recently.
 4. Kessingland and Benacre parishes, south of Lowestoft, GR 62/5.8, 1958, P. J. O. Trist (*in litt.* 1975). Not seen since.
 5. Thorpeness, 'a good deal in hollows on the beach', GR 62/4.5, 1974-1975, R. G. Lawson (*in litt.* 1975, LTR).
- W. Norfolk, v.c. 28.
1. Holme-next-the-Sea, GR 53/6.4, 1945, R. P. Libbey (*herb.* R. P. L.). Still there 1975, two good patches c 100 m apart, R. P. Libbey & C. A. Stace (LTR).
- S.E. Yorks., v.c. 61.
1. On walls at Beverley, GR 54/0.3, R. Teesdale (Robinson 1902). Apparently an error in transcription by Robinson, for Teesdale mentioned only *V. myuros* from this locality (*vide* F. E. Crackles *in litt.* 1973).
 2. On the sea coast at Atwick, GR 54/1.5 (Baines 1840). Not authenticated and thus very doubtful.
- Angus, v.c. 90.
1. On small dunes by the old railway station at Monifieth, GR 37/4.3, 1955, A. W. Robson (*Proc. bot. Soc. Br. Isl.*, 2: 150 (1956)). Still there in 1972, U. K. Duncan (*in litt.* 1973), but by 1974 destroyed by construction of a car-park. Its proximity to the station, its absence from the main dunes adjacent, and the fact that it was not found before 1955 strongly suggest that it was introduced to this locality, which represented a considerable extension of and an anomaly in the known range of the species.

Thus, of these 19 reported stations for *V. fasciculata*, a few of which are likely to be errors, the grass is now known for certain in only five (one each in E. Kent, N. Essex, and W. Norfolk and two in E. Suffolk), and only in the Essex locality is it other than extremely local. Although unknown climatic changes might account for its diminution, it seems most likely that disturbance and destruction of its sand-dune habitats have been the major cause of its decline. This has certainly been the case in Angus and on Felixstowe Ferry Golf Course, E. Suffolk.

V. membranacea, on the other hand, has a less widespread distribution, extending no further east in Europe than Provence, France, and in North Africa only as far east as western Libya, but within its geographical boundaries it has a less restricted habitat, occurring in inland sandy places as well as on maritime sands. In France, Spain and Portugal both species often appear to grow in similar conditions, perhaps in some cases together, but *V. membranacea* also occurs far from the sea, for example in the region of Madrid, Valladolid, Burgos, Clermont Ferrand and Paris.

In départements Pas de Calais and Somme, northern France, where *V. fasciculata* does not occur, *V. membranacea* is found, along with *V. ambigua* and *Corynephorus canescens*, in maritime situations which in Britain would be expected to support *V. fasciculata*. J.-R. Wattez, of Amiens, has

informed us (*in litt.* 1974) that *V. membranacea* occurs on fore-dunes at the mouth of the River Canche at Étaples, Pas de Calais (1970, J.-R. Wattez), and at Cayeux and Le Hourdel at the mouth of the River Somme, Somme (1967, M. Bon). These localities are shown in Fig. 1. Specimens from Étaples sent to us by Wattez are diploid and morphologically typical of *V. membranacea sensu stricto*; the latter fact was noted for the Somme plants also by Wattez & Géhu (1973). In Belgium, *V. membranacea* has not been recorded from coastal regions, but there are several records and specimens, the last dated 1898, from sandy habitats in the province of Hainaut, particularly from the region of Mons and westwards to Tournai (Auquier 1972). Auquier has examined the specimens (BR) and found them all to represent *V. membranacea sensu stricto*, as did Hackel (1880), but the plant now appears to be extinct in Belgium.

It should be noted that the differing distributions of these two species on either side of the English Channel, pointed out by Auquier (1972) and above, necessitate the addition of *V. membranacea* to Rose & Géhu's (1960) list of species found in the Pas de Calais but not in Kent or Sussex, and of *V. fasciculata* to their opposite list.

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Morphological and cytological studies on a hexaploid clone of *Potentilla anserina* L.

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ABSTRACT

A study was made of the morphological characters and meiotic behaviour of a single clone of hexaploid *Potentilla anserina* ($2n = 6x = 42$). Observations on leaf, epicalyx, and pollen characters confirmed previous results. The hexaploid cytodeme is morphologically very similar to the tetraploid, suggesting that it may be derived from it. The hexaploid behaved at meiosis like an autotriploid, forming a high proportion of trivalents at metaphase I. The tetraploid regularly forms bivalents, and may be an allopolyploid. Hexaploid *P. anserina* could, therefore, have an autoallopolyploid origin, arising possibly from the fusion of reduced and non-reduced tetraploid gametes.

INTRODUCTION

Potentilla anserina L. is a well-known British species with a wide geographical distribution. Rousi (1965) made an extensive study of the species aggregate and summarized earlier taxonomic treatments and chromosome counts. Three different chromosome numbers have been reported, $2n = 4x = 28$, $2n = 5x = 35$, and $2n = 6x = 42$. Rousi determined the chromosome numbers of plants from 47 different localities in Europe, N. America, and New Zealand, finding 44 tetraploids and three hexaploids, which came from California, Finland, and York, England. The last was Rousi's only British specimen, which suggested that the frequency of hexaploids in Britain might be higher than elsewhere. However, Ockendon & Walters (1970) made chromosome counts of British specimens from 31 localities and found only four hexaploids, one of which came from the same place as Rousi's hexaploid. The others occurred in Cambs., v.c. 29, Caerns., v.c. 49, and Bute, Clyde Isles, v.c. 100. The results of both investigations suggested that the hexaploids have a polytopic origin from the tetraploids.

Rousi (1965) examined 19 different morphological characters and found no significant difference between tetraploids and hexaploids in the majority of them. The only vegetative character that seemed potentially useful in distinguishing between the two races was the length/breadth ratio of the terminal leaflet. This was lower in all three hexaploids than in tetraploids from the same or neighbouring areas. Ockendon & Walters looked at three of Rousi's characters: length/breadth ratio and tooth number of the terminal leaflet, and form of the epicalyx segments. They concluded that 'the two cytodemes cannot be distinguished with absolute certainty by any character other than the chromosome number'.

In his study of meiosis in tetraploids from four sources, Rousi found that 'metaphase I is usually quite regular, the 14 bivalents being well orientated. No multivalents were found in the tetraploids'. He also examined meiosis in his British hexaploid and reported that 'diakinesis was characterized by a surprisingly low number of distinct bodies, either 14 or a few more'. However he considered a high frequency of trivalents unlikely since 'in general plants with small chromosomes seldom have a high number of pairing blocks and chiasmata.' He suggested the possibility of secondary pairing between univalents and homologous bivalents, and noted that anaphase I and later stages showed numerous irregularities.

This paper is concerned with a morphological and cytological investigation of a hexaploid clone of *P. anserina* found beside the tow-path of the Union Grand Canal near Tring, Herts., v.c. 20 (GR 42/924.138). It was morphologically indistinguishable from other tetraploid specimens collected in the same locality. Only subsequently was its ploidy level discovered, from chromosome preparations made after a period of cultivation in an experimental garden.

MORPHOLOGY AND FERTILITY

Length/breadth ratio of terminal leaflet

Rousi determined this ratio in plants from 20 different sources. The mean values for individual plants ranged from 1.51 to 3.35. The three hexaploids all had low ratios, from 1.51 to 2.06, but several tetraploids also had ratios lower than 2.00. Ockendon & Walters confirmed Rousi's findings; their three hexaploids all had low ratios of between 1.6 and 2.0 but the ratios for tetraploids ranged from 1.5 to 3.1. In our hexaploid the length/breadth ratio of the terminal leaflet was 2.4 (mean of ten leaves), a higher value than previously reported for a hexaploid. This character is therefore of little use in recognizing hexaploids in the field.

Number of leaflet teeth

On his sample of tetraploids and hexaploids, Rousi counted the number of teeth on one side of the terminal leaflet, including the terminal tooth, and found a range of 7.0 to 13.8. The range given by Ockendon & Walters was 7 to 13. There was no correlation between number of teeth and ploidy level. Our hexaploid had an average tooth number of 11.8 (ten leaves).

Epicalyx segments

Rousi's British hexaploid from York had lacinate epicalyx segments, and Ockendon & Walters confirmed that plants from this population had larger, more deeply toothed epicalyx segments than most of the tetraploids which they examined. Our hexaploid similarly had long lacinate segments. However, Rousi warned that this character is inconsistently expressed in many populations and is not, therefore, a good indicator of ploidy level.

Pollen grain stainability and size

Pollen fertility and grain size are directly affected by meiotic irregularities and these characters are therefore most useful in identifying polyploids or hybrids. Rousi measured pollen stainability in cotton blue for the tetraploids (from 19 different sources) and found a range of 59.8 to 98.1% whilst the three hexaploids had from 18.9 to 22.2%. Ockendon & Walters did not find such a clear difference; their hexaploids all had low levels of pollen stainability, ranging from 2 to 28%, but several of the tetraploids had unusually low values down to 26%. They concluded that plants with values of 25 to 35% could be tetraploid or hexaploid. They also noted that the value for a single plant varies widely at different times of the year.

The pollen of our hexaploid was stained with acetocarmine and the percentage of stainable pollen was 29.7%, the highest value so far recorded for a hexaploid. A tetraploid (growing in an adjacent pot) which was sampled on the same day gave a rather low value of 50.6%. This suggests that the relatively high value for the hexaploid was not due to especially favourable environmental conditions.

Rousi measured the size of stainable pollen grains and found that his three hexaploid populations had larger mean values than most tetraploids, although two tetraploid populations had larger

TABLE 1. CHROMOSOME CONFIGURATIONS AT DIAKINESIS AND METAPHASE I IN HEXAPLOID *P. ANSERINA*

Chromosome configuration			No. of cells	% of total
Trivalents	Bivalents	Univalents		
14	0	0	42	35.3
13	1	1	30	25.2
12	2	2	24	20.2
11	3	3	14	11.8
10	4	4	8	6.7
8	6	6	1	0.8
			119	

values than the hexaploids. More significant was the variability shown by the hexaploid grains. Even when empty grains were excluded, the hexaploid pollen grains were much more variable in size than those of the tetraploids. This was confirmed in our own plants: the average pollen grain diameter for the hexaploid was $30.1\mu\text{m}$ with a range of $20.0\text{--}37.5\mu\text{m}$. The tetraploid plant had much more uniform grains with a mean diameter of $27.4\mu\text{m}$ and a range of $25.0\text{--}28.7\mu\text{m}$.

Achene formation

Rousi's hexaploids did not produce any achenes after artificial self- or cross-pollination. The tetraploids were seed-fertile but completely or partially self-incompatible. Our hexaploid formed no achenes, but, as only a few plants of either cytodeme were cultivated, this may have been due to a lack of compatible pollen.

CYTOLOGY

Method

Buds were fixed in freshly prepared acetic alcohol (acetic acid: ethanol, 1:3) at about 10°C for a minimum period of a week. Anthers were squashed in strong acetocarmine solution and the stain was finally replaced by 45% acetic acid to prevent excessive colouration of the cytoplasm. Cells were observed under a $\times 100$ oil immersion phase-contrast objective.

Meiotic observations

A total of 119 pollen-mother-cells was examined at diakinesis or metaphase I and their chromosome configurations are summarized in Table 1. The most striking feature was the high trivalent frequency; the configurations were clearly trivalents and not secondary associations between

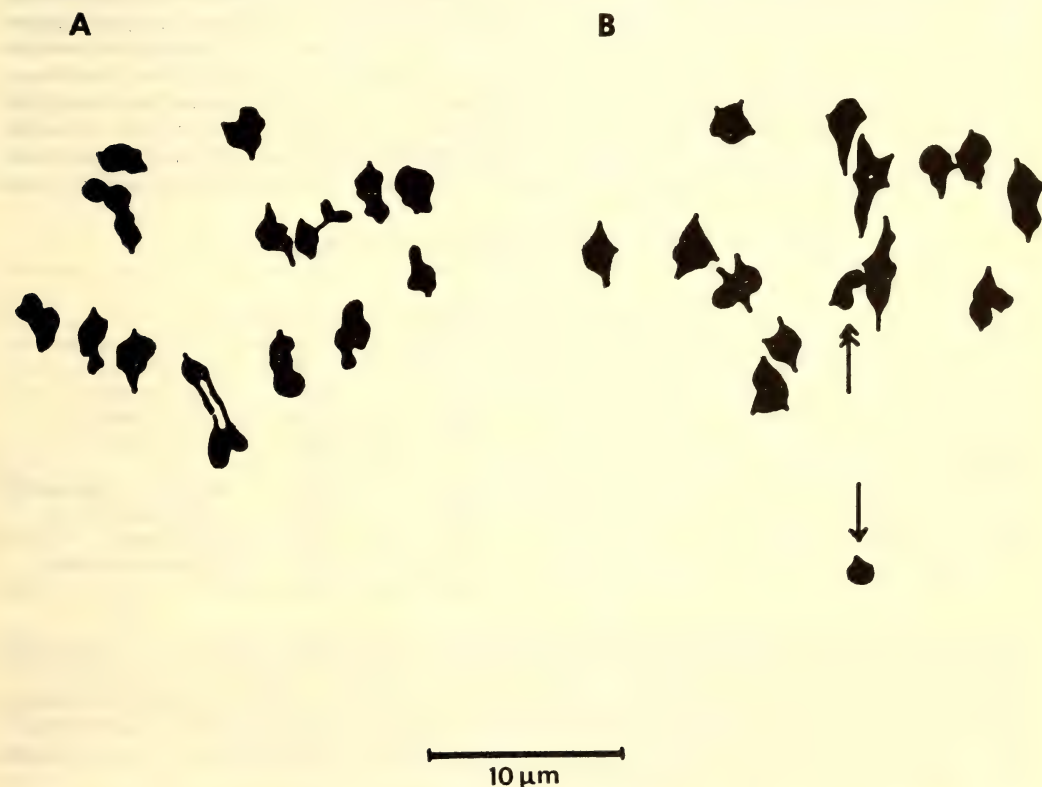


FIGURE 1. Two metaphase I chromosome configurations in hexaploid *P. anserina*: A) 14 trivalents; B) 13 trivalents, 1 bivalent (double arrow), 1 peripheral univalent (single arrow).

bivalents and univalents as suggested by Rousi. The maximum possible trivalent number in a cell with 42 chromosomes is 14 and this was observed in 35% of the cells (Fig. 1A). The mean trivalent number was 12.6 and the lowest was 8. The univalents were usually around the periphery of the cell (Fig. 1B). The bivalents and trivalents were aligned on the metaphase plate, and were often distinguishable only by their different sizes. *Potentilla* chromosomes are too small for the number and positions of chiasmata to be accurately determined. However, the rarity of protruding chromosome arms indicated that chiasmata were generally terminal at diakinesis. Some of the trivalents were clearly V- or 'pan-handle'-shaped (Fig. 1B). Where the three chromosomes were arranged in a chain, its metaphase orientation was usually convergent rather than linear. Many of the trivalents were very compact and asymmetrical; although three chromosomes were clearly present, their exact arrangement was obscure. At anaphase I and subsequent stages disjunction was uneven and univalents were often excluded from the polar groups and formed micronuclei, or occasionally were left at the equator. Such univalents divided into chromatids as they normally would at anaphase II. In two cells it was possible to count accurately the number of chromosomes at each pole: in one the groups contained 19 and 23 chromosomes, and in the other 20 and 22 chromosomes. The latter cell contained one pair of chromosomes still associated at late anaphase I.

DISCUSSION

The lack of any clear morphological distinction between tetraploid and hexaploid *P. anserina* was observed by Rousi (1965) and Ockendon & Walters (1970), and is confirmed by the present study. In *Potentilla*, an increase in ploidy level is usually accompanied by a series of morphological changes including a decrease in the length/breadth ratio of leaves and petals (Matfield 1968). The higher polyploid is sometimes, but not always, gigas. When Matfield (1968) doubled the chromosome number of two tetraploid *Potentilla* species, *P. erecta* (L.) Räusch. and *P. reptans* L., by colchicine treatment, the octoploids of *P. reptans* had larger leaves than the tetraploids, whereas the reverse was the case in *P. erecta*. In both species the decrease in length/breadth ratio of the leaves was, however, very marked. Although the comparison in *P. anserina* is between tetraploid and hexaploid it is surprising that the morphology of the two cytodesmes is so similar. This similarity between hexaploid and tetraploid *P. anserina* suggests a close relationship between the two. No diploids have yet been found in the *P. anserina* species aggregate and Rousi concluded that tetraploidy is an

TABLE 2. MEIOTIC BEHAVIOUR IN AUTOTRIPLOIDS

	x	No. of trivalents range	mean	% of chromosomes as trivalents	Reference
<i>Dactylis glomerata</i> L.	7	1-7	4.7	56.7	Carroll (1966)
<i>Anthoxanthum ovatum</i> Lag.	5	0-5	3.2	63.5	Carroll (1966)
<i>Tulipa praecox</i> Ten.	12		10.2	85.0	Upcott (1939)
<i>Potentilla erecta</i> (L.) Räusch. (6x - see text)	7	8-14	12.3	87.6	Matfield & Ellis (1972)
<i>Impatiens balsamina</i> L.	7	3-7	6.2	89.3	Smith (1938)
<i>Tradescantia bracteata</i> Small	6		5.4	90.0	King (1933)
<i>Zea mays</i> L.	10	6-10	9.2	92.4	Punyasingh (1947)

ancient phenomenon in the group. An increase in chromosome number from 4x to 6x could be achieved in a single step by the fusion of reduced and non-reduced gametes. Functional non-reduced gametes have been demonstrated in related species. Müntzing (1958) reported the occasional fertilization of non-reduced egg cells in hexaploid *P. collina* Wibel., giving rise to nonaploid individuals. Unreduced gametes are also believed to have played an important part in the evolution of the closely related genus *Fragaria* (Ellis 1962).

Tetraploid *P. anserina* forms bivalents regularly at meiosis (Rousi 1965). This suggests that the tetraploid could have an allopolyploid origin, which may be represented genomically as AABB.

The high frequency of trivalents in the hexaploid suggests that it is probably an autoallopolyploid, which may be represented as AAABBB, and which behaves cytologically as an autotriploid.

For comparison with the meiotic behaviour of hexaploid *P. anserina*, Table 2 shows the trivalent frequencies in a number of known autotriploids. Most of them have high trivalent frequencies, with about 89% of the chromosomes taking part in trivalent configurations; the two grasses studied by Carroll (1966) had somewhat lower multivalent frequencies. The hexaploid *P. erecta* in Table 2 was artificially produced from the naturally occurring tetraploid (Matfield & Ellis 1972). It is included because, as in *P. anserina*, the tetraploid has regular bivalent formation in meiosis, indicating a possible allopolyploid origin. Hexaploid *P. erecta* has, therefore, like hexaploid *P. anserina*, a probable autoallopolyploid origin, and behaves cytologically like an autotriploid.

It can be seen that the trivalent frequency in hexaploid *P. anserina* is as high as that in a number of other species, despite the small size of *Potentilla* chromosomes. It is usually thought that autopolyploids with small chromosomes form fewer multivalents than those with larger chromosomes. This follows from Darlington & Mather's (1932) theory that small chromosomes contain fewer 'pairing blocks'. Although this generalization may hold true for chromosomes of different sizes within the same complement, it does not seem to apply to differences of size between unrelated species. Morrison & Rajhathy (1960) came to the same conclusion when they compared quadrivalent frequencies in ten different autotetraploids, and found that as many quadrivalents were formed in species with small chromosomes as in species with larger ones.

In tetraploid *P. anserina* the relative importance of vegetative and sexual reproduction is unknown. Flower production in vigorous wild populations is often poor, and runners of up to one metre in length may be produced in a single growing season (Ockendon & Walters 1970). The low fertility of the hexaploids may therefore result in no disadvantage in short-distance dispersal, although Ockendon & Walters suggested that it may prevent them from spreading far from their point of origin. However, the plant used in this study was found on a canal tow-path, a habitat in which opportunities for the dispersal of detached vegetative parts must be good.

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Artificial hybrids between some
European diploid species of *Euphrasia*

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ABSTRACT

Euphrasia alpina (diploid) has been crossed with the diploids *E. rostkoviana* and *E. picta*, and morphologically intermediate hybrid progeny have been obtained. Pollen-mother-cell meiosis was slightly abnormal in the hybrid of *E. rostkoviana* and strongly so in the hybrid of *E. picta*. The results are discussed in relation to the origin of tetraploid species.

INTRODUCTION

It has been shown previously that the chromosome numbers of numerous European *Euphrasia* taxa are on two levels, diploid ($n = 11$) and tetraploid ($n = 22$) (Yeo 1954, 1970; Favarger 1969; Feoli & Cusma 1974). Yeo (1966) has further shown that on either ploidy level interspecific hybrids can be raised. On the tetraploid level enough crosses were made to show that the fertility of the hybrids is roughly proportional to the morphological similarity of the parents. It is now possible to report interspecific crosses on the diploid level additional to the only one previously made (which was between *E. anglica* Pugsl. and the form of *E. hirtella* Reut. found in Bretagne (Yeo 1966)).

Plants of two stocks of *E. alpina* Lam. (serial nos. E1072 and E1091) were pollinated in 1969 with pollen from *E. rostkoviana* Hayne subsp. *rostkoviana* (E1105) and *E. picta* Wimmer subsp. *picta* (E1113 and E1119A). Places of origin and available chromosome counts of these samples are given in the Appendix. The chromosome number of E1105 was not counted, but in *E. rostkoviana* subsp. *rostkoviana* from other localities it is $n = 11$ (Witsch 1932, Yeo 1970). The taxonomic problem surrounding the eglandular *E. picta* and the glandular-hairy *E. rostkoviana* has been briefly indicated elsewhere (Yeo 1970, 1972). Their recognition as separate species, as in *Flora Europaea* (Yeo 1972), is maintained here for the sake of convenience despite the evidence of intergradation presented by Schaeftlein (1967).

RESULTS

SUCCESS OF CROSSES

The seeds and plants resulting from the cross-pollinations are enumerated in Table 1. Some of the flowers pollinated were already open when emasculated, and one of those of E1091 pollinated

TABLE 1. RESULTS OF INTERSPECIFIC POLLINATIONS OF *EUPHRASIA ALPINA*

Female parent	No. of flowers pollinated	Pollen source	Apparently good seeds obtained	Died young	Progeny Hybrids	Selfs
<i>E. alpina</i>						
E1091, plant 6	10	<i>E. rostkoviana</i> E1105, plant 5	30	0	2	0
E1091, plant 8	5	<i>E. picta</i> E1119A, plant 6	41	3 or 4	2	2
E1072	5	<i>E. picta</i> E1113	11	0	0	0

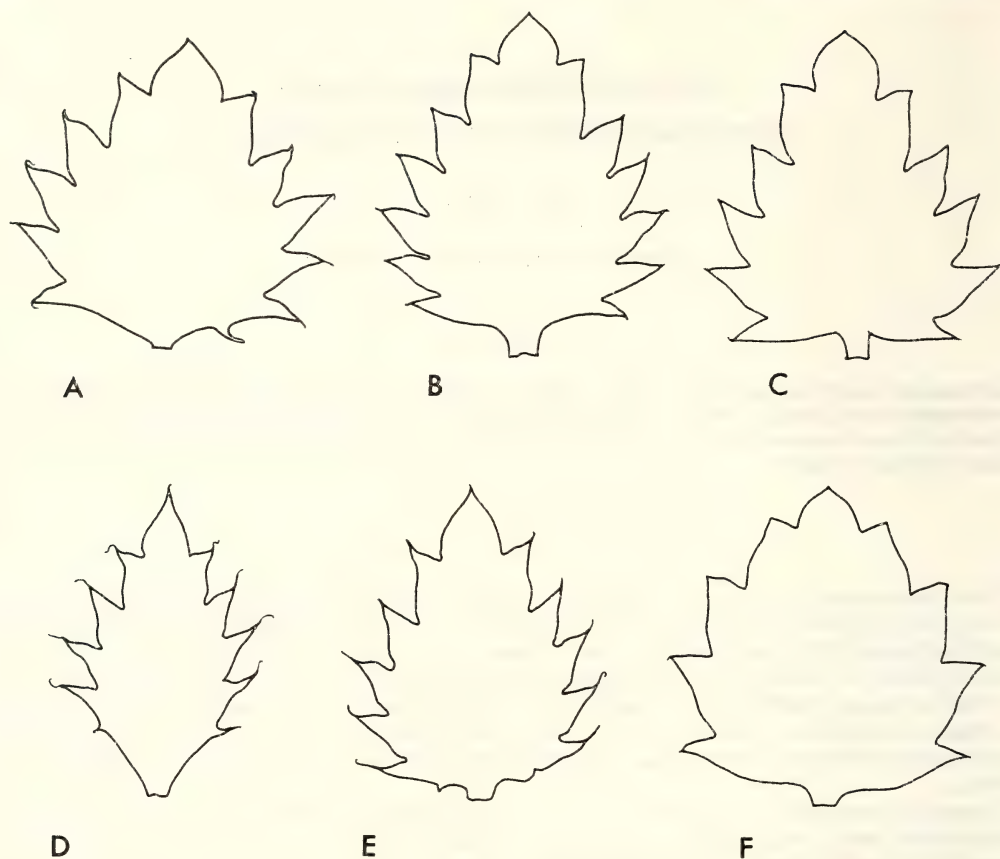


FIGURE 1. Leaves of *Euphrasia*. A. *E. alpina* E1091, plant 6, leaf 8. B. *E. alpina* E1091 $\times$ *E. rostkoviana* E1105, plant 1, leaf 7. C. *E. rostkoviana* E1105, plant 5, leaf 8. D. *E. alpina* E1091, plant 8, leaf 9. E. *E. alpina* E1091 $\times$ *E. picta* E1119A, plant 1, leaf 9. F. *E. picta* E1119A, plant 6, leaf 9. Leaves are numbered according to node, counted from base of plant, excluding cotyledonary node.

with E1119A was probably self-pollinated before it was crossed. All the seeds which appeared to be viable (except some from this last-mentioned flower) were imperfect in having obviously undersized contents and a normal-sized, but more or less crumpled, testa. Nevertheless, as Table 1 shows, some of them germinated. If it is assumed that 10 seeds per capsule is a normal production (cf Yeo 1966), the proportion of seeds with apparently significant swelling ranges from 22% to 80%.

In addition to the hybrids listed in Table 1, among plants of *E. alpina* (E1091) raised in 1970 from open-pollinated plants grown in 1969 there were two plants which were also apparently *E. alpina* $\times$ *E. rostkoviana* subsp. *rostkoviana*. The pollen parent of these must have been either E1105 or a sample from the Grossglocknerstrasse, Land Salzburg, Austria. The large and attractive flowers of *E. alpina* have a structure which ensures that most seed is produced as a result of insect-pollination; open-pollinated capsules of E1091 contained some normal seeds and some imperfect ones, and some of the latter doubtless had resulted from cross-pollination with other species.

MORPHOLOGY OF THE HYBRIDS

The leaf-shape and flower-shape of the hybrids and parents are illustrated in Figs. 1 and 2. Because climatic conditions were drier in 1970 than in 1969, the plants were less vigorous in that year and their corollas and leaves were smaller. However, in Fig. 1 the leaves have been unequally magnified to make them all approximately equal in length.

E. alpina (E1091) × *E. rostkoviana* subsp. *rostkoviana* (E1105)

The habit of the hybrids combines the short cauline internodes of E1105 with the rather stiff, ascending branches of E1091 (the branches of E1105 are flexuous).

The leaves of E1091, plant 6, are exceptionally broad for *E. alpina* (Fig. 1A). It is possible to see an intermediate condition in the hybrid in the shape of the leaf-base and the acuminate teeth of the leaf. The bristles terminating the teeth of leaves at higher nodes are fairly long in the hybrids, but inspection shows that on average they are shorter than those of E1091. The leaves also bear longer glandular hairs and denser eglandular hairs than in E1091, differences evidently due to the influence of the densely long-glandular *E. rostkoviana*.

Fig. 2A shows that the same plant of *E. alpina* also had broad corolla lobes. The hybrid is intermediate not only in the details of the lobing but also in the shape of the widened distal part of the tube. The corollas of E1091 were lilac and in E1105 they were white with a lilac upper lip. In the hybrids the corollas were almost white at first and rather strongly lilac finally, the degree of intensification being greater than is usual in lilac-flowered *Euphrasiae*. In *Euphrasia* corollas, any lilac colouring is usually weaker around the yellow spot on the lower lip. However, in both hybrids of this cross it retained its intensity and actually transgressed the boundary of the yellow spot, giving the latter a brownish border from the blending of the two pigments.

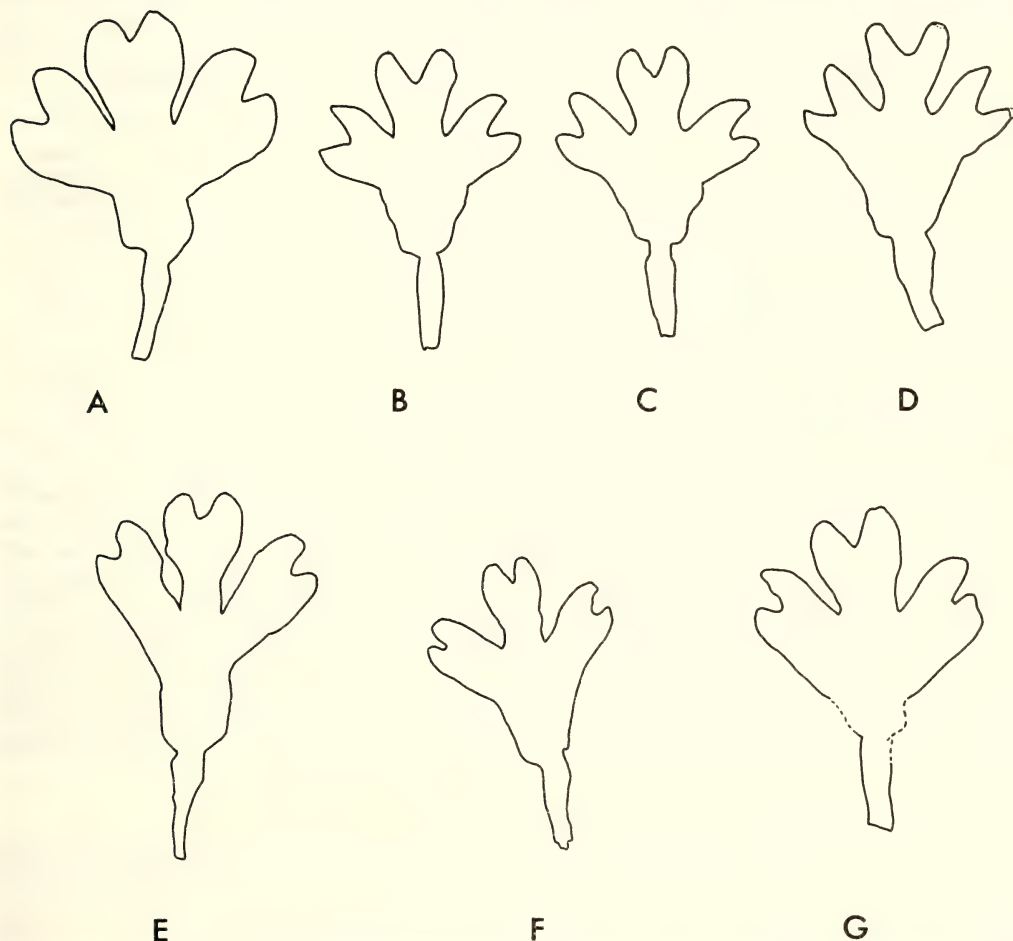


FIGURE 2. Corolla-lip and corolla-tube of *Euphrasia*. A. *E. alpina* E1091, plant 6. B. *E. alpina* E1091 × *E. rostkoviana* E1105, plant 1. C. The same, plant 2. D. *E. rostkoviana* E1105, plant 5. E. *E. alpina* E1091, plant 8. F. *E. alpina* E1091 × *E. picta* E1119A, plant 1. G. *E. picta* E1119A, plant 6.

E. alpina (E1091) $\times$ *E. picta* subsp. *picta* (E1119A)

The internodes of the hybrid are intermediate between the long ones of *E. alpina* and the short ones of *E. picta* subsp. *picta*. One plant of this cross was disordered throughout its life, the leaves and flowers being deformed. However, the habit and colouring are like those of its sibling and it is thought that it is a hybrid. Similar disorder has occasionally been seen in non-hybrid *Euphrasia* plants in cultivation, and it cannot therefore be attributed to partial hybrid incompatibility in this case.

The narrow leaves of E1091, plant 8 (Fig. 1D), are more typical of *E. alpina* than those of plant 6, and the intermediate condition of the hybrid leaf is easily appreciated, owing to the great difference between the parents.

Owing to the similarity of the parental corollas that of the hybrid is not very distinct. It does, however, show the same shape in the widened part of the tube as in *E. alpina* $\times$ *E. rostkoviana*.

MEIOSIS IN THE HYBRIDS

The stages of meiosis observed in *E. alpina* $\times$ *E. rostkoviana* subsp. *rostkoviana* were first and second metaphase, first anaphase (early and late) and first telophase. In second metaphase a chromosome was occasionally seen away from the equator; these were probably derived from chromosomes which had failed to pair in first prophase, but had divided at first anaphase. In the first division, pairing failure affecting one or more pairs of chromosomes was not infrequent (Table 2).

TABLE 2. BIVALENT FORMATION AT MEIOSIS IN *EUPHRASIA* HYBRIDS

Hybrid	No. of cells showing these numbers of bivalents												Total cells observed
	11	10	9	8	7	6	5	4	3	2	1	0	
<i>E. alpina</i> E1091													
$\times$													
<i>E. rostkoviana</i> E1105, plant 1	15	9	4	2	0	0	0	0	0	0	0	0	30
<i>E. alpina</i> E1091													
$\times$													
<i>E. picta</i> E1119A, plant 1	0	2	8	3	2	5	4	10	3	1	1	0	39

In *E. alpina* $\times$ *E. picta* subsp. *picta* pairing failure was much more extensive (Table 2). Univalents were frequently seen dividing in the equatorial region at late first anaphase, and half-chromosomes were easily seen in some cells at second metaphase. A few cells which appeared to contain very large numbers of chromosomes were seen, but these were not very clear and were not understood.

Apart from this, the abnormality of meiosis in these plants, amounting simply to varying degrees of pairing failure, followed by the division of some or all univalents at first anaphase, is similar to that observed previously in tetraploid hybrids of *Euphrasia* (Yeo 1966). Pairing failure in diploid *Euphrasia* has previously been observed only in naturally occurring diploid derivatives of the putative diploid-tetraploid cross *E. anglica* $\times$ *E. nemorosa* (Yeo 1956, p. 263), in which it involved only one chromosome-pair. The cytological observations thus support the initial morphological diagnosis of hybridity.

FERTILITY OF THE HYBRIDS

No controlled pollinations were carried out in the hybrids and none of their mature capsules have had their contents analysed. Well-formed seeds were seen on both hybrids when the plants were still growing, and were apparently being produced quite freely. A few very well-filled seeds have been found in both hybrids by dissecting two or three dehiscent capsules from the dried specimens of each. Capsules of both hybrids also yielded apparently undeveloped ovules and enlarged but empty or nearly empty testas, but these could also be found in the open-pollinated capsules of *E. alpina*.

DISCUSSION

There is a close morphological similarity between *E. picta* subsp. *picta* and at least some plants of *E. rostkoviana* and, as already mentioned, they sometimes intergrade. *E. alpina*, on the other hand, is sufficiently distinct morphologically to be classified apart from the other two species. Accordingly, when I published chromosome counts for *E. picta* and *E. alpina* (Yeo 1970), I suggested that *E. alpina* might have combined with one of them to give rise, by amphidiploidy, to some or all of the European tetraploids outside the section *Augustifoliae*. Morphologically the artificial hybrids are not dissimilar to species such as *E. stricta* Lehm., *E. arctica* Lange ex Rostrup and *E. nemorosa* (Pers.) Wallr.

The present results, showing successful crossing of *E. alpina* with the other two species, and the occurrence of varying degrees of chromosomal non-homology in the hybrid, are grounds for suggesting that my hypothesis might be followed up by someone more suitably placed to do it than I.

However, it seems that the hybrids reported here are not so sterile that they might not occur naturally as populations of morphologically intermediate plants with the diploid chromosome number. In fact I have found a population of modified *E. alpina* which might have resulted from crossing with *E. rostkoviana* subsp. *rostkoviana* (which accompanied it) in Switzerland (E1107A & B, see Appendix). The larger plants of this gathering are similar to the Pyrenean *E. asturica* Pugsl., which Pugsley (1932) placed in Series *Nemorosae* and which I previously listed as a synonym of *E. stricta* (Yeo 1972).

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APPENDIX

SOURCES OF MATERIAL AND LOCATION OF VOUCHERS

Specimens of the hybrids and their parents are in herb. P. F. Yeo and of the latter in CGE.

E. alpina

- E1072. France: Alpes Maritimes. Grown at Cambridge in 1968 and 1969 from seed supplied by the Muséum National d'Histoire Naturelle, Paris, 1968. *n* = 11 (Yeo 1970).
 E1091. Switzerland: Above Brunnen, Simplon Pass, Valais, 1380m, collected 1968. *n* = 11 (Yeo 1970).

E. alpina ? × *E. rostkoviana* subsp. *rostkoviana*

- E1107A & B. Switzerland: Blatten, N. side of Rhône Valley near Brig, Valais, c 1350m, collected 1968.

E. rostkoviana subsp. *rostkoviana*

- E1105. Switzerland: Near Bitsch, 3km N.E. of Brig, Valais, 700m, collected 1968.

E. picta subsp. *picta*

- E1113. Austria: Hochmais, Grossglocknerstrasse, Land Salzburg, 1850m, collected 1968.
 E1119A. Austria: Enzinger Boden, Stubbachtal, Land Salzburg, 1480m, collected 1968. *n* = 11 (Yeo 1970).

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Pollen grain size in *Quercus robur* L. and *Quercus petraea* (Matt.) Liebl.

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Olsson (1975) has recently reported on the size of pollen grains of *Quercus robur* L. and *Q. petraea* (Matt.) Liebl. in southern Sweden and the results were in broad agreement with an earlier study of the genus in France by Van Campo & Elhai (1956). This short contribution explores pollen grain size in British and Irish trees of *Q. robur*, *Q. petraea* and their suspected hybrids.

The trees used in this study were sampled over a period from 1968 to 1975 and include both trees sampled periodically throughout the flowering season and individual trees sampled successively over several years. Each tree had been previously scored on a morphological scale to determine its taxonomic status. (Details may be found in Rushton (1974)). After collection, the pollen was immediately stained for viability using the nitro-blue-tetrazolium (NBT) method of Hauser & Morrison (1964) and fixed using formalin-acetic-alcohol (FAA). Pollen grains showing a positive staining reaction were measured using an eyepiece micrometer. Since NBT stains only those grains having the ability to carry out oxidative metabolism, the survey did not include empty or inviable grains.

TABLE 1. POLLEN GRAIN SIZE, MEASURED AS POLAR DIAMETER, IN *QUERCUS ROBUR* AND *QUERCUS PETRAEA*

	Author	Mean (μm)	Standard deviation (μm)	Coefficient of variation (%)	Sample size	% Pollen viability
<i>Q. robur</i>	Olsson (1975)	26.77	2.73	10.20	200	≥90
	Present	26.74	2.27	8.47	1296	
					(37 trees)	92
	Van Campo & Elhai (1956)	27.80	—	—	—	—
<i>Q. petraea</i>	Olsson (1975)	28.41	2.31	8.13	200	≥90
	Present	29.37	2.46	8.38	1400	
					(42 trees)	90
	Van Campo & Elhai (1956)	30.20	—	—	—	—

TABLE 2. ANALYSIS OF VARIANCE OF POLLEN GRAIN SIZES, MEASURED AS POLAR DIAMETER, OF *QUERCUS ROBUR* AND *QUERCUS PETRAEA*

	Degrees of freedom	Sums of squares	Mean square	Variance ratio	Significance level
Between species	1	4655.05	4655.05	828.30	< 0.001
Within species	2694	15139.20	5.62		
Total	2695	19794.25			

Table 1 compares the results of this survey with those of Olsson (1975) and Van Campo & Elhai (1956). The mean polar diameter of pollen grains of *Q. petraea* was 29.37 μm whilst that of *Q. robur*

was 26.74 μm ; this difference proved to be significant when subjected to analysis of variance (Table 2). The method of pollen preparation differed from that of Olsson and Van Campo & Elhai and, since grain size is related to preparative technique, some discrepancies between previous data and those presented here might have been expected. However, differences between the three surveys were small.

247 suspected hybrid trees, i.e. trees of morphological intermediacy, were assessed for pollen grain size and a representative range of these is given in Table 3. Fig. 1 compares the frequency

TABLE 3. POLLEN GRAIN SIZE, MEASURED AS POLAR DIAMETER, OF SUSPECTED HYBRID OAK TREES

Tree number	Mean (μm)	Standard deviation (μm)	Coefficient of variation (%)	Sample size	% Pollen viability
1	24.73	2.97	12.01	100	46
2	25.54	4.17	16.33	50	29
3	26.09	3.34	12.80	50	65
4	26.24	3.58	13.64	150	18
5	26.66	3.48	13.05	125	72
6	27.66	4.63	16.74	100	48
7	28.99	3.16	10.90	100	35
8	29.06	4.49	15.45	150	33
9	29.24	3.04	10.40	140	58
10	29.66	2.87	9.68	75	48
11	30.11	4.39	14.58	75	22
12	31.01	4.33	13.96	150	27
13	39.72	4.94	12.44	100	36
14	42.34	5.81	13.72	125	25

histograms of pollen grain polar diameters of a representative *Q. petraea* tree, a representative *Q. robur* tree, and two suspected hybrid trees. The percentage pollen viability of putative hybrids was always below 75%, the lowest recorded value being 16% and the average 37%. Whilst some suspected hybrid trees showed mean pollen grain polar diameters corresponding to those of the pure species, others were intermediate and still others were outside the range exhibited by either *Q. robur* or *Q. petraea*, e.g. Table 3, trees nos. 1 and 12. However, the important characteristic shown by suspected hybrids was a higher coefficient of variation due primarily to a higher standard deviation of the mean, e.g. Fig. 1, tree IRP027. Tree IRP109 (Fig. 1) shows a somewhat less common pattern, a bimodal (more rarely polymodal) distribution. The higher coefficient of variation of pollen grain size detected in suspected hybrid trees combined with measures of pollen viability and morphological status might well improve the recognition of hybrid oaks. Some suspected hybrid trees showed mean pollen grain sizes far in excess of the normal species ranges (Table 3, trees nos. 13 and 14). Olsson (1975) identified such individuals as *Quercus petraea* $\times$ *Q. robur* f. *mespilifolia* (Wallr.) Weimarck, a form with subentire leaves. However, neither trees nos. 13 and 14, nor indeed any other oak in the present study with a mean pollen grain polar diameter above 37 μm , showed subentire leaves. Such trees may well be hybrids but the large difference in pollen grain size, approximately 50% greater than that of *Q. robur*, could be due to polyploidy.

Unfortunately, the differences in pollen grain size between *Q. robur* and *Q. petraea* reported here and elsewhere are of no help to the palynologist, since the difference is slight and comparatively large samples are required from individual trees to determine their status correctly. A single pollen grain would be impossible to identify due to the wide overlap and range of sizes exhibited by the species (Fig. 1). Exine and sexine size differences (Rushton 1974) would appear to have more potential for use in palynology.

This survey did not include material from Scotland, where the taxonomic status of some oak woodlands is still a matter for debate (Jones 1968). An extension of the present survey to include pure species and suspected hybrid material from Scotland and elsewhere could help settle what Gardiner (1970) has rightly described as a hybrid controversy, since pollen grain size appears to provide useful contributory evidence to studies of hybrid oaks.

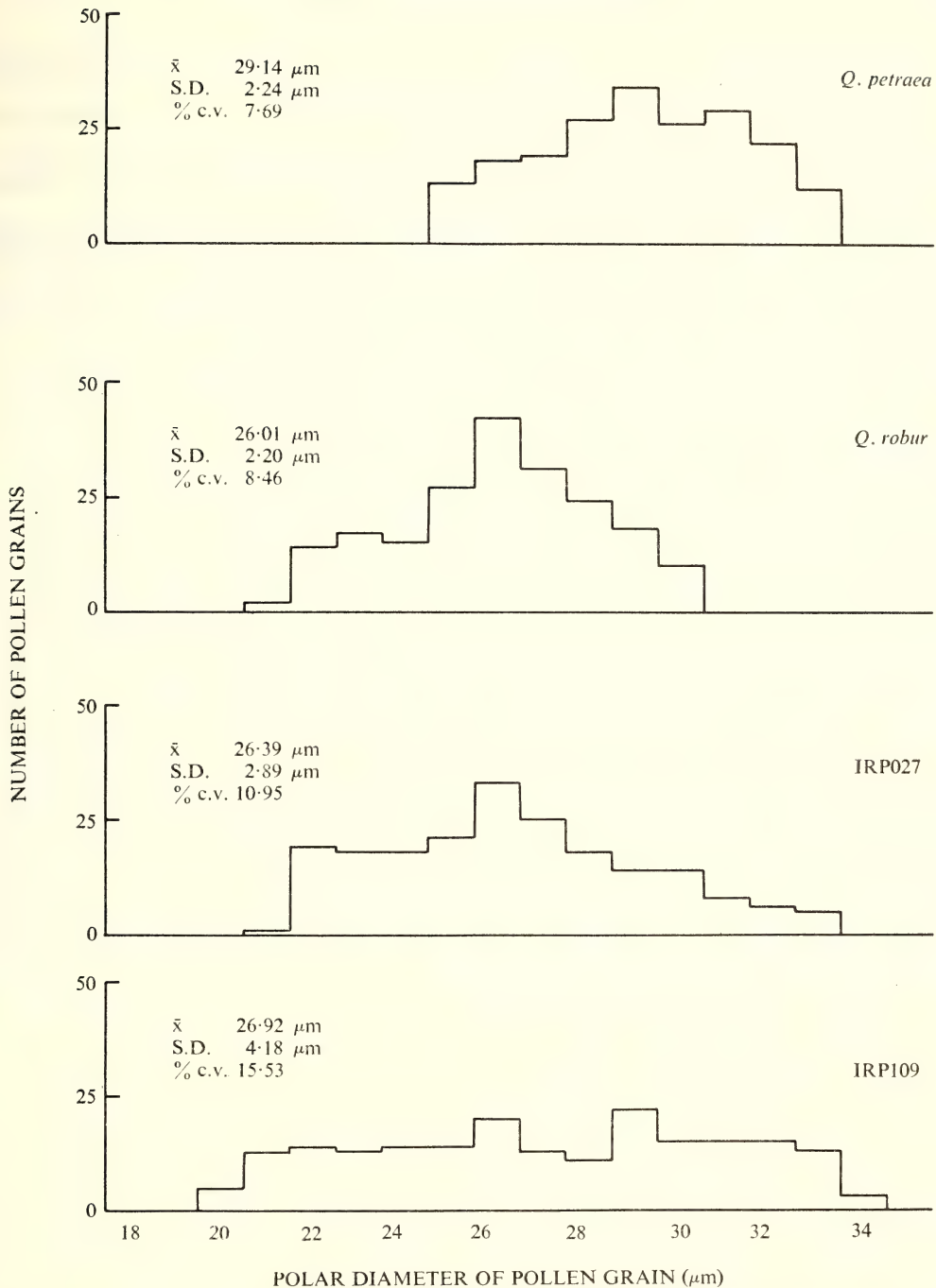


FIGURE 1. Histograms of pollen grain size (polar diameter) of a tree of *Quercus petraea*, a tree of *Q. robur*, and two suspected hybrid trees, IRP027 and IRP109. ($\bar{x}$ = mean, S.D. = standard deviation, % c.v. = coefficient of variation).

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(Accepted February 1976)

Short Notes

LENGTH AND INSERTION OF THE FILAMENTS IN *ENDYMION*

Chicken (1973) has recently drawn attention to the possible rapid increase of the Spanish Bluebell, *Endymion hispanicus* (Mill.) Chouard, and its hybrids with the Common Bluebell, *E. non-scriptus* (L.) Garcke, in northern England and has suggested that the plant may be under-recorded in Britain. In the attempt to check the identity of plants growing on a roadside verge near Bristol, N. Somerset (v.c. 6), I examined fairly closely the differences between the two species as given by Warburg (1962) and others. As Chicken says, the horizontal, more open perianth of *E. hispanicus* is recognizable at a distance, and the blue anthers of this species provide a confirmatory character; but a further distinction given by Warburg - 'Filaments all inserted about middle of perianth' in *E. hispanicus*, and '... outer inserted about middle of perianth, inner lower' in *E. non-scriptus* - cannot be upheld, as will be shown below.

Baker (1872) reported on a large collection of 'Wood Hyacinths' obtained from various sources, classifying them into eight groups distinguished mainly by the shape of the perianth and the length and attachment of the stamen filaments. These two characters were, in general, associated - 'the absolute length [of the filaments] being increased, and the proportion that is adnate [to the perianth] greater the higher and more distinctly the [perianth] segments are permanently connivent'. Numbering the groups in order in this respect and comparing them with the existing published figures, he found no difficulty in identifying nos 1 and 2 with *E. non-scriptus* and nos 5, 6 and 7 with *E. hispanicus*. Nos 3 and 4 were intermediate between these two, whilst no. 8 was 'a more extreme form' than *E. hispanicus*. He concluded that the whole range could scarcely be regarded as other than 'a single species in a broad scientific sense'. Unfortunately, he made no mention of the colour of the anthers.

Baker defined the attachment of the filaments in general terms, ranging from 'free at the top only' through 'free in the upper half' to 'attached at the very base only'. However, by expressing these characters numerically, as estimated percentages of the total filament length attached, it has been possible to represent Baker's data diagrammatically (Fig. 1A, groups 1 & 2; Fig. 1B, groups 5-7).

A similar diagram (Fig. 1C) has also been prepared from the account of *E. hispanicus* given by Turrill (1952). Turrill noted the ready occurrence of hybridization with *E. non-scriptus* when the two species are grown together in gardens and suggested that, in their natural distribution, they

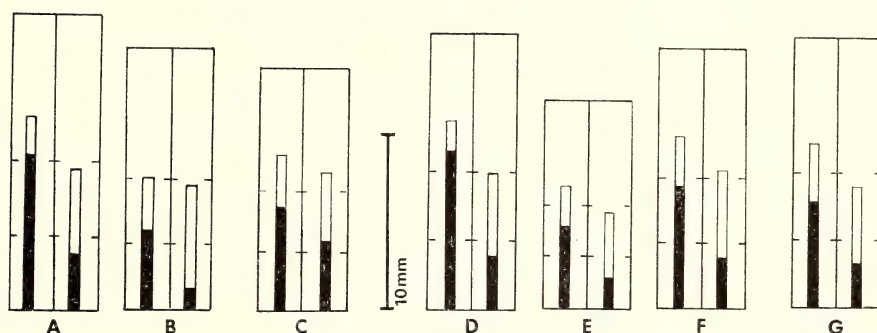


FIGURE 1. Diagrammatic representation of length of perianth segments and length and attachment of stamen filament in (A, D) *Endymion non-scriptus*, (B, C, E, F) *E. hispanicus* and (G) their putative hybrid. (See text for origins). In each diagram, the outer perianth segment and its associated filament is shown on the left, the inner on the right. The wide rectangles represent the perianth segments and the narrow the filaments (with the attached portion shown solid). The diagrams are drawn to scale in the vertical axis only.

are probably vicarious. Both species and their hybrid are illustrated, but the ultimate origin of the specimen of *E. hispanicus* is not stated. It is a typically robust plant, as commonly seen in gardens, and is depicted with blue anthers (although this character is not mentioned in the text). It would appear to agree fairly closely with group no. 7 of Baker (1872).

The remaining diagrams (Fig. 1D–1G) refer to my own data, from the following material:

- 1D. *Endymion non-scriptus* – 13 plants from three localities near Bristol, N. Somerset (v.c. 6); one of them within a few metres of the plants represented by Figure 1G, i.e. on the same roadside verge, the others in woods nearby.
 1E. *E. hispanicus* – six plants collected in Portugal, 1908, and Spain, 1925 (BRIST).
 1F. *E. hispanicus* – 20 cultivated plants, from three local gardens.
 1G. The five plants which it was originally sought to identify, from a roadside verge near Bristol (see above).

All measurements were made as far as possible from flowers at a uniform stage of development, when the anthers of the inner stamens had just started to dehisce.

Study of the data summarized in Fig. 1A–1F suggests that the most consistent difference between the two species, as far as the length and attachment of their stamens is concerned, may be expressed as follows:

E. non-scriptus: Filaments distinctly unequal; the inner barely $\frac{3}{4}$ the outer; the outer inserted just above the middle of the perianth, adnate to it for more than $\frac{3}{4}$ their length.

E. hispanicus: Filaments subequal; the inner at least $\frac{4}{5}$ the outer; the outer inserted below the middle of the perianth, adnate to it for less than $\frac{3}{4}$ their length.

Smith (1975) stated that, in many of the hybrids, the stamens 'are inserted fairly close together near the middle of the perianth', noting that 'the anthers vary in colour from cream to blue'. My plants, represented in Fig. 1G, had the general appearance of rather slender *E. hispanicus*. They had the blue anthers of that species, but in relative filament length (inner a little under $\frac{3}{4}$ the outer) they approached *E. non-scriptus*. Probably, they are best regarded as hybrids.

In recording *E. hispanicus* and its putative hybrids with *E. non-scriptus*, close attention to the length and attachment of the filaments is obviously desirable.

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T. E. T. BOND

CHROMOSOME NUMBERS OF BRITISH PLANTS, 4

Grid Reference and locality

Cochlearia alpina (Bab.)

H. C. Watson

- $n = 6$ 35/71.31 Green Castle, Westmorland, v.c. 69
 $n = 6$ 34/98.89 Woodall, Wensleydale, N.W. Yorks., v.c. 65
 $n = 6$ 34/99.64 Grassington, Mid-W. Yorks., v.c. 64
 $n = 6$ 43/15.82 Dirlow Rake, Castleton, Derbys., v.c. 57
 $2n = 12$ As last
 $2n = 26$ 37/16.77 Glas Maol, Forfar, v.c. 90
 $2n = 24$ 31/46.54 Cheddar Gorge, N. Somerset, v.c. 6

Draba incana L.

- $2n = 32$ 35/81.30 Widdybank Fell, Teesdale, Durham, v.c. 66
 $n = 16$ As last

	<i>n</i> = 16	35/84.28 Cronkley Fell, Teesdale, N.W. Yorks., v.c. 65
	<i>n</i> = 16	43/16.72 Millers Dale, Derbys., v.c. 57
<i>Juncus alpinoarticulatus</i> Chaix	<i>2n</i> = 40	35/81.29 Widdybank Fell, Teesdale, Durham, v.c. 66
	<i>n</i> = 20	As last
	<i>2n</i> = 40	35/83.31 Sand Sike, Teesdale, Durham, v.c. 66
	<i>2n</i> = 40	35/90.27 Winch Bridge, Teesdale, Durham, v.c. 66
	<i>2n</i> = 40	37/14.76 Glenshee, E. Perth, v.c. 89
	<i>2n</i> = 40	37/14.70 Morrone, Braemar, S. Aberdeen, v.c. 92
	<i>2n</i> = 40	37/72.56 Shiehallion, Mid Perth, v.c. 88
	<i>2n</i> = 40	27/94.61 Ben Vrackie, E. Perth, v.c. 89
	<i>2n</i> = 40	36/42.11 Branxholme, Roxburgh, v.c. 80
<i>Juncus nodulosus</i> Wahlenb. var. <i>marshallii</i> (Pugsl.) P. W. Richards	<i>2n</i> = 40	28/50.57 Loch Ussie, E. Ross, v.c. 106
<i>Carex ericetorum</i> Poll.	<i>n</i> = 15	35/81.30 Widdybank Fell, Teesdale, Durham, v.c. 66
	<i>n</i> = 15	35/84.28 Cronkley Fell, Teesdale, N.W. Yorks., v.c. 65
	<i>n</i> = 15	34/45.77 Arnside Knott, Westmorland, v.c. 69
	<i>n</i> = 15	34/46.73 Jenny Brown's Point, W. Lancs., v.c. 60
	<i>n</i> = 15	44/50.17 Kirk Smeaton, S.W. Yorks., v.c. 63
	<i>n</i> = 15	43/50.74 Markland Grips, Derbys., v.c. 57
	<i>n</i> = 15	53/80.90 Grimes Graves, W. Norfolk, v.c. 28
	<i>n</i> = 15	52/73.77 Foxhole Heath, W. Suffolk, v.c. 26

G. M. FEARN

FLOWER-BASKING BY INSECTS IN BRITAIN

Hocking & Sharplin (1965) and Hocking (1968) showed that in the Arctic there is a predominance of white flowers, many of them cup-shaped, and concluded that the reason for this was that these reflected the sun to a focus so that the temperature inside the flower becomes greater than that outside. They postulated that, with this temperature increase, the fertilized ovaries could mature more quickly (important with such short summers) and also that nectar production would be stimulated. In addition it could act directly as an attractant for insect visitors in the cold environment. Using thermocouples, Hocking & Sharplin (1965) recorded a difference in temperature of up to 6.5°C in the corolla of *Dryas integrifolia* M. Vahl and 10.5°C in *Papaver radiculatum* Rottb. (a larger flower) compared with positions outside the corollas. Hocking's (1968) figures are smaller, recording only up to 4.4°C difference in *Dryas integrifolia* (mean 1.6°C) and up to 3.6°C in *Papaver radiculatum* (mean 3.4°C). My observations suggest that this phenomenon may be much more widespread.

Parnassia palustris in Britain flowers from July to October, with a peak in the area studied (Cothill Marsh, Oxon., v.c. 23) around mid-September, when the air temperature is considerably lower than earlier in the year. On the morning of 13th September 1975, a cool, still, sunny morning, several flies, in particular the syrphids *Helophilus pendulus* L. and *Eristalis tenax* L., were observed to visit the flowers of *Parnassia* and sit and groom themselves in addition to feeding on the nectar. In many cases the visits to *Parnassia* were interspersed with visits to other flowers, particularly *Succisa pratensis*. In these cases the insects fed quite briefly at the *Succisa* and rested for some time in the *Parnassia* flowers. Since several insects visited more than one flower of *Parnassia*, it is likely that these were incidentally pollinated. *Parnassia* is adapted particularly for pollination by the larger Diptera such as those above, and smaller insects rarely effect pollination (Knuth 1908). Knuth also noted that the larger Syrphidae usually settle across the middle of the flowers to feed at the nectaries, a habit which I also observed, and perhaps this is related to the position of focus of the warmth. The plant is clearly adapted for this habit since the anthers dehisce one at a time over the centre of the flower. Previous workers (see Proctor & Yeo 1973) have not considered this aspect.

No thermocouples were available to me at the time of the observations in Oxon., but on 7th October 1975, again a sunny though windy morning, I recorded the temperature inside and outside *Parnassia* flowers on Scotstown Moor near Aberdeen, S. Aberdeen, v.c. 92, using a thermocouple placed in roughly the position in which I had previously observed the hoverflies to sit. The temperature inside the flowers was significantly higher than that immediately outside, the difference being 1.4°C–2.9°C (mean 2.04°C). The ambient air temperature was approximately 10°C. These differences are quite similar in magnitude to those shown by Hocking (1968) in the Arctic, but would almost certainly be greater on a still day such as the morning of the initial observations. The added heat would probably be most important for the insects early in the morning when the air is cool.

Many intriguing questions are posed by these observations and there seems to be great potential for further study. How widespread is this phenomenon and what is the importance of it as a stimulus for increased nectar production in the flower and as a direct attractant for insects? It is probable that the temperature increase is more important for Diptera and small Hymenoptera than for bumblebees since it has recently been postulated (Newsholme *et al.* 1972) that these may be able to generate their own heat by internal enzyme reactions. Many plants common in Britain have pale, cup-shaped flowers and thus may show this effect to some extent, e.g. species of Ranunculaceae, Hypericaceae, Nymphaeaceae, Caryophyllaceae and Rosaceae. It is probably more important in spring and autumn than in summer, and this might be reflected in the succession of flower colour, pale colours predominating early in the year but blues and purples in midsummer.

ACKNOWLEDGMENTS

I am very grateful to Mr C. O'Toole of the Hope Department of Entomology, University of Oxford, for identifying the insects, and to Dr N. M. Pritchard of the Department of Botany, University of Aberdeen, for encouragement and criticism.

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A. J. LACK

THREE SPECIES OF POLYGONACEAE ESTABLISHED IN BRITAIN

The B.S.B.I. has in preparation a handbook for the identification of Polygonaceae found in the British Isles and it therefore seems desirable to report now three seldom-grown species which appear to be permanently established outside gardens.

1. *Polygonum alpinum* All., *Mélang. Philos. Math. Soc. Roy. Turin (Misc. Taur.)*, **5**: 94 (1774).

Stems 30–70 cm, stout, erect, arising from a creeping rhizome. Leaves 1–3 cm wide, lanceolate or broadly lanceolate, tapering to both ends, puberulous. Ochreae hyaline or brownish, soon becoming torn and falling. Flowers in a loose, widely spreading panicle. Perianth segments white or pink, subequal. Nut (not yet seen in Britain) 4–5 mm, slightly exceeding perianth, trigonous, pale brown, shining. Pyrenees, Alps, Appennines, Carpathians, and mountains of Balkans, Orient, Central Asia and Siberia.

S. Aberdeen, v.c. 92: naturalized with lupins on river shingle, Ballater, 1968, *Lady Sally Paget*, comm. D. McClintock, herb. J.E.L.; Ballater, on a shingle island, patch some 3 m long, 1975, *J. E. Lousley*, herb. J.E.L. My own gathering has very much narrower leaves than Lady Paget's specimen although it is believed to be from the same colony.

The species was reported earlier from Argyll, v.c. 98: shore between Innellan and Dunoon, 10th July 1909, *J. Fraser*, E, *Ann. Scot. nat. Hist.*, 1911: 102 (1911) and quoted (incorrectly) in *Rep. Botl Soc. Exch. Club Br. Isl.*, 3: 30 (1912).

In addition there is an allied plant, with narrower leaves usually less than 1 cm wide and smaller and less congested flowers, which was collected in Stirling, v.c. 86: garden weed near Kirkintilloch, undated, *A. W. Exell* 2238, BM; one plant as weed in bed, Solsgirth, Kirkintilloch, 1967, *D. McClintock*, herb. J.E.L. This is a shorter plant which deserves a separate name, but it has not been found outside gardens. The two gatherings differ considerably.

2. *Polygonum molle* D. Don, *Prodr. Fl. Nepal.*, p. 72 (1825) (*Aconogonum molle* (D. Don) Hara, *Fl. E. Himal.*, 1: 68 (1966); *Polygonum paniculatum* Blume, *Bijdr. Fl. Ned. Ind.*, p. 153 (1825-6); *Polygonum rude* Meisn. in DC., *Prodr.*, 14: 137 (1856); *Polygonum frondosum* Meisn. in DC., *Prodr.*, 14: 137 (1856); *Aconogonum molle* var. *frondosum* (Meisn.) Hara, *Fl. E. Himal.*, 1: 68 (1966); *Aconogonum molle* var. *rude* (Meisn.) Hara, *Fl. E. Himal.*, 1: 68 (1966)).

Stout, bushy perennial allied to *P. polystachyum*. Stems 60-100 cm; branches stout with appressed hairs. Ochreae cylindrical, or the upper cyathiform, covered with long silky hairs. Leaves lanceolate or broad-lanceolate, 2-7.5 cm wide, up to 25 cm long, acute or sometimes acuminate, ciliate, pubescent above, pilose below, the younger leaves subsericeous; petioles of upper leaves up to 1.5 cm. Panicle terminal, thyrsoid, flowers with small (less than 2 mm), white perianths on hairy branches. Perianth said to become fleshy. Himalayas, S.E. Asia.

N. Lincs., v.c. 54: Woodhall Spa, 'alien or escape', 1921, *A. H. G. Alston*, BM.

Argyll, v.c. 98: Coylet, Loch Eck, GR 26/143.878, 1956, 1969, 1970, *P. Macpherson*, herb. J.E.L.

At the Loch Eck station there are three patches, each about 20 m long, near a house with a walled garden, and there is no doubt that some or all of the colonies arose from material from this garden, where it still grows. The present owners say that when they took over the garden about 1960 they tried to dig out the 'roots' and threw them out on the other side of the road, where they spread down the slope towards the shore, but it had already attracted Dr Macpherson's attention four years earlier. There are three more clumps near the Coylet Hotel over half a mile to the north.

P. molle D. Don, as here recognized, comprises a group of closely related taxa which grade into one another in Asia, and are probably best treated as varieties of *P. molle* D. Don (the earliest name). Typical *P. molle* (var. *molle*) has densely hirsute stems, long-appressed-pubescent petioles, and densely pubescent leaf-laminae and inflorescence rhachides; *P. paniculatum* (*Aconogonum molle* var. *frondosum*) is more or less glabrous; and *P. rude* (*Aconogonum molle* var. *rude*) has hirsute stems, long-retroscissely-appressed-pubescent petioles, and pubescent leaf-laminae and inflorescence rhachides. The latter two have apparently not been found outside gardens in this country.

Most of the 'Hairy-stemmed Polygonums' exhibited by D. McClintock at the 1974 B.S.B.I. Exhibition Meeting (McClintock 1975) belong to *P. molle*, but the specimens are at present mislaid.

3. *Fagopyrum dibotrys* (D. Don) Hara, *Fl. E. Himal.*, 1: 69 (1966) & *op. cit.*, 2: 22 (1971) (*Polygonum dibotrys* D. Don, *Prodr. Fl. Nepal.*, p. 73 (1825); *Polygonum cymosum* Trev., *Nova. Acta. Acad. Leop.-Carol.*, 13: 177 (1826); *Fagopyrum cymosum* (Trev.) Meisn., in Wall., *Pl. Asiat. Rarior.*, 3: 63 (1832)).

Tall, branching, sparsely pubescent perennial with stout, annual stems 1m or more tall. Lower leaves c 10 × 9 cm, broadly triangular, cordate, acute or obtuse, sparsely pubescent; upper leaves narrower, acute, sometimes amplexicaul. Panicle open, with widely spreading branches each 4-10 cm. Flowers congested near tips of branches, mostly on short pedicels, white. Himalayas (Kashmir to Sikkim), Khasia Mountains, Manipur, Tibet, Thailand and China (Yunnan, Szechuan, Ichang, Shanghai).

Pemb., v.c. 45: 'A strong colony beside the road between Townsend and Cliff Cottages' (as *Fagopyrum esculentum*) (George 1961); (same place), just north of Dale, a large patch on the cliff side of the road, no houses very near, August 1975, *J. E. Lousley*, herb. J.E.L., BM.

Although not often grown today, it was introduced into Britain before 1846, said to have been

sent to the Horticultural Society from China by Capt. Munro (Lindley 1846), and a little later stated to have been introduced by the East India Company (Lindley 1852). William Borrer (1781–1862) collected it from a garden (K).

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J. E. LOUSLEY

MARITIME SPECIES ON ROADSIDE VERGES

Rock salt is used for de-icing roads (Westing 1969) and it has been calculated (Davison 1971) that this can lead to roadside soils and vegetation receiving a deposit of 3 to 4 kg salt/m²/year. This, coupled with the effects of grit, oil and other debris, often has a drastic effect on the roadside flora. Usually the number of species is reduced and the flora often consists solely of sparse patches of *Agropyron repens*, *Atriplex patula*, *Polygonum aviculare sensu lato*, *Poa pratensis*, *Taraxacum* sect. *Vulgaria* and *Agrostis* spp.

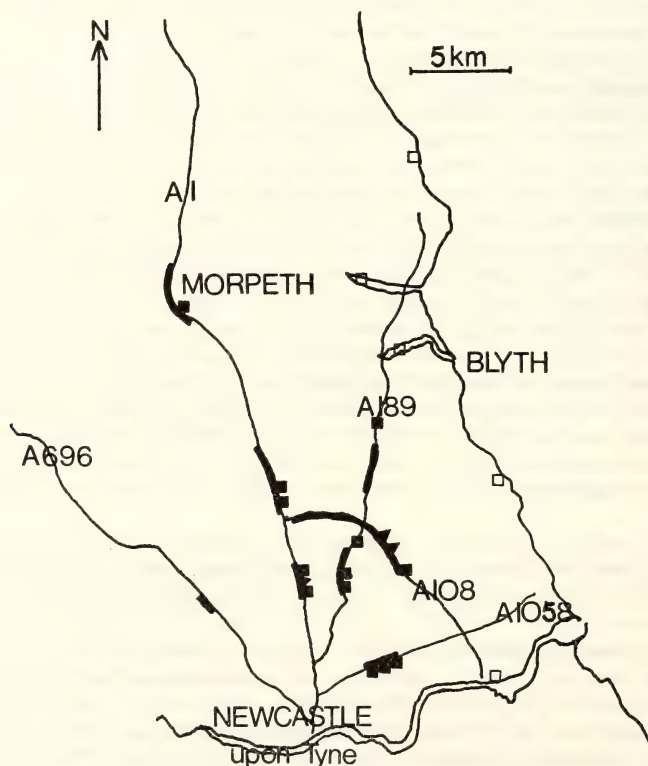


FIGURE 1. Distribution of *Puccinellia distans* showing areas of highest density of plants along the roadside (continuous heavy line).

- Roadside localities for *A. tripolium*.
- Some of the previously known localities for *A. tripolium*.
- ▲ Roadside localities for *S. maritima*.

Recently, however, the authors started a detailed floristic survey of verges in south-eastern Northumberland, and discovered a number of maritime species growing on the saline verges of several trunk roads (Fig. 1). The sites are 7 to 13 km from the coast. The maritime species found were: *Aster tripolium*, *Plantago coronopus*, *Plantago maritima*, *Puccinellia distans*, *Puccinellia maritima*, *Spergularia marina*, *Spergularia media*, *Suaeda maritima*.

The distribution and abundance of the species is very variable. Both species of *Puccinellia* occur along many kilometres of the A1, A696, A189, A108 and A1058, with *P. maritima* in tussocks up to 70 cm in diameter. All the species flower, and seedlings of *P. distans* have been recorded. Perhaps the most surprising records are those of *Aster tripolium* and *Suaeda maritima*. The latter species is scattered but populations consist of hundreds of individuals. The remaining species are less frequent though the individual plants are often large and flower well. One individual of *Plantago maritima* had 60 scapes.

There are three obvious sources of these plants. First, they could be deliberate introductions as part of an experimental trial. However, neither the Nature Conservancy Council nor the County Planning Office have any record of this being the case and it is difficult to see how such a large-scale operation could be done without the knowledge of either of the above organizations. At the same time, deliberate introduction cannot be ruled out at present and the authors would appreciate receiving information from any reader with any knowledge of experimental trials with maritime species. The second possibility is that the topsoil used on the verges was imported from maritime sites and therefore contained seeds and plants. Unfortunately, the authors have not been able to trace the sources of the soil, but there are no records of soil being removed on such a scale from any local maritime habitats. The third possibility is that seeds were transported and deposited by cars returning from the coast. There are several localities on the coast where cars have access to suitable habitats and so this is regarded as the most probable source. However, it is interesting that most of the roads have been in existence for less than three years, so incursion has been very rapid. It is also possible that birds (gulls, moorhens, rooks, jackdaws) might introduce some seed but this would appear to be a minor source compared with the scale and speed of the incursion. Introduction in the de-icing salt is not considered an important possibility because none of the species has been found near any of the salt stockpiles.

A full list of localities has been deposited with the vice-county recorder.

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P. MATTHEWS & A. W. DAVISON

REDISCOVERY OF *HYMENOPHYLLUM WILSONII* HOOK. IN SALOP

The rediscovery of *Hymenophyllum wilsonii* in Salop, v.c. 40, where it had previously been unrecorded for a century, occurred in 1973 during a survey of the distribution of *Oxalis acetosella* in the Long Mynd (GR 42/4.9). A specimen collected in 1975 is in BM. The following species were associated with *Hymenophyllum* in a 0.1m² quadrat:

<i>Deschampsia flexuosa</i>	<i>Dicranella heteromalla</i>
<i>Oxalis acetosella</i>	<i>Dicranum scoparium</i>
<i>Vaccinium myrtillus</i>	<i>Hypnum cupressiforme</i>
	<i>Mnium hornum</i>
<i>Diplophyllum albicans</i>	<i>Rhytidiadelphus squarrosus</i>
<i>Lepidozia reptans</i>	

The quadrat site faced almost due north, had a slope of 68° and was shaded by overhanging *Calluna vulgaris* established on the ledge above. Due to its steepness, the site was not grazed or trampled

by sheep as in most of the Long Mynd. The soil pH was 5.8 and plants are subjected to very little water stress, indeed during wet periods water oozes continuously down the rock face on which the vegetation mat is established.

The presence of *Hymenophyllum* in Salop was noted by Phillips (1877), in which the relevant entry reads:

Hymenophyllum unilaterale Willd.

Longmynd, near the Stiperstones: G; on the same mountain Spout Valley, near Church Stretton: Rev. J. F. Crouch; Treflach Wood near Oswestry: Moore.

The G in the quotation is a reference to G. H. Griffiths, M.D., of Shrewsbury. The records of Dr Griffiths and the Revd Crouch are in the same grid-square and with the same underlying rocks, Pre-Cambrian Longmyndian sediments, as the present site. The few subsequent references to *Hymenophyllum* in Salop, such as Campbell-Hyslop & Cobbold (1904), seem all to derive from Phillips' list.

The addition of the new record to the distribution map for *Hymenophyllum wilsonii* given by Perring & Walters (1962) is of considerable interest as it is the most easterly locality in the southern part of its distribution. The rainfall on the Long Mynd (40 in.) is much higher than that in some other parts of Salop, that at Shrewsbury being only 23 in. (Burnham & Mackney 1964). This is of great importance to a filmy fern such as *H. wilsonii* and records for this species, and for *H. tunbrigense* also, are confined to areas where the annual rainfall is not less than 30 inches. The Long Mynd site also has a low evapo-transpiration rate, being at an altitude of over 1,000 ft. The associated species listed above commonly occur with *Hymenophyllum* in mountainous areas of Scotland and Snowdonia.

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J. R. PACKHAM

EVALUATION OF ROADSIDE VERGES

Many highway authorities now realise the important amenity value of their roadside verges, and are prepared to conserve those of high-amenity value. Devon County Council, for instance, feel that 'the quality of the landscape, as seen by visitor and resident from the roads is paramount. This quality depends upon a healthy wildlife habitat being maintained along the roadsides, whose most significant characteristic is the richest possible population of wild flowers' (Steventon 1973). How then might one identify high-amenity verges, so that appropriate management could be practised?

In an attempt to discover this in a local context the flora of a selected group of verges around Tring, Herts., was noted during August 1974 (Reeve 1975). (Ideally the verges should be visited throughout the flowering season.) The verges selected were those on both sides of the first road north of the intersections of the 1km national grid lines. Clearly other conventions could be adopted. A further verge, known from casual observation to be species-rich, was also included, making 40 verges in all. A species list of plants occurring on each verge was made over 100 yards. Some 120 species of flowering plants, other than grasses, rushes and sedges, were noted. The latter groups were excluded from the evaluation because they were considered to be of low amenity value. However, they could, of course, be included in an evaluation. Each species was assigned a value which was the inverse of its frequency; a species found at only one site would therefore be rated at 40. The value of each individual verge was derived by adding the values of all the species

present. It follows that a verge with a high value is one with a large number of species of restricted distribution in the whole sample. The species-rich verge had a value significantly higher than any other verge. The results are summarized in Table 1.

TABLE 1. VALUE OF VERGES

No. of verges	Geology	Aspect	Range	Value Mean
1	chalk	W	1122	
11	chalk	SE-W	787-241	591 $\pm$ 54
11	chalk	NW-E	722-187	514 $\pm$ 40
6	gravel	SE-W	675-253	477 $\pm$ 66
7	gravel	NE-W	532-198	378 $\pm$ 36
2	clay	SE-W	362, 304	333
2	clay	NW-E	606, 330	468

The above method for evaluating verges provides a quantitative basis for identifying high-amenity verges from which verges can be selected for conservation. Conservation of rare or sensitive species would have to be considered separately.

ACKNOWLEDGMENTS

This note is based, in part, on a dissertation for the Certificate in Ecology and Conservation submitted to the University of London. My thanks are due to Dr F. B. Goldsmith who supervised the project.

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- REEVE, H. A. (1975). *A survey of roadside verge flora around Tring, Hertfordshire*. Certificate in Ecology and Conservation dissertation, University of London.
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H. A. REEVE

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 his subsequent revision (*Watsonia*, 7: 157-178 (1969)) but *Taraxacum* is arranged according to A. J. 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.

4/1. *EQUISETUM HYEMALE* L. 57, Derbys.: S. of Millington Green, GR 43/26.47. Wood. A. Willmot, 1975, **DBY**. 1st record for over 50 years. 59, S. Lancs.: Whalley, GR 34/73.35. Scrub by river. P. Jepson, 1975, **LIV**. 1st record since 1850.

4/10. *EQUISETUM TELMATEIA* Ehrh. 107, E. Sutherland: Dunrobin Castle, GR 29/85.00. Damp woodland. L. S. Garrad, 1972, field record. 2nd record.

7/2. *HYMENOPHYLLUM WILSONII* Hook. 40, Salop: see *Watsonia*, 11: 147-148 (1976).

21/3. *DRYOPTERIS ABBREVIATA* (DC.) Newm. 50, Denbigh: Migneint, Ysbyty Ifan, GR 23/80.44. Rocky outcrop. R. H. Roberts, 1975, field record. 2nd record. (*Nature Wales*, 15: 32 (1976)). *80, Roxburgh: Tod Craigs, Town Yetholm, GR 36/80.27. Greatmoor Hill, Newcastleton, GR 36/49.07. Both records on scree, R. W. M. Corner, 1974, **BM**, det. A. C. Jermy & J. M. Mullin. 1st and 2nd records.

25/1/2 × 1. *POLYPODIUM AUSTRALE* Fée × *P. VULGARE* L. *42, Brecon: Dan y darren, Crickhowell, GR 32/18.16. Limestone cliff. A. McG. Stirling, 1973, **E**, **NMW**, conf. R. H. Roberts.

25/1/3. *POLYPODIUM INTERJECTUM* Shivas *96, Easternness: Reelig Glen, Kirkhill, GR 28/55.42. Wall. M. McC. Webster, 1975, **E**, det. **BM**.

25/1/3 × 1. *POLYPODIUM INTERJECTUM* Shivas × *P. VULGARE* L. *96, Easternness: Tomich, GR 28/31.27. Rocky gully. M. McC. Webster, 1975, **E**, det. **BM**.

26/1. *PILULARIA GLOBULIFERA* L. 61, S.E. Yorks.: Skipwith Common, GR 44/66.37. T. F. Medd, 1974, field record. 1st post-1930 record.

†27/1. *AZOLLA FILICULOIDES* Lam. 1, W. Cornwall: Carn Marth, Redruth, GR 10/71.40. Flooded quarry. R. Murphy, 1972, field record. 2nd record. *50, Denbigh: Trefalun Meadows, Pulford, Wrexham, GR 33/40.58. Field ditch. A. G. Spencer, 1974, field record. (*Nature Wales*, 15: 32 (1976)).

34/1. *JUNIPERUS COMMUNIS* L. 45, Pembroke: Cemais Head, GR 22/12.49. Sea-cliff, 1 plant. S. B. Evans, 1975, field record. 2nd record. (*Nature Wales*, 15: 30 (1976)).

46/22b. *RANUNCULUS AQUATILIS* L. subsp. *PELTATUS* (Schrank) Syme *50, Denbigh: Trefalun Meadows, Pulford, GR 33/40.58. Field ditch. B.S.B.I. Meeting, 1975, field record, det. A. Newton. (*Nature Wales*, 15: 32 (1976)).

48/1. *MYOSURUS MINIMUS* L. *50, Denbigh: Trefalun Meadows, Pulford, Wrexham, GR 33/40.58. By field gate. A. G. Spencer, 1973, field record. (*Nature Wales*, 14: 204 (1975)).

58/4. *PAPAVER HYBRIDUM* L. †*106, E. Ross: Muir of Ord station, GR 28/52.50. Railway-yard. U. K. Duncan, 1975, field record.

66/7. *FUMARIA MICRANTHA* Lag. *106, E. Ross: Tore, Black Isle, GR 28/58.51. Field. M. McC. Webster, 1975, E.

66/8b. *FUMARIA OFFICINALIS* L. subsp. *WIRTGENII* (Koch) Arcangeli *66, Durham: Pierce-bridge, GR 45/20.15. Old Roman excavations. M. Burnip, 1974, herb. G. G. Graham, conf. M. G. Daker.

†76/2. *RAPISTRUM RUGOSUM* (L.) All. *57, Derbys.: Stoney Middleton, GR 43/22.75. Ditch. M. C. Hewitt, 1975, DBY. *96b, Nairn: Newton of Park, GR 28/90.54. Tip. M. McC. Webster, 1975, E.

†80/2. *CORONOPUS DIDYMUS* (L.) Sm. *96, Easternness: Longman, Inverness, GR 28/67.46. Lochend, GR 28/60.38. Both records M. McC. Webster, 1975, E. 1st and 2nd records.

88/6. *COCHLEARIA ANGLICA* L. *50, Denbigh: Furnace, Bodnant, Talycafn, GR 23/79.72. J. M. Brummitt, 1974, field record. (*Nature Wales*, 14: 204 (1975)).

94/4. *DRABA MURALIS* L. *72, Dumfries: Wanlockhead, GR 26/86.13. C.S.S.F. Meeting, 1975, DFS.

†100/3. *ARABIS CAUCASICA* Willd. *72, Dumfries: Dalveen Pass, GR 26/90.07. By stream. O. M. Stewart, 1974, E.

102/4 × 3. *RORIPPA PALUSTRIS* (L.) Bess. × *R. SYLVESTRIS* (L.) Bess. *73, Kirkcudbright: Maxwelltown, GR 25/97.76. By river. O. M. Stewart, 1975, K, det. R. D. Meikle.

102/5. *RORIPPA AMPHIBIA* (L.) Bess. *50, Denbigh: Trefalun Meadows, Pulford, Wrexham, GR 33/40.58. Field ditches. B.S.B.I. Meeting, 1975, field record, det. A. Newton. (*Nature Wales*, 15: 32 (1976)).

113/2. *VIOLA HIRTA* L. 80, Roxburgh: Deanbrae, Trow Burn, Hawick, GR 36/53.14. Wooded bank. M. E. Braithwaite, 1973, herb. R. W. M. Corner. 1st record this century.

113/6a. *VIOLA CANINA* L. subsp. *CANINA* *99, Dunbarton: Inchlonaig, Loch Lomond, GR 26/38.93. Shore. A. McG. Stirling, 1975, E.

†115/2. *HYPERICUM INODORUM* Mill. *45, Pembroke: Hook, GR 12/97.11. Hedgebank. J. W. Donovan, 1973, field record. (*Nature Wales*, 14: 202 (1975)).

133/3. *STELLARIA PALLIDA* (Dumort.) Piré *50, Denbigh: Bryn Ewyn, Colwyn Bay, GR 23/83.79. J. M. Brummitt, 1968, NMW. (*Nature Wales*, 12: 40 (1970)).

141/2. *ARENARIA LEPTOCLADOS* (Reichb.) Guss. 95, Moray: Waterford, Forres, GR 38/02.59. By river. M. McC. Webster, 1974, E, conf. A. O. Chater. 2nd record.

145/1. *CORRIGIOLA LITORALIS* L. †59, S. Lancs.: Huyton station, GR 33/44.90. N. F. McMillan, 1968, LIV, det. A. J. Richards. 2nd record.

154/2. *CHENOPODIUM POLYSPERMUM* L. *43, Radnor: 3 miles W. of Painscastle, GR 32/12.46. Lake-shore. B. R. Fowler, 1975, field record, det. J. P. M. Brenan. (*Nature Wales*, 15: 28 (1976)).

159/1. *SALSOLA KALI* L. *96, Easternness: Camp Sands, Fort George, GR 28/77.57. M. McC. Webster, 1975, E. Probably 1st record.

163/4. *MALVA NEGLECTA* Wallr. *73, Kirkcudbright: near Lochinvar Loch, GR 25/65.85. Roadside. R. C. L. Howitt, 1975, field record.

†170/4. *OXALIS EUROPAEA* Jord. *61, S.E. Yorks.: Skipwith, GR 44/65.38. Churchyard. T. F. Medd, 1972, field record.

†184/a. *LABURNUM ALPINUM* (Mill.) Bertold & J. Presl *96, Easternness: Fort Augustus, GR 28/38.08. Wood by loch. M. McC. Webster, 1975, E.

- 187/2. *ULEX GALLII* Planch. **96**, Easternness: Morayston, Dalcross, GR 28/74.49. Roadside bank. M. McC. Webster, 1975, E, conf. P. M. Benoit, 2nd record.
- 192/24. *TRIFOLIUM MICRANTHUM* Viv. ***73**, Kirkcudbright: Mossdale, GR 25/65.69. P. H. A. Sneath, 1973, LTR, det. A. O. Chater & T. G. Tutin.
- †203/1. *CORONILLA VARIA* L. ***49**, Caerns.: near Treborth Hall, Bangor, GR 23/55.70. Waste ground. Mrs P. Chapman, 1975, herb. M. Morris. (*Nature Wales*, **15**: 32 (1976)). ***72**, Dumfries: Kenneth Bank, GR 35/00.66. Roadside. H. Darke & E. Pringle, 1975, field record.
- †206/14. *VICIA SATIVA* L. **73**, Kirkcudbright: near South Corbely, GR 25/98.62. By stream in field. O. M. Stewart, 1975, field record. 1st post-1930 record.
- 206/16. *VICIA LATHYROIDES* L. **73**, Kirkcudbright: South Glen bay, Palnackie, GR 25/83.55. By shore. O. M. Stewart, 1975, DFS. 2nd record.
- †207/5. *LATHYRUS TUBEROSUS* L. ***96b**, Nairn: Newton of Park, GR 28/90.54. Tip. M. McC. Webster, 1975, E.
- 212/11. *POTENTILLA TABERNAEMONTANI* Aschers. ***61**, S.E. Yorks.: Knapton Wold, GR 44/89.74. G. Simpson, 1973, herb. F. E. Crackles.
- 212/14 × 13. *POTENTILLA ANGLICA* Laichard. × *P. ERECTA* (L.) Räusch. ***52**, Anglesley: Rhydwyn, GR 23/31.88. Grassland, with both parents. R. H. Roberts, 1975, herb. R.H.R. (*Nature Wales*, **15**: 33 (1976)). ***73**, Kirkcudbright: near Lochanhead, GR 25/91.71. By disused railway. O. M. Stewart, 1974, E, det. B. Matfield.
- 218/2. *AGRIMONIA ODORATA* (Gouan) Mill. ***107**, E. Sutherland: Creag an Amalaidh, GR 28/76.98. Rock-ledges. J. E. Kirby, 1974, field record, det. BM.
- 223/2. *POTERIUM POLYGAMUM* Waldst. & Kit. **61**, S.E. Yorks.: Hessle Road, Hull, GR 54/05.26. Railway siding. F. E. Crackles, 1972, herb. F.E.C. 2nd record.
- †226/3. *PRUNUS CERASIFERA* Ehrh. ***50**, Denbigh: Trefnant, St Asaph, GR 33/0.7. Hedgerow. D. Stephenson, 1975, NMW. (*Nature Wales*, **15**: 33 (1976)).
- †232/4/1. *SORBUS INTERMEDIA* (Ehrh.) Pers. ***57**, Derbys.: Brockwell, Chesterfield, GR 43/37.71. Near tip. M. C. Hewitt, 1975, field record.
- 232/5/7. *SORBUS RUPICOLA* (Syme) Hedl. ***75**, Ayr: Three Sisters Cliff, Portencross, West Kilbride, GR 26/17.50. Wooded cliff. A. McG. Stirling, 1975, field record.
- 232/7. *SORBUS TORMINALIS* (L.) Crantz **45**, Pembs.: Lawrenny, GR 22/00.06. Wooded river bank. T. A. W. Davis & S. B. Evans, 1975, NMW. 2nd record. (*Nature Wales*, **15**: 31 (1976)).
- 237/1. *CRASSULA TILLAEA* L.-Garland **96**, Easternness: Ballindarroch, Scaniport, GR 28/61.39. Garden paths. M. McC. Webster, 1975, E. 2nd record.
- †241/1. *TOLMIEA MENZIESII* (Pursh) Torr. & Gray ***57**, Derbys.: Brookbottom, GR 33/98.86. By stream. B. W. Fox, 1974, field record.
- †254/6. *EPILOBIUM ADENOCALON* Hausskn. ***72**, Dumfries: Auldgirth Inn, Dumfries, GR 25/91.86. M. McC. Webster, 1975, field record. 1st definite record. **95**, Moray: Kinloss, GR 38/06.61. M. McC. Webster, 1975, field record. 2nd record. **96**, Easternness: Culloden, GR 28/72.45. M. McC. Webster, 1975, E. 2nd record.
- 262/3. *CALLITRICHE OBTUSANGULA* Le Gall ***73**, Kirkcudbright: River Cree, near Wheeb Bridge, GR 25/33.86. O. M. Stewart. 1974, DFS, det. H. D. Schotsman.
- 285/2 × 3. *APIUM NODIFLORUM* (L.) Lag. × *A. REPENS* (Jacq.) Lag. ***61**, S.E. Yorks.: by Hornsea Mere, GR 54/19.47. F. E. Crackles, 1975, K, det. R. D. Meikle.
- 300/3. *OENANTHE SILAIFOLIA* Bieb. **61**, S.E. Yorks.: Bubwith, GR 44/70.36. Water meadow. E. Chicken, 1969, herb. E.C., conf. F. E. Crackles & W. A. Sledge. 2nd record.

†319/16. *EUPHORBIA CYPARISSIAS* L. *80, Roxburgh: S. of Shankend, GR 36/52.03. Old railway embankment. M. E. Braithwaite, 1975, herb. R. W. M. Corner.

320/1/4. *POLYGONUM ARENASTRUM* Bor. *94, Banff: Portessie, GR 38/44.66. M. McC. Webster, 1975, E. Probably 1st record.

320/10. *POLYGONUM LAPATHIFOLIUM* L. *96b, Nairn: Newton of Park, GR 28/90.54. M. McC. Webster, 1975, E.

320/16. *POLYGONUM DUMETORUM* L. 10, Wight: Alverstone Garden Village, GR 40/57.85. Disturbed woodland. J. E. Lousley, 1974, field record. 1st post-1930 and only extant record.

†320/20. *POLYGONUM SACHALINENSE* F. Schmidt 68, Cheviot: Beal, GR 46/06.42. G. A. & M. Swan, 1974, field record. 2nd record.

325/17. *RUMEX PALUSTRIS* Sm. †*44, Carms.: Cilycwm, GR 22/75.39. Garden. I. M. Vaughan, 1975, field record, det. N.M.W. 2nd Welsh record. (*Nature Wales*, 15: 29 (1976)).

325/18. *RUMEX MARITIMUS* L. 61, S.E. Yorks.: Grindale, GR 54/13.71. M. Taylor, 1973, field record. 1st post-1930 record.

342/4. *POPULUS NIGRA* L. *49, Caerns.: Talybont, Conway Valley, GR 23/76.68. Near Llandudno Junction, GR 23/80.77. Both records Mrs D. Stephenson, 1975, field record. 1st and 2nd records. (*Nature Wales*, 15: 32 (1976)).

343/5. *SALIX TRIANDRA* L. 61, S.E. Yorks.: bank of River Humber, near Skeffling, GR 54/38.17. F. E. Crackles, 1974, field record. 1st post-1930 record. *96, Easternness: Beaully, GR 28/53.45. Marsh by river. Aldowrie, GR 28/59.35. Both records M. McC. Webster, 1975, field record. 1st and 2nd records but probably planted. *106, E. Ross: N. of Achandunie, near Alness, GR 28/64.73. Mrs B. H. S. Russell, 1955, field record.

358/3. *VACCINIUM ULIGINOSUM* L. *80, Roxburgh: Birnside Moss, Hartsgarth, Newcastleton, GR 35/49.92. Peat bog. R. W. M. Corner, 1975, herb. R.W.M.C.

†358/6. *VACCINIUM MACROCARPON* Ait. *99, Dunbarton: Ardmore Point, near Helensburgh, GR 26/31.78. Damp heath. A. McG. Stirling, 1975, E.

368/1. *HOTTONIA PALUSTRIS* L. 50, Denbigh: Tybroughton, GR 33/4.4. J. M. Brummitt, 1975, field record. 2nd record. (*Nature Wales*, 15: 33 (1976)).

†370/4. *LYSIMACHIA CILIATA* L. *80, Roxburgh: Groundistone Heights, GR 36/49.20. Roadside. R. W. M. Corner, 1974, herb. R.W.M.C.

†370/5. *LYSIMACHIA PUNCTATA* L. *80, Roxburgh: near Carter Bar, GR 36/68.07. Roadside. M. E. Braithwaite, 1974, field record.

372/4. *ANAGALLIS MINIMA* (L.) E. H. L. Krause *96, Easternness: Ardersier, GR 28/77.55. Cart track. M. McC. Webster, 1975, BM,E. 1st definite record.

400/4 × 1. *MYOSOTIS CAESPITOSA* K. F. Schultz × *M. SCORPIOIDES* L. *52, Anglesey: Llyn Cerrig Bach, near Valley, GR 23/30.76. By lake. R. H. Roberts, 1975, herb. R.H.R. (*Nature Wales*, 15: 33 (1976)).

†406/2. *CALYSTEGIA PULCHRA* Brummitt & Heywood *96b, Nairn: Newton of Park, GR 28/90.54. By tip. M. McC. Webster, 1975, E.

†409/2. *LYCIUM CHINENSE* Mill. *68, Cheviot: Holy Island, GR 46/12.41. G. A. & M. Swan, 1974, herb. G.A.S., conf. F. H. Perring. 1st definite record.

416/7. *VERBASCUM NIGRUM* L. 50, Denbigh: Chirk, GR 33/29.37. Roadside bank. J. M. Brummitt, 1974, field record. 1st post-1930 record. (*Nature Wales*, 14: 204 (1975)).

416/10. *VERBASCUM VIRGATUM* Stokes *106, E. Ross: Munloch Bay, GR 28/68.52. A. Higginbottom, 1975, field record, det. I. K. Ferguson.

424/3. *SCROPHULARIA UMBROSA* Dumort. *78, Peebles: near Romanus Bridge, GR 36/16.48. D. J. McCosh, 1968, *herb.* D. J. McC., det. C. W. Muirhead.

†425/1 × 2. *MIMULUS GUTTATUS* DC. × *M. LUTEUS* L. *33, E. Gloucs.: Eastington, North-leach, GR 42/13.13. In river. S. C. Holland, 1974, field record, det. R. H. Roberts. Known for over 20 years.

†428/1. *ERINUS ALPINUS* L. *52, Anglesey: Beaumaris, GR 23/60.75. Old walls. R. H. Roberts, 1975, field record. (*Nature Wales*, 15: 33 (1976)).

†445/3 × 5. *MENTHA ARVENSIS* L. × *M. SPICATA* L. *96, Easternness: Raigmore pond, Inverness, GR 28/68.45. M. McC. Webster, 1975, E, det. R. M. Harley.

459/5. *STACHYS ALPINA* L. 50, Denbigh: Cilygroslywd Wood, Ruthin, GR 33/12.55. Open limestone woodland. B. Ing, 1973, field record. 2nd record. (*Nature Wales*, 15: 33 (1976)).

459/6 × 7. *STACHYS PALUSTRIS* L. × *S. SYLVATICA* L. *95, Moray: Grantown-on-Spey, GR 38/03.26. By old bridge. M. McC. Webster, 1975, E. *96b, Nairn: Cran Loch, Nairn, GR 28/94.59. Edge of loch. M. McC. Webster, 1975, E.

†475/5. *CAMPANULA PERSICIFOLIA* L. 61, S.E. Yorks.: Allerthorpe Common, GR 44/75.47. E. J. Chicken, 1975, field record. 2nd record. *73, Kirkcudbright: Lauriston, GR 25/68.64. Hedgerow. O. M. Stewart, 1975, field record.

478/2. *PHYTEUMA SPICATUM* L. †*57, Derbys.: Ednaston, GR 43/23.42. Under trees by drive. K. Hollick, 1975, *DBY*, det. D. McClintock. Known for over 40 years.

498/1. *KNAUTIA ARVENSIS* (L.) Coult. *96b, Nairn: Nairn, GR 28/89.56. Railway embankment. M. McC. Webster, 1975, E.

502/2. *BIDENS TRIPARTITA* L. 50, Denbigh: Llannerch bridge, Trefnant, St Asaph, GR 33/05.72. J. M. Brummitt, 1975, field record. 1st record for 50 years. (*Nature Wales*, 15: 33 (1976)).

506/2 × 1. *SENECIO AQUATICUS* Hill × *S. JACOBAEA* L. *52, Anglesey: near Afon Llugwy, Penrhosllugwy, GR 23/48.85. R. H. Roberts, 1975, field record. (*Nature Wales*, 15: 33 (1976)). *96, Easternness: Corrimony, Glen Urquhart, GR 28/39.30. M. McC. Webster, 1975, E.

†506/4. *SENECIO SQUALIDUS* L. *106, E. Ross: Muir of Ord station, GR 28/52.50. U. K. Duncan, 1975, *herb.* U.K.D.

†519/6a. *ASTER NOVI-BELGII* L. subsp. *NOVI-BELGII* *80, Roxburgh: ½ mile E. of Stobs Home Farm, 6 km S. of Hawick, GR 36/51.08. By stream. R. W. M. Corner, 1974, *herb.* R.W.M.C., det. P. F. Yeo.

†519/7. *ASTER LAEVIS* L. *96b, Nairn: Nairn, GR 28/89.56. Railway embankment. M. McC. Webster, 1975, E.

†519/9. *ASTER SALIGNUS* Willd. *96, Easternness: Kingussie, GR 28/75.00. By stream. M. McC. Webster, 1975, E.

†535/2. *ARTEMISIA VERLITORUM* Lamotte *67, S. Northumberland: 1 mile S.E. of Corbridge, GR 45/00.63. Wooded river bank. G.A. & M. Swan, 1972, *herb.* G.A.S., det. C. Jeffrey. N. Tyne near Haughton Castle, GR 35/92.72. River bank. M. E. Braithwaite, 1973, field record. 1st and 2nd records; non-flowering.

†552/2. *TRAGOPOGON PORRIFOLIUS* L. *52, Anglesey: Cemaes Bay, GR 23/36.93. Mrs J. E. Smith, 1975, field record. (*Nature Wales*, 15: 33 (1976)).

558/1/38. *HIERACIUM AMPLIATUM* (W. R. Linton) A. Ley *94, Banff: Dalnasheugh, GR 38/18.35. River bank. M. McC. Webster, 1974, E, det. P. D. Sell.

558/1/39. *HIERACIUM PETROCHARIS* (E. F. Linton) W. R. Linton *72, Dumfries: Capplegill, GR 36/14.09. Rocky ravine. O. M. Stewart, 1974, *DFS*, det. P. D. Sell & C. West.

558/1/59. *HIERACIUM ORIMELES* F. J. Hanb. ex W. R. Linton *94, Banff: Dalnasheugh, GR 38/18.35. River bank. M. McC. Webster, 1974, *CGE*, det. P. D. Sell.

558/1/120. *HIERACIUM SUBHIRTUM* (F. J. Hanb.) Pugsl. *72, Dumfries: Dalveen Pass, GR 26/90.06. By stream. O. M. Stewart, 1974, DFS, det. C. West.

558/1/139. *HIERACIUM RUBIGINOSUM* F. J. Hanb. *72, Dumfries: Dalveen Pass, GR 26/90.06. By stream. O. M. Stewart, 1974, CGE, det. C. West.

558/1/189. *HIERACIUM GOTHICOIDES* Pugsl. *73, Kirkcudbright: Carsphairn Bridge, GR 25/56.93. River bank. O. M. Stewart, 1974, DFS, det. C. West.

558/1/206. *HIERACIUM LATOBRIGORUM* (Zahn) Roffey *73, Kirkcudbright: High Bridge of Ken, GR 25/60.90. By river. J. McClure, 1971, 1974 specimen herb. O. M. Stewart, det. C. E. A. Andrews.

558/1/223. *HIERACIUM VAGUM* Jord. *73, Kirkcudbright: near Minnigaff, GR 25/40.65. Quarry, J. McClure, 1971, 1974 specimen herb. O. M. Stewart, det. C. E. A. Andrews.

†559/7. *CREPIS NICAENSIS* Balb. 62, N.E. Yorks.: Hinderwell, GR 45/79.17. Roadside bank. E. Chicken, 1975, BM, det. J. B. Marshall. 1st post-1930 record.

560/1. *TARAXACUM BRACHYGLOSSUM* (Dahlst.) Dahlst. *72, Dumfries *75, Ayr.

560/2. *TARAXACUM ARGUTUM* Dahlst. *73, Kirkcudbright.

560/9. *TARAXACUM GLAUCINUM* Dahlst. *52, Anglesey.

560/23. *TARAXACUM DEGELII* Hagl. *75, Ayr.

560/33. *TARAXACUM UNGUILOBUM* Dahlst. *72, Dumfries.

560/35. *TARAXACUM LANDMARKII* Dahlst. *72, Dumfries *73, Kirkcudbright.

560/37. *TARAXACUM SPECTABILE* Dahlst. *61, S.E. Yorks.

560/42. *TARAXACUM EURYPHYLLUM* (Dahlst.) M.P.Chr. *73, Kirkcudbright *75, Ayr.

560/43. *TARAXACUM MACULIGERUM* H.Lindb.f. *72, Dumfries.

560/44. *TARAXACUM PRAESTANS* H.Lindb.f. *52, Anglesey *72, Dumfries *73, Kirkcudbright.

560/50. *TARAXACUM NAEVOSUM* Dahlst. *96b, Nairn.

560/51. *TARAXACUM LAETIFRONS* Dahlst. *95, Moray.

560/58. *TARAXACUM STICTOPHYLLUM* Dahlst. *52, Anglesey.

560/61. *TARAXACUM NORDSTEDTII* Dahlst. *72, Dumfries.

560/64. *TARAXACUM ADAMII* Claire. *75, Ayr.

560/67. *TARAXACUM SUBCYANOLEPIS* M.P.Chr. *52, Anglesey *73, Kirkcudbright.

560/68. *TARAXACUM CYANOLEPIS* Dahlst. *73, Kirkcudbright *94, Banff.

560/69. *TARAXACUM SELLANDII* Dahlst. *73, Kirkcudbright.

560/70. *TARAXACUM ANCISTROLOBUM* Dahlst. *61, S.E. Yorks.

560/71. *TARAXACUM SUBLACINIOSUM* Dahlst. *73, Kirkcudbright.

560/75. *TARAXACUM PANNUCIUM* Dahlst. *96b, Nairn.

560/78. *TARAXACUM ALATUM* H. Lindb.f. *73, Kirkcudbright.

560/81. *TARAXACUM CROCEIFLORUM* Dahlst. *73, Kirkcudbright.

560/87. *TARAXACUM TENEBRICANS* (Dahlst.) Dahlst. *94, Banff.

560/90. *TARAXACUM SPILOPHYLLUM* Dahlst. *73, Kirkcudbright.

560/93. *TARAXACUM AEQUILOBUM* Dahlst. *106, E. Ross.

- 560/103. *TARAXACUM CORDATUM* Palmgr. *61, S.E. Yorks. *73, Kirkcudbright.
- 560/104. *TARAXACUM ADSIMILE* Dahlst. *61, S.E. Yorks.
- 560/105. *TARAXACUM LONGISQUAMEUM* H.Lindb.f. *49, Caerns. *73, Kirkcudbright.
- 560/108. *TARAXACUM MELANTHOIDES* Dahlst. *61, S.E. Yorks.
- 560/111. *TARAXACUM HAEMATICUM* Hagl. *61, S.E. Yorks.
- 560/113. *TARAXACUM BRACTEATUM* Dahlst. *96b, Nairn.
- 560/115. *TARAXACUM HAMATIFORME* Dahlst. *73, Kirkcudbright.
- 560/116. *TARAXACUM MARKLUNDII* Palmgr. *49, Caerns. *61, S.E. Yorks. *73, Kirkcudbright.
- 560/117. *TARAXACUM LATISECTUM* H.Lindb.f. *95, Moray.
- 560/119. *TARAXACUM MACULATUM* Jordan *49, Caerns.
- 560/120. *TARAXACUM FASCIATUM* Dahlst. *61, S.E. Yorks.
- 560/121. *TARAXACUM RAUNKIAERII* Wiinst. *61, S.E. Yorks. *99, Dunbarton.
- 560/123. *TARAXACUM OBSCURATUM* Dahlst. *61, S.E. Yorks.
- 560/125. *TARAXACUM POLYODON* Dahlst. *94, Banff.
- 560/126. *TARAXACUM REFLEXILOBUM* H.Lindb.f. *49, Caerns. *96, Easternness.
- 562/1. *LURONIUM NATANS* (L.) Raf. *57, Derbys.: Peak Forest Canal, near New Mills, GR 33/99.84. B. W. Fox, 1973, field record.
- †571/1. *LAGAROSIPHON MAJOR* (Ridl.) Moss 33, E. Gloucester: Lechlade, GR 42/21.00. Flooded gravel pit. S. C. Holland, 1974, field record. 2nd record.
- 577/9. *POTAMOGETON PERFOLIATUS* L. 44, Carms.: head of Upper Liedi reservoir, Llanelli, GR 22/50.94. I. M. Vaughan, 1975, NMW, det. J. E. Dandy. 1st record since 1912. (*Nature Wales*, 15: 30 (1976)).
- 577/12. *POTAMOGETON RUTILUS* Wulfg. *96, Easternness: Loch Flemington, GR 28/80.52. M. McC. Webster, 1975, BM,E, det. J. E. Dandy.
- 577/20. *POTAMOGETON FILIFORMIS* Pers. 79, Selkirk: Hellmoor Loch, Kirkhope, GR 36/38.17. R. W. M. Corner, 1975, BM, det. J. E. Dandy. 2nd record.
- 579/2. *RUPPIA MARITIMA* L. *96, Easternness: Kirkhill, GR 28/56.46. Salt-marsh pool. M. McC. Webster, 1975, BM,E, det. J. E. Dandy. 1st localised record.
- 580/1. *ZANNICHELLIA PALUSTRIS* L. 45, Pems.: Pembroke, GR 12/99.01. Mill pond. S. B. Evans, 1975, NMW. 2nd record. (*Nature Wales*, 15: 31 (1976)).
- †605/2. *JUNCUS TENUIS* Willd. 84, Linlithgow: Winchburgh, GR 36/08.75. Canal towpath. I. R. Bonner, 1974, field record. 2nd record.
- 605/4. *JUNCUS COMPRESSUS* Jacq. 73, Kirkcudbright: Glenstocking shore, GR 25/86.52. Salt-marsh. O. M. Stewart, 1974, E, det. R. J. Pankhurst. 1st record for 70 years.
- 607/5. *ALLIUM VINEALE* L. *106, E. Ross: Rosemarkie, GR 28/73.57. U.K. Duncan, 1956, field record.
- 611/2. *LEUCOJUM AESTIVUM* L. †*73, Kirkcudbright: Low Bridge of Tarff, GR 25/68.54. Brackish mud. O. M. Stewart, 1975, E.
- 642/3. *ORCHIS SIMIA* Lam. *61, S.E. Yorks.: — . A. Fritchley, 1974, 1975, field record. 1 plant.

643/1 $\times$ 7. *DACTYLORHIZA FUCHSII* (Druce) Soó $\times$ *D. TRAUNSTEINERI* (Sauter) Soó *64, Mid-W. Yorks.: upper Wharfedale, GR 34/9.6. D. J. Tennant, 1974, 1975, herb. R. H. Roberts, det. R.H.R. 1st record.

643/3b. *DACTYLORHIZA INCARNATA* (L.) Soó subsp. *PULCHELLA* (Druce) Soó *96, Easternness: Lundie, Glen Moriston, GR 28/14.10. Basic flush. M. McC. Webster, 1975, specimen lost, conf. K. Probably 1st record.

645/1. *ANACAMPTIS PYRAMIDALIS* (L.) Rich. *80, Roxburgh: S. of Longnewton, St Boswells, GR 36/58.26. Old railway cutting. R. W. M. Corner, 1975, field record.

656/6. *ELEOCHARIS UNIGLUMIS* (Link) Schult. *50, Denbigh: Trefalun Meadows, GR 33/40.58. By River Dee. B.S.B.I. Meeting, 1975, field record. (*Nature Wales*, 15: 33 (1976)). 82, Haddington: Yellow Craig, Dirleton, GR 36/52.85. Dune-slack. I. R. Bonner, 1974, field record 2nd record.

660/1. *RHYNOSPORA ALBA* (L.) Vahl 50, Denbigh: Tyn coed, Capel Garmon, Llanwrst, GR 23/81.54. B.S.B.I. Meeting, 1974, field record. 2nd and only extant record. (*Nature Wales*, 14: 204 (1975)).

663/2. *CAREX DISTANS* L. *57, Derbys.: Pleasley, GR 43/49.63. J. Hodgson, 1975, DBY.

663/2 $\times$ 11. *CAREX DISTANS* L. $\times$ *C. EXTENSA* Gooden. *1, W. Cornwall: Harbour Cove, Padstow, GR 10/91.77. R. W. David, 1964, herb. R.W.D., det. A. C. Jermy.

663/3. *CAREX PUNCTATA* Gaudin *1, W. Cornwall: Kemyel Point, Mousehole, GR 10/46.24. Sea cliffs. B. M. Sturdy, 1975, field record, det. R. W. David.

663/10. *CAREX SEROTINA* Mérat 73, Kirkcudbright: near Ornockenoch Loch, GR 25/57.59. O. M. Stewart, 1975, DFS, det. A. C. Jermy. 1st post-1930 record.

663/23. *CAREX STRIGOSA* Huds. 57, Derbys.: Clattercotes Wood, near Ogston, GR 43/35.60. J. Hodgson, 1975, DBY. 1st post-1930 record.

663/37. *CAREX MONTANA* L. 1, W. Cornwall: between St Agnes and Perranporth, GR 10/73.52. Maritime heath. L. J. Margetts, 1975, CGE, det. R. W. David. 2nd record.

663/67. *CAREX SPICATA* Huds. 45, Pembs.: West Williamston, GR 22/03.05. Old quarry. T. A. W. Davis, 1974, BM, det. R. W. David. 2nd record. (*Nature Wales*, 15: 31 (1976)).

663/69. *CAREX ELONGATA* L. 99, Dunbarton: near Rossdhu House, Luss, GR 26/3.8. Alder wood by loch. J. Mitchell, 1975, E. 2nd record.

669/4. *GLYCERIA MAXIMA* (Hartm.) Holmberg *45, Pembs.: Wisemans Bridge, GR 22/14.06. Flood-plain mire. S. B. Evans, 1974, field record. 1st localized record. (*Nature Wales*, 15: 31 (1976)).

670/4. *FESTUCA ALTISSIMA* All. *59, S. Lancs.: 5 km W. of Blackburn, GR 34/63.28. Woodland above river. P. Jepson, 1975, field record, det. C. E. Hubbard.

†671/2 $\times$ 1. *LOLIUM MULTIFLORUM* Lam. $\times$ *L. PERENNE* L. *73, Kirkcudbright: N. of Dumfries, GR 25/97.76. Waste ground by river. O. M. Stewart, 1975, K, det. C. E. Hubbard.

676/12. *POA SUBCAERULEA* Sm. *72, Dumfries: Capple burn, GR 36/14.09. Grassland, O. M. Stewart, 1974, E, det. C. E. Hubbard.

677/1. *CATABROSA AQUATICA* (L.) Beauv. 50, Denbigh: Llanarmon yn Ial, Alltgyrmyd, GR 33/20.54. Marsh. B.S.B.I. Meeting, 1974, field record. 2nd record. (*Nature Wales*, 14: 205 (1975)).

683/1. *BROMUS ERECTUS* Huds. *80, Roxburgh: River Tweed below Hendershyde Park, Kelso, GR 36/74.35. River bank. A. Brotherston, *Hist. Berwicksh. Nat. Club*, 7: 273 (1875). Belses Mill, GR 36/58.26. Railway embankment. M. E. Braithwaite, 1975, herb. R. W. M. Corner. 2nd record.

†683/4. *BROMUS INERMIS* Leyss. *57, Derbys.: Staveley, GR 43/43.75. Roadside. J. Hodgson, 1975, DBY. Well naturalized.

693/1. *HELIOTOTRICHON PRATENSE* (L.) Pilg. **45**, Pembs.: Linney Head, GR 11/88.96. Cliff-top turf. P. J. Masters, 1973, field record. 2nd localized record. (*Nature Wales*, **14**: 202 (1975)).

702/2. *APERA INTERRUPTA* (L.) Beauv. †***57**, Derbys.: Sheepbridge, near Chesterfield, GR 43/37.74. Old slag-heaps. J. Hodgson, 1975, **DBY**.

708/3 × 2. *ALOPECURUS GENICULATUS* L. × *A. PRATENSIS* L. ***61**, S.E. Yorks.: Elvington, GR 44/70.48. Field. F. E. Crackles, 1973, **K**, det. C. E. Hubbard.

708/6. *ALOPECURUS ALPINUS* Sm. **78**, Peebles: Hartfell Rig, GR 36/12.14. Grassy flush. D. J. McCosh, 1974, **herb. D. J. McC.** 2nd record.

†718/1. *ECHINOCHLOA CRUS-GALLI* (L.) Beauv. ***95**, Moray: Elgin, GR 38/28.63. Tip. M. McC. Webster, 1975, **E**.



Book Reviews

Die Vegetation der Moore im südlichen Teil der Böhmischo-Mährischen Höhe. K. Rybniček. Pp. 243, with 79 text figures and plates, 73 tables and 11 folded maps. Vegetáce ČSSR A6. Academia, Prague. 1974. Price not given.

Die Entwicklung der Vegetation und Flora im südlichen Teil der Böhmischo-Mährischen Höhe während des Spätglazials und Holozans. Eliška Rybničková. Pp. 163, with 16 text plates, 20 plates, 9 folded pollen diagrams and 11 folded tables. Vegetáce ČSSR A7. Academia, Prague. 1974. Price not given.

Kamil Rybniček's monograph documents his detailed phytosociological and ecological studies of bogs and fens in the southern part of the Bohemian-Moravian uplands in Czechoslovakia. Although the phytosociological approach is broadly that of the Zürich-Montpellier school, Dr Rybniček's study differs in that considerably more emphasis than usual is placed, quite rightly I feel, on the role that bryophytes play in mires. The result is that several of his noda are characterized primarily by bryophytes such as *Meesia triquetra*, *Sphagnum warnstorffianum* and *Scorpidium scorpioides*. Many of the noda described are immediately familiar to British botanists, for example the Scorpidio-Utricularietum corresponds closely to the *Carex rostrata*—brown moss nodum that occurs widely but locally in northern Britain. The Caricetum diandrae and Sphagno-Caricetum appropinquatae fen noda are reminiscent of, for example, parts of the North Fen complex at Malham Tarn. Besides containing thorough phytosociological descriptions, there is a wealth of useful ecological information, with data for each nodum on water and peat chemistry, and on fluctuations in water-level during the year. Dr Rybniček is so successful in delimiting the ecological range of his noda that he presents, as a useful summary, a key to the noda based, not on floristics, but on environmental factors. The book is well produced with many excellent habitat photographs. It is an important and notable contribution to the literature on European mire ecology, and it deserves a place in any ecology library.

In the companion volume, Eliška Rybničková describes the late- and post-glacial vegetational history of the same area as that described by her husband. Her study is based largely on pollen analysis of lake and bog sediments, although some information on plant macrofossils is also given. The pollen record covers the last 11,000 years, and reveals a succession from a virtually treeless late-glacial landscape, possibly with some pine, to a forested landscape dominated initially by pine, then by hazel, and finally by oak, elm and lime. The *Fagus-Abies-Picea* forests that are so characteristic of much of central Europe appear to have developed only about 2,000 years ago. Effects of human activity are detectable in the pollen stratigraphy from about the 12th century A.D., with massive forest clearance and the development of secondary *Pinus-Picea* forests. The local development of each site is also considered, and palaeovegetational differentiation between the sites is briefly discussed. A large number of pollen and spore types is identified, and photomicrographs (of varying quality) are presented for many of them. The volume is well produced, and the pollen diagrams are clearly presented. The raw data are also provided, allowing one to recalculate the data in different ways. The sole criticism of the work is that, in conjunction with many pollen-analytical projects, this study suffers from the small number of radiocarbon dates available to the author. The correlation of Czechoslovakian pollen zones with the Firbas zonation scheme is, in the absence of an absolute chronology, a potentially hazardous procedure, as there is no reason to suppose that the time of expansion of, for example, pine or hazel was the same throughout central and western Europe. Indeed the available evidence suggests that such expansions occurred at different times at different places even in areas as small as western Scotland.

The high quality of the pollen analyses, coupled with the thorough and sound ecological interpretations, does, however, make this book an important contribution to our understanding of the vegetational history of Czechoslovakia, and it should be read and studied by all interested in the history of the flora and vegetation of central Europe.

H. J. B. BIRKS

Wild Flowers of the Channel Islands. John D. Bichard & David McClintock. Pp. xi+69, with 100 colour photographs. Chatto & Windus, London. 1975. Price £2.50.

This slim volume, which goes easily into the coat pocket, consists of annotated colour photographs of 100 characteristic plants of the Channel Islands. All the photos, except four taken by Mrs Margaret Long, come from the camera of John Bichard; the words are those of David McClintock.

The photos, apart from one full-page illustration of the Guernsey Elm, are arranged in threes and fours on the page with a uniformity which is most pleasing. The general standard of the photography is very high. The photo of the Early Sand-grass is less successful than some, but the other grasses are clearly and artistically portrayed. Bright flowers like the Bee Orchid, which for the sake of the record I saw myself at Portinfer in Guernsey in 1952, and the Variegated Catchfly are easy subjects, but Mr Bichard succeeds with the least promising. For example, his photo of the Sea Knotgrass could hardly be better, showing the inrolled leaves to perfection. The photo of the Vipers Bugloss has a distracting background and the colour of the Bog Pimpernel is not as true as one could wish; but the overall impression is one of excellence.

The notes which accompany the photographs add to their value and are characteristic of the writer, who has a comprehensive knowledge of garden plants as well as wild ones and is just as interested in their history as in their taxonomy. The style and the knowledge, as well as the enthusiasm, are well displayed in his account of the daffodils at the beginning of the book. But why does he call a botanist a plantsman? If that name catches on we shall soon have a plantswoman and after that no doubt a plant person! Let us stick to botanist, not an elegant title perhaps, but old and Greek and safe.

This little book is the Tempter's ultimate weapon. No visitor to the Channel Islands who cannot afford £2.50 should pick it up.

E. S. EDEES

Crop Genetic Resources for Today and Tomorrow. Edited by O. H. Frankel & J. G. Hawkes. Pp. 492, with 10 black and white plates and 40 line drawings. International Biological Programme, vol. 2. Cambridge University Press, Cambridge. 1975. Price £13.00.

This volume is one of a series produced at the culmination of the 10-year International Biological Programme (1964–1974) and, to quote the dustcover, it is concerned with 'one of the world's fastest disappearing natural resources—the invaluable reservoir of genetic variability in our cultivated plants which has evolved since our forebears began to domesticate them some 10,000 years ago'.

This is a problem of truly international importance, and one which man ignores at his gravest peril. The problem can be stated simply: Future advances in crop production depend on a continuing supply of genetic variability; this variability resides in the main in the less well-developed parts of the world, and it is being eroded with increasing rapidity as civilization advances in those areas; the variability surviving must be explored and conserved before it is too late.

The editors have taken this problem and dissected it into many small components, each of which has been analysed in great detail by one or more of the 43 contributors representing distinction in many different fields. The result is a large volume of concentrated information—something for everyone, though probably few will read it from cover to cover. British botanists, particularly those with the more insular outlook, may find the contents novel—Britain is after all remote from most of the areas where these conservation problems are greatest; and furthermore it is conservation of rare forms of common species rather than of rare species—but all the more reason for them to profit from the reading.

With a volume of such very varied specialities it is perhaps invidious for one reviewer to pick out particular contributions. The overall high standard is impressive. All are concerned with problems and their possible solutions. It appears that the problems loom somewhat larger in the areas of exploration, evaluation, documentation and information management, while solutions seem a little rosier where the storage of living materials is concerned. The book should go some way towards alerting mankind, and possibly reversing the attitude of 'Perhaps if we ignore it it will go away'.

D. J. HARBERD

Water Plants of the World. C. D. K. Cook, B. J. Gut, E. Martyn Rix, J. Schneller & Marta Seitz. Pp. viii + 561, with 266 line drawings. W. Junk, The Hague. 1974. Price Dfl. 120 (£21.00).

The aim of the authors was to provide a manual for the identification of freshwater macrophytes of the world, namely genera in the Charophyta (6 genera), Bryophyta (51 genera), Pteridophyta (6 genera) and Spermatophyta (66 families, c. 400 genera) whose photosynthetically active parts are permanently, or at least for several months each year, submerged in fresh water or floating on the water surface. Marine and exclusively brackish-water species are specifically excluded, although a mention, in their systematic place, could have been of more than academic interest. There will be those who would have wished for genera not included; but Professor Cook has defined his 'water plant' and no doubt has stood by it according to his own, considerable, knowledge of the species. He has in addition taken advice from many specialists.

Two identification keys are given: a traditional key to families based on reproductive structures and one to the genera (when few in a family) or families on vegetative characters. Both are very usable, although the second is more practical for the non-expert. Each genus is described (and sometimes illustrated by a line drawing), its ecological and geographical ranges are given, and important species or those of monotypic genera are named. References are added, and perhaps these could have been fuller. Cook has adopted the more correct but less familiar family names such as Apiaceae (Umbelliferae), Asteraceae (Compositae) and Poaceae (Gramineae). As all families are arranged alphabetically, it would have been kinder to have given a cross-reference on the appropriate page rather than make the confused reader use the index.

This is an immensely interesting book and will be invaluable to ecologists, both botanists and zoologists, and all those involved in land use, agriculture, fisheries, land drainage, irrigation, water storage, water-based recreation and conservation. Although it was conceived as an adjunct to I.B.P. projects on freshwater productivity, it will equally find use in various MaB (Man and the Biosphere) programmes. Professor Cook is to be congratulated on the successful direction of this publication at the University of Zürich. It seems that field workers must turn more and more to the university botanists for practical publications, whilst 'professional' taxonomists spend their uninterrupted hours—and often the taxpayers' money—updating elaborate floristic or monographic treatises for the use of successive curators in other national herbaria.

A. C. JERMY

Plant Chromosomes. Askeff Löve & Doris Löve. Pp. 184, with 29 text figures. J. Cramer, Vaduz. 1975. Price DM 36.

The authors of this book are well known for their numerous contributions in the general field of cytotaxonomy; they have also been responsible for compiling several atlases of chromosome numbers for plants in various regions of the northern hemisphere. They have now produced this compact book which they rightly describe as 'A kind of conducted tour of the elementary practical aspects of chromosome studies'. It can be viewed as being divided into two main sections—the first surveying basic chromosome theory and the second describing the materials and methods of chromosome study. And one is much better than the other.

For those who want an unusually detailed account of chromosome practice designed to lead the novice through all the procedures and likely events from the initial collection of tissues to their final description, the second section may contain much of value. Much of this is written in a conversational manner, and the authors are clearly trying to communicate the benefits of their own experience, being aware of the need of many taxonomists for this type of practical information. Here they will be told of the various tissues which can be used for mitotic studies and how to deal with meiosis on the male and female sides. Methods of squashing and sectioning are described and many recipes listed. Hints and wrinkles are here in abundance, including such unusual items as restaining old preparations and recycling cover slips. Information is also given on the use of the microscope and the procedures involved in drawing and measuring chromosomes. One omission to be noted is the absence of any instructions for setting up the microscope for critical illumination; but overall this is a very comprehensive account of practical chromosome cytology which will undoubtedly help any newcomer to the field.

On the theoretical side the book is far more superficial, rapidly passing through basic descriptions of nuclear divisions and their significance in diploid and polyploids, in species and in hybrids. For those who are not attracted to detailed texts on the subject it may prove a convenient introduction, but it is certainly not suitable for those who wish to learn the details of chromosome behaviour. It contains a number of errors of fact, only a few of which need to be mentioned here. For example, it is not correct to say (p. 14) that triploids are inevitably sterile. Many, particularly autotriploids, are quite capable of producing progeny (cf. *Dactylis*), and some are highly fertile (cf. *Hyacinthus*). Polyploids (p. 15) do not increase variation, but are more effective in storing it. On this same page the authors express the view that polyploids show pre-adaptation, which makes them superior to the diploids from which they spring. It is impossible to conceive of how a state which has not yet existed can be a pre-adaptation. This word is normally used relating to existing states and their potential for producing others. Chromosome size-differences, such as those between *Drosera* and *Drosophyllum* (p. 24), are not determined by differences in coiling as the authors state, but by large, measurable differences in total DNA. There is certainly no reason to believe, as they do, that chromosome size-differences between related taxa imply that they might be better separated into distinct genera. When dealing with inversion heterozygosity (p. 49), the authors are in error in saying that loop chromosomes are produced by crossing-over within a paracentric inversion. Loops can only be formed when in addition there are chiasmata formed between the inversion and the centromere.

If, then, the theoretical part of this book can be understood to be nothing more than a general guide which will lead readers on to more authoritative and more detailed works, the practical section is more successful. The authors do not intend this to be a textbook on chromosome cytology, and it would be foolish and dangerous to treat it as such. If instead we remember the authors' own description of its nature, then undoubtedly taxonomists and others who wish to make chromosome observations will be encouraged and well instructed on how to proceed.

K. JONES

The Historical Flora of Middlesex: An account of the wild plants found in the Watsonian vice-county 21 from 1548 to the present time. Douglas H. Kent. Pp. 673, with 5 half-tone plates. The Ray Society, London. 1975. Price £15.00.

More than a century has passed since Trimen & Dyer produced the last Flora of Middlesex, a scholarly work which still ranks as one of the best of our county Floras. Since this appeared, the administrative county of Middlesex has been entirely absorbed into its larger neighbours, and is now almost forgotten except by the Post Office, and by biologists who still use it as a recording unit, v.-c. 21. During the century its 283 square miles have mostly become covered by bricks and mortar or preserved as trampled public open spaces. It is from this apparently unfavourable material that Mr Kent has produced an account full of interest, of great accuracy, and a worthy successor to Trimen & Dyer.

His treatment is very conservative, though some of the traditional features of local Floras have seldom been done so well—the list of recorders with so many dates of birth and death, the analysis of the flora according to status and countries of origin, and comparisons of current frequencies with those reported earlier. To include Characeae while omitting other algae may be carrying tradition a bit far and his 'Account of Botanical Exploration' is too short to give scope for his great knowledge of the early botanists of Middlesex, though this was brilliantly covered by Trimen & Dyer. The absence of maps makes the introduction and the records given later unnecessarily difficult to understand. The divisions are defined in words, but it is impossible, without further help, to mark these on any maps the reader is likely to have. Reference back to Trimen & Dyer is not very helpful, as the main landmarks on their map are small streams difficult to trace on modern maps. Similarly with the geology, the absence of a map is a great handicap.

The *Flora* covers charophytes, bryophytes, flowering plants and ferns, and localities are given at length. Thus, for example, *Equisetum telmateia* and *Rumex palustris* extend to about a page each, which is justified in the case of the first by discussion of the late date at which this conspicuous plant was first recorded. Middlesex, and especially Division 7 Metropolitan, was very thoroughly

botanized by the early botanists and thus offers the opportunity of recording a changing flora over three centuries. For 'common' species found in all seven divisions, detailed records are given only for Division 7, and no variations in frequency are indicated for the rest. This can be a little confusing when, on the same page, there are three 'common' species like *Galega officinalis* (p. 259), with a long list of Division 7 localities, and two others, *Robinia pseudacacia* and *Colutea arborescens*, with no localities at all. In cases like this, modern distribution maps would have given more information.

For many rare species this book gives a fine account of their early history in Britain—*Sisymbrium irio* and *Cucubalus baccifer* for example. The nomenclature and taxonomy are in line with the latest literature, though more personal observations, like the view that *Polygonum nodosum* should be retained as a species, would have been welcome in view of the author's long experience. Misprints are very few, but it is not surprising to find that they include the name of A. S. Montgomery, which is correct on page 41, and wrong on pages 26 and 50, and unfortunate that they include the name of T. G. Collett on the frontispiece. The photographs were no doubt excellent as supplied, but have been reproduced with such a 'soot and whitewash' emphasis that three of them have lost most of their detail. The book was designed by Ruari McLean for the Ray Society, and was printed by the University Printing House, Cambridge, and is a high-quality production. Mr Kent has produced an account full of interest, of exceptional accuracy, and a worthy successor to Trimen & Dyer. *The Historical Flora of Middlesex* can be thoroughly recommended.

J. E. LOUSLEY

Ray's Flora of Cambridgeshire (Catalogus Plantarum circa Cantabrigiam nascentium). Translated and edited by A. H. Ewen & C. T. Prime. Pp. 146, with 17 black and white plates. Wheldon & Wesley Ltd, Hitchin. 1975. Price £3.95.

This elegant and dignified little book fills a long-felt want for many of us, knowing the contents of Ray's *Catalogus* only from references in other works. Here we have the whole of it, in an eminently readable translation and informatively edited by two enthusiasts, one of whom, at least, has first-hand knowledge of Cambridgeshire and its flora. The list of plants growing around Cambridge is arranged in alphabetical order of Ray's Latin names. Each of these is followed by his English name and by notes on the locality and habitat in which he found the plant, and sometimes by notes on its biology or uses. The editors have most usefully added the modern Latin names and occasional informative notes. Ray also gave species lists of plants he found in about a dozen localities in and around Cambridge, much as in many modern county Floras. For ease of reference, the editors have given modern Latin names in these lists instead of those used by Ray himself.

Anyone who botanizes in Cambridgeshire will be fascinated to find famous rarities growing now just where Ray saw them three hundred years ago: *Linum anglicum* on the Gog Magog Hills and *Geranium sanguineum* on the Devil's Ditch, the only locality in the south-eastern half of England. *Smyrniolum olusatrum* survives in a hedge at Cherry Hinton, as in Ray's time, and another long-established alien, *Inula helenium*, is still in one locality 'about Madingley in great plenty'. *Senecio paludosus*, found by Ray 'in many places about the Fens', was long thought to be extinct in the British Isles; it was refound in 1972 (*Watsonia*, 10: 49 (1974)) within the former area of its distribution. On the other hand, some plants, such as *Centaurea cyanus* and *Agrostemma githago*, were widespread in Ray's time but have now disappeared. The multitude of plants he recorded as found in Cambridgeshire, then as now, indicates Ray's thoroughness, so the absence from his Catalogue of so prominent a tree as the beech is good evidence that there was no beech here in the 17th century.

Probably the greatest all-round naturalist this country has ever produced, John Ray put the study of plants and animals on a really scientific basis and paved the way for the later work of Linnaeus. The first of his many books, the *Catalogus* was published in 1660 and is the earliest local Flora ever written and the forerunner of all scientific Floras. This modern edition will be of value to everyone interested in field botany and in the naming of plants; it will be read with pleasure now, and then consulted again and again. I only wish that the editors had also given us

at least some of the text in the original Latin. It is a pity, too, that the maps are so indistinct; they would have been better, perhaps, as line blocks rather than half-tone.

The amateur student of plant nomenclature will find Ray's *Catalogus* a splendid source of material. Here we see the earlier, descriptive names, such as Ray's own *Trifolium pratense hirsutum majus flore albo sulphureo*, or the simple Latin name, like *Ligustrum*, from antiquity. There are also a surprising number of modern-looking binomials, many of which were a century later adopted unaltered by Linnaeus: *Angelica sylvestris*, *Chelidonium majus*, *Lamium album*, *Campanula rotundifolia*, *Circaea lutetiana*, etc. We can see how multinomials were reduced to binomials by selecting as the specific epithet one adjective out of a phrase, thus *Ranunculus hederaceus rivulorum se extendens atra macula notatus* became merely *Ranunculus hederaceus* and *Salix folio latosplendente fragilis* was reduced to *Salix fragilis*. Again, Ray's simple names were often adopted by Linnaeus as either generic names or specific epithets, so *Sambucus* and *Ebulus* became, respectively, *Sambucus nigra* and *Sambucus ebulus*. Ray's English names will also repay study; many were much the same as those in current use, but some have a delightfully old-world flavour. Others, like Forget-me-not and Lords-and-Ladies, were not used in his time.

Ray's own Preface to the Reader is a beautiful essay, here sensitively translated; we can almost hear 'the excellent Mr Ray' recommending the study of Botany: 'I readily admit that, as human affairs are now, such studies do not greatly contribute to the accumulation of wealth or to the winning of the favour of our fellow-men, nevertheless I know of no occupation which is more worthy or more delightful for a free man than to contemplate the beauteous works of Nature and to honour the infinite wisdom and goodness of God the Creator'.

W. H. PALMER

Index Holmensis. A world index of plant distribution maps. Vols. 1-4. Edited by Hans Tralau. The Scientific Publishers Ltd, Zürich. 1969, 1972, 1973, 1974. Prices S Fr. 115, 140, 140, ?, respectively.

I once began compiling an index of distribution maps of British plants, but gave up after a year or two as I became aware of the inadequacy of my literature searches. It was the right decision because now Hans Tralau and an international team of collaborators including such botanical household names as Hedberg, Hultén, Munsel, Runemark and van Steenis have embarked on a definitive catalogue of all plant distribution maps ever published, and so successfully has this 'embarkation' been that in six years they have already sailed through the Equisetales — Gymnospermae (Vol. I), the Monocotyledoneae (Vols. II and III) and the Dicotyledoneae to the end of B (Vol. IV) and plan to land the complete work in 12 volumes by 1982.

Within each major taxonomic group the index is in alphabetical order at the generic level and, within genera, by species. Within species the entries are chronological. Thus the user has a complete bibliography of maps published on each species to within about a year of the date of publication of the volume. But it soon becomes apparent that this is much more than just a bibliography of maps: all the *Biological Flora* accounts are included for example, so that in a very real sense it can act as a bibliography of species (50 references under *Acer campestre* alone gives some idea of its scope).

This comprehensiveness at the species level is costly. It is flattering but worrying to know that by 1982 the *Atlas of the British flora* will have been quoted in full 1,700 times each with a four-line entry and taking up over 20 pages of close-set three-column space. This method becomes absurd in the Caytoniales, where all eleven seven-line entries are to the same paper by Tralau himself, which modesty at least might have forbidden. Abbreviations for frequently repeated references would be no handicap to the user and might help to keep the price of remaining volumes within the reach of at least all botanical libraries, for which these volumes are surely essential works of reference to stand alongside *Index Kewensis* and *Index Londinensis*.

F. H. PERRING

Supplement to the Flora of Wiltshire. Compiled and edited by L. F. Stearn. Pp. xvi+150, with 1 black and white photograph, 7 line drawings, and 8 text figures and maps. Wiltshire Archaeological and Natural History Society, Devizes. 1975. Price £4.50.

Those of us who love Donald Grose's *Flora of Wiltshire* and regard it as one of the finest County Floras ever produced may be surprised that a *Supplement* would ever be needed and astonished that 18 years separate 'father and son'. But Grose himself went on working in Wiltshire for another 15 years before his death early in 1973, and he and two other compilers have published 15 annual parts of *Wiltshire Plant Notes* since 1957. As a memorial to Grose, and as a way of bringing together these separate parts, L. F. Stearn and fellow members of the Wiltshire Archaeological and Natural History Society have produced a single list following the order of the *Flora*, retaining the original nomenclature as far as possible. They have also included an index to place names with full grid-references, thus continuing the excellent example which Grose himself set in the *Flora*. Cyril Rice has produced some strongly characterized drawings with the quality of woodcuts, to embellish what might otherwise make a 'dry' book. Perhaps it was the size of these which persuaded the Committee to adopt a 2-column format and a large-page size, so that the *Supplement* is not strictly a companion volume to the *Flora*.

Further embellishment is provided by devoting the second half of the book to articles on the flora and vegetation of Wiltshire. As these were written either by Grose himself or by former or present colleagues of mine, I feel like the man in the Army who, when asked how he was enjoying it, replied 'I can't complain'. However, one thing is certain, these articles are a proper tribute to Grose. One of the most remarkable features of his *Flora* was the long section on the vegetation in which he analysed the occurrence and frequency of species in each major habitat. In that setting, these articles on *The floristic composition of chalk grassland* (T. C. E. Wells), *The flora of neutral grasslands* (D. A. Wells & N. King) and *The vegetation of roadside verges* (P. J. Horton) are truly supplementary to Grose's pioneer work and, like the *Flora*, will be of wide interest to ecologists who are not concerned with the flora of Wiltshire alone. As Wells points out, about 70% of the total acreage of chalk grassland in Britain is found in Wiltshire and yet it has never been adequately described. That this has now been done is another reason to be grateful for this *Supplement*. I hope it will redouble demands for the *Flora*, long unobtainable, so that a reprint will swiftly follow.

F. H. PERRING

British Botanical and Horticultural Literature before 1800. Blanche Henrey. 3 volumes in slip-case. Pp. lix + 1,180, with 32 colour plates and 208 black and white illustrations. Oxford University Press, London. 1975. Price £70.00.

Although much has been written about the literature on botany, horticulture and silviculture produced in the British Isles during the 16th, 17th and 18th centuries, there has never before been an attempt to treat it as a whole, both historically and bibliographically. Miss Henrey set herself this daunting task in 1945, and now, 30 years later, the mere bibliographical details of her achievement make impressive reading, especially as she has seen copies of each of the total of 1,538 works listed. If, as she explains in her Preface, the relevant publications between 1800 and 1850 are twice as numerous as those that appeared earlier, it is not surprising that she eventually decided on 1800 as a dateline.

All known botanical, horticultural and silvicultural works published in England, Scotland and Ireland* before 1800 have been painstakingly traced, and their bibliographical details and the location of at least some copies noted. Their contents are described (sometimes at considerable length) and often illustrated. Indeed, the profusion of coloured and black and white illustrations, as well as the high quality of their reproduction, makes this a work to treasure for aesthetic reasons, quite apart from its value as an inexhaustible source of information.

A history of the literature of a subject inevitably tends to become a survey of the subject itself; and so it is here. To take botany alone, biographical accounts of all the great British and Irish botanists of these centuries, as well as mentions of many that are less well known, are provided in the historical parts, and their contributions to the knowledge of botany are described in terms of their publications. These are discussed under general headings such as: herbals and medical

*No mention is made of Wales, presumably because no works on these subjects were published there until later.

botany, works on anatomy and physiology, Floras (local, British, foreign), works associated with gardens (botanic, private), botanical publications of seedsmen and nurserymen, botanical drawing books, and works on plants of economic importance. The practical subjects are treated similarly in chapters on gardening operation and practice and on planting and garden design, each being a miniature history of the subject. For example, under 'Garden Design' the author deals in some detail with Le Notre and 'Capability Brown', even though neither name appears in the bibliography.

The identity of every person mentioned seems to have been established as far as possible and details of their life given, frequently from the *Dictionary of National Biography*. In addition, however, Miss Henrey has obtained information from extraordinarily diverse sources: public and learned society records, peerages, local public libraries and *The Gentleman's Magazine* and other journals of the period, as well as numerous biographical works (including manuscript material). Cross-references and the phrase 'It will be remembered that' occur whenever the reader might otherwise be at a loss to place one of the people mentioned. In fact, the footnotes themselves contain much interesting information, for example that Dr Samuel Johnson advised on 'the formation of the botanic language' of the English translation of Linnaeus's *Systema vegetabilium*, or that, during Peter the Great's three-month stay at John Evelyn's Sayes Court (1698), much damage was done to the garden.

The Oxford University Press have clearly aimed at making this work a 'quality production', and they have succeeded in their aim. The paper, printing and illustrations are all of a high standard, and misprints are very few. The only criticisms that seem worth mentioning are both very minor and relate to the length of time that the work has been in production. The French botanist Auguste Chevalier died in 1956, but a note in Vol. 1, p. 174, (written in 1953) implies that he is alive today. Again, in the discussion of the early history of the Royal Botanic Garden, Edinburgh, no mention is made of Harold Fletcher's *The Royal Botanic Garden, Edinburgh, 1670-1970*, presumably because it appeared after Miss Henrey's work had gone to press. It seems churlish, however, to draw attention to small imperfections in these volumes, which are a joy to read and will be a standard reference work for the foreseeable future.

N. K. B. ROBSON

Flora of Essex. Stanley T. Jermyn, assisted by Kenneth J. Adams. Pp. 302, with 17 2-colour maps, 1 full-colour geological map, 6 colour plates and 23 pp. of distribution maps. Essex Naturalists' Trust Ltd, Dunmow. 1974*. Price £10.00.

In the 112 years since the last *Flora of Essex* was written by G. S. Gibson of Saffron Walden, and published in 1862 (at a cost of 6/-!), the county has been subjected to all the hazards connected with material progress, and these changes are all admirably set out in the late Stanley T. Jermyn's new *Flora*.

This is a truly monumental work, and fills the reader with admiration that it has been achieved in such a short time. The author was Essex-born and bred, and all his life had taken a keen interest in every form of wild life. He contributed numerous Essex records for the *Atlas of the British flora*; and from 1965 his connection with the Essex Naturalists' Trust, as General Secretary/Treasurer, took him all over the county, where his efforts resulted in conservation successes in many ways, not least the establishment of numerous Nature Reserves. Sadly, he died before the *Flora* was finished; but the Introduction and Plant Records were already with the printers, so with devotion his widow and his collaborator, Dr Kenneth Adams, completed the work and published this lasting memorial.

The *Flora* is much more than just a botanical record. Excellent short accounts of past Essex botanists have been contributed by Dr A. Adams, and it is interesting to note that Essex plant-recorders dates back to 1568, when William Turner listed just four species: *Ruscus aculeatus*, a *Tilia*, a Hellebore and *Viscum album*, all of which still grow in the county.

There are accounts of the Essex landscape, its climate, geology, soils and other factors affecting plant distribution, and an invaluable gazetteer.

Essex is the tenth largest county in England and was divided by Watson into two vice-counties,

* The year of publication was 1975 and not 1974 as stated in the book. Eds.

18 and 19. Gibson divided the county, somewhat arbitrarily, into eight districts; Jermyn's recording is on the basis of the 10 × 10 km squares of the National Grid, totalling 57. All these were visited by him many times and at all seasons of the year, which resulted in a remarkable coverage, not only for the *Flora*, but also for the Naturalists' Trust.

About 60,000 recent field records have been assembled, and the status and distribution is given for some 2,000 vascular plants, bryophytes and charophytes. These include aliens and adventives, designated by an asterisk in the main text, but I feel that ephemeral records of some rubbish-tip species merit inclusion in an appendix only.

Common species are dealt with on a 10 km square basis, summarised on 300 appendix maps, whilst rarer and local species are described by localities with 180 1 km dot distribution maps in the text. For these, a transparent overlay is provided with a 1 km grid superimposed on a county outline map. These, like the 17 fascinating maps depicting soils, relief, rainfall and drainage, parishes, built-up areas, woodland, etc., deserved better reproduction, as the use of photo-reduction has led to some ill-definition in the printing. The full-colour map of the surface geology is superb.

The records are mainly post-1930, with Gibson's given as aggregates. The six very beautiful water-colour plates, by Benjamin Perkins and Kenneth Adams, are of the rarest Essex plants, three of which were also illustrated by Gibson. Jermyn gives most interesting details of these and other rarities and, in several cases, has been responsible for their survival.

The changes in the flora and the reasons for them are clearly set out, and it is shocking to realize that in the past 25 years losses due to urban sprawl, draining of wetlands, the use of chemical sprays and changed methods of verge-cutting, etc., have been far greater than in the whole preceding period since 1862.

It is to be hoped that Stanley Jermyn's realization of the deep need for conservation will be shared by all who read his book.

J. RUSSELL

Dictionary of cultivated plants and their centres of diversity. Excluding ornamentals, forest trees and lower plants. A. C. Zeven & P. M. Zhukovsky. Pp. 219, with 92 maps and 20 line-drawings. Centre for Agricultural Publishing and Documentation, Wageningen. 1975. Price Dfl. 45.

This book is a much enlarged translation of Zhukovsky's *World genofund of plants for breeding: world gene centres of cultivated plants and their wild progenitors* (1970), which covered 700 species and was in turn based on a paper by Zhukovsky published in 1968.

Two short introductory chapters summarise the history of plant domestication and the distribution of centres of diversity of cultivated plants. The latter is an extremely useful survey of different classifications of centres of diversity, starting with A. de Candolle (1882) and progressing through N. I. Vavilov (1926 and later) to the system adopted in the present work, Zhukovsky's 1970 grouping of 12 'megacentres of diversity'.

The main part of the book consists of 12 chapters, each corresponding to a megacentre and prefaced by a map showing the extent of the area in question. Within each chapter the species (about 2,300 in total) are dealt with alphabetically under families and genera, and are each allocated from a single line to almost a page according to importance and available data. For most species the common name(s), chromosome number, native distribution, area of cultivation and agricultural uses are given, with additional information on genomic constitution, evolutionary origin and breeding characteristics provided where known. Some species which have a wide distribution or are of uncertain provenance are treated under more than one megacentre. These chapters are illustrated by useful maps and a few, pleasant line-drawings. There is a valuable bibliography and a full index.

The importance of this book cannot be over-estimated, particularly in these days when the exploration, preservation and exploitation of wild genetic resources is foremost in the minds of many plant breeders, taxonomists and conservationists. I feel that botanists should demonstrate their gratitude to Dr Zeven (of the Institute of Plant Breeding, Wageningen) for making this book available in English by ensuring that it is on the shelves of every library, herbarium and

research laboratory. It is to be hoped that in due course a new edition will follow, incorporating yet more species and filling in gaps under those covered in the present edition.

C. A. STACE

The History of the British Flora: A Factual Basis for Phytogeography. 2nd edition. H. Godwin. Pp. x+541, with 24 plates and 174 text-figures. Cambridge University Press, Cambridge. 1975. Price £30.00.

This long-awaited second edition of Professor Sir Harry Godwin's classic work on Quaternary botany will become essential to all palaeoecologists, phytogeographers and Quaternary palaeobotanists, and should be read by all taxonomists who have ever speculated about the history of the British flora. The author emphasizes the particular importance to biogeography of the British Isles, as an area of which the flora and fauna 'have probably been more exhaustively studied than those of any comparable area of country'. In the large central section of the book (pp. 81-415)—'The Plant Record'—the author presents the factual record of distribution in space and time for those genera and species of vascular plants which have been found within Quaternary deposits in the British Isles, collated from the data bank of 60,000 80-channel punched cards in the Sub-department of Quaternary Research in the Cambridge Botany School. To the historical ecologist this section constitutes a work of reference as indispensable as are Floras to taxonomists.

The first part of the book provides, in agreeably readable prose, an introduction to methods of Quaternary botany and to the background scale of Pleistocene events, with sections on such matters as past climatic changes, evaluated from physical and biological evidence, and the initiation and development of the peat mires which have provided so many long and sensitive records of former climates and vegetation types. Attention is directed to related studies in the fields of palaeozoology and archaeology, and the importance of Quaternary botany in providing information on the environment, techniques and diet of prehistoric man is illustrated. A section on pollen analysis reviews the development of this discipline, from the initial conception of Von Post, in which it was primarily a stratigraphic tool providing a generalised time-scale of wide applicability (still of unique value in interglacial deposits beyond the span of radiocarbon dating)—towards the present situation in which the pollen analyst aims, by refinement of techniques, to reconstruct former vegetation. The author makes, clearly and firmly, the point that the pollen-zonation system for Late-Weichselian (Devensian) and Flandrian deposits—that now generally known to workers in this field as 'the Godwin zones'—constitutes 'the binding chronology for our historical plant record of the British Isles over the last 15,000 years'. At the end of this part there is a comprehensive list of the position and nature of the investigated sites from which records were collected (input of information ended in September 1970).

In the factual record which occupies the middle section, the majority of species records will be found to have been made from identifications of fruits, seeds and other macroscopic remains, though the author points out that improved techniques of pollen identification have contributed to the great increase in the number of species identifications since the first edition. The increased volume of records has forced a change from the first edition, in that for taxa with more than 20 or 30 records the evidence is now represented by histograms, omitting individual site names; details for each taxon can, however, be obtained from the data bank. In addition to the numerous histograms, this section is copiously illustrated by maps of past and present distributions (using the same or updated 10 km grid distribution maps as the *Atlas of the British flora*) and by drawings, of a high standard, of plant features of diagnostic value. The discussions of habitats and historical ecology in relation to the records are very full for those taxa for which numerous records of presence and relative abundance are available, such as the native forest trees.

The third part of the book, entitled 'Pattern of change in the British flora', is a synthesis of all the evidence, dealing in chronological order with each period of the Pleistocene. The allocated space increases towards the present, in accordance with the increasing volume of available evidence, so that three-quarters of the text is devoted to the last 15,000 years. Through the whole of this compulsively readable section, one can recognize the warm enthusiasm, the encyclopaedic knowledge and the broad biological culture which have been inspiring Sir Harry's students and readers during the forty years since he introduced the study of Quaternary palaeoecology to

Britain. British botanists are indeed fortunate to have available such an integrated and enthralling account of the history of their flora.

The first edition was published in 1956, 22 years after the appearance of the author's early papers on British Quaternary botany, so this largely re-written second edition not only presents a comprehensive account of two further decades of British research in a rapidly expanding field, but incorporates facts which have been garnered over a period roughly twice as long as that covered by the first edition. Not only are there nearly 150 additional pages, but the type is smaller—nevertheless the Cambridge University Press has produced a volume comparable with the first in size and elegance. The price for this superb production is inevitably high, but in view of its enduring value as an unrivalled factual record, not unduly so.

W. TUTIN

Det Grønne Grønland (Green Greenland). T. W. Böcher. Pp. 256, with 8 groups of coloured plates, and 3 of black and white plates. Rhodos, Copenhagen. 1975. Price D.Kr. 228 (c £18).

This beautifully-produced book on the flora and vegetation of Greenland represents the culmination of more than two centuries of Danish botanical investigation of that Arctic territory. The text is written by Professor Tyge Böcher, who has achieved an international reputation for his many-sided botanical researches, especially in the experimental study of plant variation; and the excellent photographs, many reproduced in colour, are the work of his son Jens.

In the Foreword, Professor Böcher explains his aim—to give to everyone interested in Greenland or the Arctic in general an account of the results of botanical research in Greenland—research in which he has himself played a very important part ever since, more than 40 years ago, he first set foot in Greenland.

The main text of the book covers the following subjects: a historical review of botanical research in Greenland; a general account of climate and soil conditions; an analysis of the flora in terms of Raunkiaer life-forms; a classification in terms of distribution; and, finally, a résumé of biosystematic research on the flora. There is a very complete bibliography and an index.

Most of the colour photographs are of a very high quality and some are outstandingly beautiful. Enthusiasts for the arctic/alpine flora will no doubt all find their favourite plants portrayed—perhaps the full-size photograph of *Saxifraga cernua* with white flowers and red axillary bulbils, or the luscious grey-blue berries of *Vaccinium uliginosum*—and the scientific names of all the plants depicted are given in the captions.

The book is published with the help of grants from the Carlsberg Fund, the Carlsberg Foundation in memory of the brewer J. C. Jacobsen, and other sources. It would be ensured of the much wider circulation it undoubtedly deserves if an English translation could be made.

S. M. WALTERS

Reports

VICE-COUNTY RECORDERS' CONFERENCE, ATTINGHAM PARK, SALOP 18th–21st SEPTEMBER, 1975

INTRODUCTION

Over 60 members of the B.S.B.I., representing 42 vice-counties, took part in the fifth Recorders' Conference. Because of the location it is not surprising that Wales (8 out of 13 vice-counties) and England (24 out of 58 vice-counties) were best represented, but some participants came long distances, notably three members from Ireland, Mrs Murray from the Isle of Skye, and Dr and Mrs Mennema from Leiden in the Netherlands.

This conference, like its predecessors, was aimed at helping Recorders with all aspects of the work which they do for the Society in collecting information about the flora of their area: identification of critical material, searching literature and herbaria, keeping records, writing a Flora and getting it published. This was achieved in part by a programme of formal lectures and three short field meetings, of which a brief account follows. However, what cannot be reported is the immense exchange of ideas—the identification sessions and the general camaraderie which was evident in the many little groups which went on until the small hours of each morning.

THURSDAY, 18TH SEPTEMBER

Dr F. H. Perring (*The flora and Flora of Shropshire*) showed that, whilst because of its position as a Midland county Salop has very few nationally rare species, it has one of the richest floras of any inland county in England or Wales. In part this is due to its central position, so that all the main phytogeographical elements are represented, and in part to its very varied geology and topography. The north of the county is part of the Midland plain, where relics of former peat bogs still occur, and there is a rich aquatic flora associated with the meres and the Shropshire Union Canal. The south is a series of parallel ridges in which limestone and acidic rocks are both represented and large tracts of uncultivated land still remain. Despite this, the flora has been neglected by botanists. The last comprehensive Flora, by W. A. Leighton, was published in 1841, and it is clear that a new work is long overdue. Work began in January 1975 after a successful inaugural meeting at Preston Montford Field Centre attended by 45 potential recorders. Dr Perring concluded by giving details of the methods being used to gather the data.

FRIDAY, 19TH SEPTEMBER

R. D. Meikle (*Salix*) stated that the willows are a very ancient group, going back certainly to the Upper Cretaceous and possibly to the Lower Cretaceous, which probably shows little morphological change between then and now. Such a natural and uniform group is exceptionally difficult to subdivide, and existing treatments either produce infrageneric taxa which include too wide a range of morphology or, at the other extreme, result in groups which are virtually monotypic. In *Salix* it would seem that a system of Series best reflects the situation in nature. The difficulties of identification at the species level are largely the consequence of two characteristics: the plants are dioecious, and male and female specimens are not easily matched; and flowering and foliage material must normally be collected at different times, with consequent possibilities of confusion. Hybridisation also gives rise to taxonomic problems, though the prevalence of hybrids has, in recent years, probably been overestimated. Some of the commoner hybrids are relics of cultivation and are in many instances represented by easily recognised clones. The lecture ended with an illustrated survey of the commoner lowland species and hybrids.

J. H. Chandler (*Beginning to look at wild roses*) said that, with knowledge of the unusual method of reproduction shown by roses, it is possible to understand why they are so variable. He discussed the available literature on the subject. A. H. Wolley-Dod (*A revision of the British roses*, *J. Bot., Lond.*, 68–69, Suppl. (1930–1931)) described the species of native British roses and a host of varieties and forms. Recently published is an account of rose hybrids in *Hybridization and the flora of the*

British Isles (ed. C. A. Stace (1975)) by R. Melville, who recognises 15 native species and considers that the intermediate groups are hybrids. These hybrids are so many and so mixed that for general recording purposes it seems best to ignore them. By so doing the problem of identification is eased and an overall picture of rose distribution is more readily obtained. Recognition of the species is not too difficult. A table of their distinguishing characters was provided, and the field excursions gave more practice on the Salop species, supplemented by fresh material of some northern roses brought from Durham by G. G. Graham.

Dr J. Mennema's lecture (*Plant-recording in the Netherlands*) will, it is hoped, soon be published in full.

SATURDAY, 20TH SEPTEMBER

E. S. Eedes (*The Rubus problem*) said that, despite popular belief, most brambles, when once known, can be recognised quickly. Identification is a problem for two reasons. The first is that there are so many species, over 500 in the British Isles and about 2,000 in Europe. However, few English counties have more than 100, and less than 50 species have been recorded for the whole of Scotland. The second reason is that there is no satisfactory handbook. W. C. R. Watson made a valiant attempt, but his book (*Handbook of the Rubi of Great Britain and Ireland* (1958)) is not easy to use; the terms are undefined and vague. Y. Heslop-Harrison (*Flora Europaea*, 2 (1968)) mentions only 500 of the 2,000 taxa, and only 66 'circle' species are described, chosen because they have a wide distribution. But, though they may be the best selection for Europe as a whole, some do not occur in Britain and a different selection would be needed for each individual country. The solution would be to produce handbooks for selected areas of the British Isles. It would be easy to produce one for Scotland and England north of the Humber-Mersey line; others could cover the Midlands, Wales, East Anglia, the south-east, the south-west and Ireland. Each handbook could deal with fewer than 100 species, and the amount of descriptive material could be kept to a minimum by listing the characters which, say, 70% of them have in common. The individual taxa could be described in the ways in which they differed from the hypothetical norm.

J. E. Lousley (*Preparing a manuscript for publication*) used his experience with *Flora of the Isles of Scilly* (a one-man job following 35 years of work) and *Flora of Surrey* (for which he has edited 15 years' teamwork). His first piece of advice was to pause before dashing in; mistakes made at the beginning can cause much unnecessary work later. The nature of the public for which the *Flora* is intended and the consequences of the way the records have been collected must be reviewed. The records themselves must be tested for coverage (numbers per tetrad or other recording area),

TABLE OF PRIORITIES

The Systematic List		Additional Material	
Latin name of species	98	Index	100
Habitat of species	96	Physical features of the area	100
Location of rarer species	87	Map of the area	99
Last known record of extinct species	87	Bibliography	90
Distribution of species (written)*	85	Botanical survey of the area	76
Status of species, i.e. native, etc.	84	Photographs of habitats	36
English name of species	78	Gazetteer	31
Distribution maps of species*	66	Biographical details of botanists	16
Notes of interest on species	63	Photographs of interesting plants	10
First record of species	39	Drawings of interesting plants	-2
Keys to critical groups	8	Coloured plates	-6
Altitudinal range of species	-1		
Months of flowering	-12		
Cross-references to numbers in Dandy or C.T.W.	-29		
Life-form of species	-34		
Distribution in adjacent counties	-46		
Distribution in British Isles	-48		

* These two items overlap and each merits a higher priority if the other is rejected.

accuracy ('When in doubt, leave out.') and persistence of species not seen recently. If possible, the project should have the author's undivided attention. A readable style is a tremendous advantage. Firm decisions about nomenclature (scientific and English) and the form and sequence of the systematic part of the Flora must be made, and attention given to abbreviations and citations. The introductory material must be interestingly presented and clearly related to the distribution of the species. Accuracy in the final manuscript is of the greatest importance, as alterations at proof stage are extremely expensive. 'But,' Mr Lousley said, 'do not seek absolute perfection: you will never get it.' A fuller version of Mr Lousley's talk has been distributed to Vice-county Recorders. Copies are available from Dr F. H. Perring, Monks Wood Experimental Station, Huntingdon.

Dr J. G. Dony led a discussion on *Publishing local Floras in the 1980s*, based on the returns to the questionnaire *Putting a quart into a pint pot* sent to Recorders earlier in the year. Copies of the questionnaire and Dr Dony's report on 54 returns are available from Dr Perring. The 'table of priorities' from the report (shown opposite) provides 'some tentative conclusions' derived from awarding two points for each item considered by each respondent to be essential in a local Flora and one point for each considered 'good if costs allow', and deducting two points for each considered of very little use and one for each that 'could well be left out'.

R. J. Pankhurst (*Herbaria as a source of material for local Floras*) estimated that there might be some 8,000 relevant sheets per vice-county in **BM** and 20,000 in the ten major British herbaria. Even if the sheets are in vice-comital order (as *some* are in **BM**), the abstracting time per relevant specimen is likely to be at least 5 minutes (excluding travelling time); this amounts to something like 100 man/days for **BM** and 300 for the major herbaria, for each vice-county. Not many local Flora writers do in fact search herbaria. Computerising might appear the logical answer. If data preparation took a minute per sheet, it would take 10 man/years to computerise the British material in **BM**, costing perhaps £20,000. Data-processing would be extra. If new accessions only (*c* 5,000 *per annum*) were computerised, the cost would be comparable to current curation costs, but an enormous backlog would remain. Putting the **BM** sheets on microfiche would cost about £24,000, and sorting would be tedious and expensive, taking perhaps 1½ to 3 years. The situation is better for a few groups of plants. All *Rubus* records have been abstracted from *herb. B. Miles* (now in *CGE*) and put on computer cards, making possible the distribution of vice-county lists, and J. E. Dandy has file cards for all *Potamogeton* specimens he has examined.

P. H. Oswald (*The use of literature in collecting plant records for a local Flora*) used examples from literature about the Salop flora. He divided the relevant literature into 11 inevitably arbitrary categories and said that N. D. Simpson's *A bibliographical index of the British flora* (1960), which contains, for example, over 250 Salop entries, is indispensable for tracking down this material. Records and statements have often been copied blindly, or even miscopied, from one work to another; sources should always be verified. Similarly, it is worth comparing various editions of the same work. Many early lists were published anonymously, but it is often possible to deduce the author; and authorship is one useful test of reliability. Patently unreliable records in a work cast doubts on its other records. However, incorrect records sometimes include a clue to the true identity or location of a plant. Mr Oswald instanced earlier published records from Attingham Park, to indicate that 'more has usually been recorded already than one expects', and two nineteenth-century books on fishing, to show that 'not all the relevant material is labelled "botany"'. He had found the latter, like many other relevant publications, in N. D. Simpson's collection of works on the British flora, now housed in the Botany School at Cambridge.

Dr Perring gave an account of the plant records held by the Biological Records Centre that are available to Recorders. These include Master Cards carrying a list of all field records received since 1950 for each 10 km square; Field Cards, many of which can be localised to particular 1 km squares; and Individual Record Cards. Dr Perring explained that these last are made up as follows:

- a) For 400 species marked A in *Atlas of the British flora* (1962), the major literature and herbaria have been searched and cards prepared at 10 km square level.
- b) For 300 species in the *Red Data Book*, there is a card for every record localised to a 1 km square.
- c) For species marked B in the *Atlas*, the major literature sources for outlying counties have been searched.
- d) Records published in the *Reports of the Botanical Exchange Club* and subsequent B.S.B.I. publications from 1930 to 1962.

- e) Records published in Plant Records in *Watsonia* since 1970.
- f) All records determined by experts in the *Critical Supplement to the Atlas of the British flora* (1968).
- g) Rare, local and interesting records sent in by individuals.

Recorders now receive copies each year of all the new records received for their vice-counties during the year. They may, and often do, ask questions about any records held by the B.R.C. for particular species. Eventually all the records on Individual Record Cards will be available on microfilm.

R. D. Smith (*Seed collecting for the Kew Seed Bank*) outlined possible collaboration between the B.S.B.I. and Kew in the latter's attempt to conserve, under low temperature conditions, seed of our rare and endangered flowering plants collected in the wild. Ideally, 20,000 or more seeds should be collected at random from as many plants as possible within the local population, provided this does not exceed 20% of the total seed available. This should yield a sample of seed which reflects the genetic constitution of the parent population and provides sufficient seed for testing and future use whilst minimising any risk to the continued existence of the population. It is acknowledged that such a number will not be available in many cases. The first part of the collection should then consist of one seed head taken from each plant in the population, provided this does not exceed 20% of all the seed. This can then be used as the basis for seed multiplication in cultivation. If the first part of the collection has not exceeded 20% of the total seed yield, the second part of the collection can be made at random until 20% of the seed has been gathered. This will provide a seed sample which will more truly reflect the genetic constitution of the parent population than that produced through multiplication. It was agreed in discussion that seed of rare species should never be collected without the knowledge of Recorders, as this was the only way to ensure that seeds from the same population were not gathered more than once in the same season.

FIELD MEETINGS

Field meetings, during which the hints on identification given during the lectures were put to the test, were a feature of the conference. R. D. Meikle led parties to study *Salix* around the Stiperstones and in Attingham Park, and over a dozen species and varieties were identified. *Rosa* and *Rubus* were studied by two parties, the former led by Mrs H. R. H. Vaughan, J. H. Chandler and G. G. Graham, and the latter by E. S. Edees and A. Newton. Each made a valuable contribution to our knowledge of these groups in Salop in the course of visits to Earls Hill, Merrington Green and Haughmond Hill.

F. H. PERRING & P. H. OSWALD

EXHIBITION MEETING, 1975

The Annual Exhibition Meeting was held in the Department of Botany, British Museum (Natural History), London, on Saturday, 29th November, 1975, from 12.00 to 17.30 hours.

THE TRAVELS OF AN ATLAS

The exhibit pictured a copy of the *Atlas of the British flora* on sale in the Kashmir Bookshop, Srinagar, India, in 1974, when it was out of print in this country. It was later bought by Dr K. M. Matthew (Rapinat Herbarium, St Joseph's College, Tiruchirapalli, India) after he had advertised for one in *B.S.B.I. News*, 3(3).

M. BRIGGS

A FLOWERING SPECIMEN OF *ELODEA NUTTALLII* (PLANCH.) ST JOHN

Elodea nuttallii, determined by C. D. K. Cook, was recorded in flower from Amberley Wild Brooks, W. Sussex, in both June and September 1975. It was growing with *Elodea canadensis*,

the two species being present in approximately equal proportions in some dykes. Professor Cook comments that in some countries, e.g. Belgium, Germany and Switzerland, *E. nuttallii* has replaced *E. canadensis* within about 10 years of its first record in each country. *E. canadensis* also flowered profusely in Amberley Wild Brooks during the hot summer of 1975.

M. BRIGGS

NEW BOTANICAL WALL-CHARTS

The great success of the first series of ecological wall-charts and of the culinary herb chart has encouraged the British Museum (Natural History) to commission a second series by the same artist—Miss Barbara Nicholson. Plants from five more major habitats are illustrated: Hedgerows, Deciduous Woodland, Mountains, Freshwater and Salt-marsh. The original paintings for the new series were exhibited, and it is hoped that the charts will be available early in 1976.

DEPARTMENT OF BOTANY, BRITISH MUSEUM
(NATURAL HISTORY)

DISTRIBUTION MAPS OF PLANTS OF SOUTHERN SPAIN

Six loose-leaf volumes of maps, making up a Distribution Atlas of the flora of part of southern Spain, now showing excellent progress in the course of compilation, were exhibited. 2,000 species have so far been recorded for the area. Also shown was an index to the Atlas with the abbreviations on the recording cards and pointers to books, etc., leading to further information. This was brought up to date with a supplement dated 5th November 1975.

Some of the additions to the albums of botanical illustrations were displayed.

200 of the herbarium sheets made during 1975 were available for reference, bringing the total number of species represented in the herbarium to 1150, all local species gathered in the area.

Exhibited also were pressings and drawings of two dandelions new to Spain, found during a most successful expedition to Ronda in May, 1975. They are *Taraxacum polyschistum* Dahlst. and *T. plumbeum* Dahlst.

Further expeditions were advertised and enthusiasts with a working knowledge of the Latin names of British species were invited to come to Andalucia in 1976 and 1977 to further the project.

J. W. CARR

A *TRIGONELLA* SPECIES OMITTED FROM *FLORA EUROPAEA*

Trigonella ovalis Boiss. (*Medicago ovalis* (Boiss.) Urban) is a native of southern Spain and Mauritania amply described in Willkomm & Lange's *Prodromus Florae Hispanicae*, 3: 379 (1877), but misinterpreted in *Flora Europaea*, 2: 440 (1968), where it is wrongly equated in the index with the dissimilar and widespread *T. monspeliaca* L. Specimens of both species were exhibited together with a coloured illustration of the fresh plant made by Rosemary Wise.

T. ovalis was discovered in three scattered 10 km squares, twice in agrestal habitats and once on a trackside on an open hillside, during the May 1975 expedition organized by J. W. Carr to the Serrania de Ronda (province Malaga). Voucher specimens will be deposited in BM and LTR.

E. J. CLEMENT

ADVENTIVE NEWS, 1-3

Pressed specimens were exhibited to illustrate some of the adventive records which have appeared in *B.S.B.I. News*, 3(3), 9 and 10 (1974-1975).

E. J. CLEMENT

THE GERANIACEAE—A COMPUTER PROJECT

The exhibit included slides and living and herbarium specimens of British Geraniaceae, supporting the list of species names produced for the British Pelargonium and Geranium Society. The main part of the exhibit consisted of a demonstration of the Wang computer system used to record and print the list, and the various modes by which the data could be searched and supplementary lists produced. The production and publication of the finished list is expected to be of assistance not only to the hybridists of the British Pelargonium and Geranium Society and similar societies overseas, but also to the compilers of several overseas Floras now in production.

R. T. F. CLIFTON

COCHLEARIA DANICA L. $\times$ C. OFFICINALIS L. IN PEMBROKESHIRE

Two specimens from a population of *Cochlearia danica* at St Ann's Head, Pembs., v.c. 45, were shown. *C. danica* was dominant on an area more than 100 m long and up to 25 m wide on a gentle slope of short cliff-turf between cultivated grassland and a steep cliff-slope. Many larger plants with larger flowers about the size of those of *C. officinalis* were sparsely scattered through the population and were determined as *C. danica* $\times$ *C. officinalis*, confirmed by P. M. Benoit. The hybrid plants differed from the others only in size and in having paler lilac flowers; there was no appreciable difference in leaf-shape or the colouring of vegetative parts. There were no *C. officinalis* plants mingled with the *C. danica* but many in a hedgebank about 100 m away.

T. A. W. DAVIS

TWO NEW RUBI FROM PEMBROKESHIRE

Specimens of two new *Rubi* recently described by A. Newton (*Nature Wales*, 14: 24–34 (1974)) were exhibited.

Rubus digitatus A. Newton is a very distinct and constant species known only from South Wales. It is one of the commonest brambles in Pembs., v.c. 45, occurs in several localities in Carms., v.c. 44, and has been found in Cards., v.c. 46, Brecon, v.c. 42, and Glamorgan, v.c. 41.

Rubus aequalidens A. Newton is widely distributed in Pembs. and is known from Carms. and Glamorgan, and in Ireland from Wexford, v.c. H12, and Wicklow, v.c. H20. Watson (*Handbook of the Rubi of Great Britain and Ireland* (1958)) called it *R. nigricatus*.

T. A. W. DAVIS

ENDANGERED PLANTS

The new B.S.B.I. poster showing the 21 species now protected by law was exhibited together with maps illustrating their past and present distributions. The beautiful original paintings by Mary Gilham, on which the poster was based, were also exhibited by courtesy of the *Illustrated London News*.

L. FARRELL & F. H. PERRING

NATURALIZATION OF INTRODUCED TREES

For *Atlas Florae Europaeae* information is needed on where natural regeneration of introduced trees takes place in Britain. For Vol. 3 all sources readily available at the Biological Records Centre were searched for *Quercus ilex*, *Q. cerris* and *Castanea sativa*, including Maps Scheme records, the Nature Conservancy Council's woodland survey cards, and county Floras. The resulting maps, though satisfactory on a European scale, are clearly incomplete and members were invited to add extra records from their own observations.

E. GENT & F. H. PERRING

ECHINOPS IN BRITAIN

Drawings by Miss K. Hollick and specimens were shown of the species of *Echinops* naturalized in our islands. A key which seems to work is:

1. Plant glandular above.....*E. sphaerocephalus* L.
1. Plant eglandular above
 2. Flowers blue; phyllary tips erect and pressed together in bud; leaves shortly bristly; plant to 4 feet *E. bannaticus* Rochel ex Schrad.
 2. Flowers white or greyish; phyllary tips recurved in bud; leaves slightly hairy; plant to 10 feet *E. exaltatus* Schrad. (*E. commutatus* Juratzka)

Much help has been given with this study by Mr C. Jeffrey (Royal Botanic Gardens, Kew) and Mr & Mrs R. C. L. Howitt (Farndon, Newark).

K. HOLLICK & D. McCLINTOCK

PLANT RECORDS FROM GAMLINGAY, CAMBS., V.C. 29

Gamlingay, in the south-western corner of Cambridgeshire, lies on the only greensand in the county and many species occur which are absent or rare in the rest of the county. Much of the area is under market garden cultivation, but a few areas of more natural vegetation remain. The exhibit comprised herbarium sheets of the following: *Tilia cordata*, long known and considered native in White Wood, Gamlingay; *Gnaphalium sylvaticum*, rediscovered in 1975 after a lapse of 56 years; forms of both *Solanum nigrum* and *S. sarrachoides* with deeply divided corollas with narrow lobes (the former plant being the var. *stenopetalum* Doll); and the hybrid between typical *S. nigrum* and *S. sarrachoides*, which has not previously been recorded in the British Isles. A rooted cutting of the hybrid was also shown.

A. C. LESLIE

RANUNCULUS AURICOMUS AGG.

The exhibit demonstrated some of the variation of *Ranunculus auricomus* found in Europe, where c 500 taxa have been described in countries ranging from Sweden and France to Romania. Three living specimens from different parts of Britain showed some of the wide range of leaf-form that is important in the taxonomy of this group. A map detailing the distribution of *Ranunculus auricomus* showed its general absence from the westernmost and northernmost parts of the British Isles and its association with calcareous soils throughout most of its range.

A. C. LESLIE

POLYGONACEAE—NEW ESTABLISHED ALIENS

For a full report of the plants featured in this exhibit see Short Notes, pp. 144–146

J. E. LOUSLEY

THE GUERNSEY FLORA IN 1975

Sheets were shown of the main additions to the island's flora in 1975: *Trifolium alexandrinum*, *Duchesnea indica*, *Acanthus spinosus*, *Mentha* × *villosa-nervata*, *Physalis* sp., *Guizotia abyssinica*, *Tradescantia albiflora*, *Anacamptis pyramidalis* and *Festuca rubra* subsp. *litoralis*. In addition, *Artemisia absinthium* was added for Herm and *Atriplex laciniata* collected there for the first time for 78 years.

D. McCLINTOCK

SOME ABERRANT HEATHERS

Specimens of heathers were shown with some of the variations not covered by at least many standard Floras. Among them were:

Calluna vulgaris f. *grandiflora* Beij. and f. *multibracteata* J. Jansen, the latter of which seems characteristic of all really late-flowering forms.

Daboecia cantabrica, with stems 180 and 260 cm long, as happens when it weaves through bushes. *Erica ciliaris* f. *eglandulosa* L. Chevallier, the only form in Ireland.

E. cinerea, with stems 140 cm long; with yellow foliage; and var. *schizopetala* Boulger, appearing, significantly, not only as a seedling, but also as a sport.

E. tetralix f. *eglandulosa* L. Chevallier; var. *quinaria* Guffroy, which may not be stable; and 'Texel', collected wild in that island, with a racemose inflorescence.

Many of the details in Floras should doubtless be understood to be prefixed with the word 'usually'.

D. McCLINTOCK

A NEW *OENOTHERA*

Specimens, a drawing by Miss K. Hollick and a description by Dr K. Rostanski were shown of a new species of *Oenothera* which Dr Rostanski is about to describe from plants growing in some plenty at Jersey Marine, Glamorgan, v.c. 41, and Pembrey Burrows, Carm., v.c. 44, on the coast of S. Wales.

D. McCLINTOCK

CYNIPID OAK GALL SURVEY

Cynipid oak galls are caused by insects (Hymenoptera: Cynipidae) which lay their eggs in various tissues of the host tree, initiating a host growth-response manifesting itself as a gall structure. This survey of galls occurring on the aerial parts of *Quercus robur*, *Q. petraea* and their hybrids has been instigated for three main reasons:

1. To gather data on the distribution of Cynipid oak galls in the British Isles. These data will lead to the compilation of distribution maps, based on the 10 km grid-squares, in conjunction with the Biological Records Centre.

2. To gather more detailed site data for the county of Devon, so that tetrad maps may be drawn up. It is intended that these maps will be updated each year so that any changes in distributions can readily be recognized.

3. To obtain data on the within-tree distributions of the galls. The causative insects and their parasites and inquiline are isolated from the gall material, providing data for analysis of Cynipid population dynamics. The effect of Cynipid galls on seedling development and survival is being examined, with particular attention to *Andricus quercuscalicis* Burgsdorff., the 'Knopper' gall.

M. H. MARTIN & D. L. WIGSTON

B.S.B.I. BLACK POPLAR SURVEY

Since the exhibit shown at the 1973 Exhibition Meeting much progress has been made, but the Survey is still far from complete judging by the number of additional records which keep coming in. Since the map in *B.S.B.I. News*, 9 (March 1975) was prepared, 45 10 km grid squares have been added. The most interesting extension is the frequent occurrence of mature trees in North Wales, in the valleys of the Rivers Conway, Clwyd and Dee. The species is now known from 13 grid-squares in vice-counties 49, 50 and 51, an area where two years ago it was not known to occur. There are now firm records from Somerset and Sussex, whilst the belt of distribution through the Midlands has filled in considerably. An up-to-date distribution map was exhibited.

A most important discovery is that crucks made from *Populus nigra* were used in the construction of at least four medieval cruck barns in Hereford and Worcester. This is the strongest evidence yet supporting my belief that *P. nigra* is a native British tree.

E. MILNE-REDHEAD

PHOTOGRAPHY FOR BOTANISTS

The exhibit consisted of two panels illustrating various technical aspects of equipment and lighting, and four panels of colour prints emphasizing points of good and poor technique.

R. PARKS

PRICKLY LETTUCE (*LACTUCA SERRIOLA* L.) IN BRITAIN

In the British Isles, *Lactuca serriola* normally behaves as a winter annual, although occasionally spring germination does occur. The overwintering rosette bolts in May to form a stiffly-erect flowering stem (20–)70–180(–210)cm high. All but one of the 70 populations surveyed were composed of plants which could be assigned, quite unequivocally, to one or other of two distinct variants defined by the shape of their cauline leaves—either oblong-obovate and entire, or runcinate-pinnatifid. In one site only a dentate-leaved variant was found. Because many of the older Floras assigned all entire-leaved lettuces to *L. virosa*, there has been considerable confusion over identification. *L. virosa* var. *integrifolia* S. F. Gray and *L. serriola* vars. *dubia* Jord., *angustana* All. and *integrata* Godr. & Gren. all appear to be names applied to the entire-leaved variant of *L. serriola* found in Britain. Fruiting specimens of the two species of *Lactuca* can be distinguished by achene colour (maroon in *L. virosa*, olive-grey in *L. serriola*) and the presence (*L. serriola*) or absence (*L. virosa*) of bristles at the apex of the achenes.

S. D. PRINCE & R. N. CARTER

ANCHUSA SPECIES AT UPTON TOWANS, CORNWALL

A short account, accompanied by drawings, photographs and pressed specimens, was provided of three alien *Anchusas*, *A. azurea* Mill. (*A. italica* Retz.), *A. officinalis* L. and *A. ochroleuca* Bieb., discovered at Upton Towans between the years 1909 and 1922.

A. azurea appears to have died out, as Mr A. O. Chater found none among recent specimens sent to him; he identified deep-blue flowered *A. officinalis*, pale-yellow flowered *A. ochroleuca*, and their hybrid.

Several other aliens (*Salvia verticillata*, *S. sylvestris*, *Ajuga genevensis*, *Rumex frutescens* and *Dichondra micrantha*) were also found in the same area, all possibly introduced during the First World War, when a military camp was situated there. Most of these plants still persist today, in spite of much increased public access to this part of the dunes.

J. RUSSELL & B. E. M. GARRATT

THE IRISH IVY IN THE 19TH AND 20TH CENTURIES

Living Irish Ivy, *Hedera helix* var. *hibernica* Kirchn., was exhibited with photographs of ivy-decorated 19th and 20th century domestic ware, much of which portrayed this variety. *Hedera*s are slowly returning to popularity with designers; examples shown were a sample of curtain material, a photograph of modern china and an advertisement mainly using ivy. A postcard of the Rocks at Ballybunion, the Kerry locality where Irish Ivy is said to have arisen, was also shown with a note describing this as a most unlikely habitat for any *Hedera*. B.S.B.I. Irish Ivy Survey cards were also on display.

A. RUTHERFORD

JUNCUS PLANIFOLIUS

A herbarium specimen of this recently discovered alien was displayed in which the fruiting heads showed proliferation. An up-to-date distribution map of the species in Ireland was also shown.

M. J. P. SCANNELL

SENECIO VULGARIS WITH ALIFORM ROOTS

A specimen of *Senecio vulgaris* was exhibited from sandy shingle south-west of Ballyconneely, W. Galway, v.c. H16, on account of its peculiar aliform roots. The older parts of the roots consisted of the central, cylindrical core of vascular tissue flanked by two aliform, lateral cortical extensions. These extensions taper off apically and are absent from the youngest parts of the roots. The feature has not been seen in fresh material, but becomes apparent after drying. Herbarium material with aliform roots from other localities in Ireland and from Cheshire and Guernsey is present in DBN, but published references to the characteristic have not been found.

M. J. P. SCANNELL

MIMULUS GUTTATUS, *M. LUTEUS* AND THEIR HYBRID

Photographs of *M. guttatus*, *M. luteus* and the sterile *M. guttatus* × *M. luteus* were exhibited, showing the range of variation between different clones of the hybrid. Although the hybrid is now known from at least 39 British and Irish vice-counties, it is clear that there is still much confusion amongst botanists, resulting in the over-recording of both parent species, especially *M. luteus*. This is particularly prevalent in localities where two or more hybrid clones are present; the clear intermediate is recorded as the hybrid and the other clone may be automatically recorded as the species it most resembles. True *M. luteus* has now been confirmed by R. H. Roberts and/or A. J. Silverside from 12 localities in ten vice-counties; most of these records are from old herbarium material and *M. luteus* may now be close to extinction in the British Isles.

A. J. SILVERSIDE

POLYSTICHUM × *LONCHITIFORME*, A FERN HYBRID NEW TO THE BRITISH ISLES

Two of the three possible hybrids between the British species of *Polystichum* have been recorded from the British Isles. The third, *P. lonchitis* × *P. setiferum* (= *P. × lonchitiforme* (Halácsy) Becherer), previously known only from a single specimen from southern Greece, has recently been discovered in a locality in western Ireland, where it grows together with *P. aculeatum* and both parents. The hybrid is of intermediate morphology, with abortive spores and very narrow, erect fronds, which in the middle third are deeply dissected and almost bipinnate. It is very easily confused with the related *P. aculeatum* × *P. lonchitis* (= *P. × illyricum* (Borbás) Hahne), and the only sure way to distinguish them is by a chromosome count, *P. × lonchitiforme* being diploid ($2n=82$) and *P. × illyricum* triploid ($2n=123$).

Herbarium specimens of the hybrid and its parents were shown, together with photographs of spore and chromosome preparations and a map and pictures of the locality.

A. SLEEP

INTERESTING BRITISH HYBRIDS

The exhibit comprised herbarium specimens of 13 hybrids of particular interest to the British botanist. They included *Daphne laureola* × *D. mezereum*, found in the wild only three times anywhere in the world (all in England); *Epilobium adenocaulon* × *E. hirsutum*, known from England since 1936 but in 1972 discovered in Czechoslovakia and named *E. × novae-civitatidis* Smejkal;

Festuca rubra × *Vulpia myuros*, known only from Merioneth, S. Lancs. and W. Norfolk; *Oenothera biennis* × *O. erythrosepala*, which in the last 60 years has become the commonest Evening Primrose on the Lancashire coast; *Puccinellia distans* × *P. rupestris*, often recorded in western Europe but confirmed for the first time in 1975 (in W. Norfolk); *Rosa canina* × *R. rugosa*, which has been found in only one locality (in W. Antrim), where it is apparently now extinct; and *Symphytum asperum* × *S. officinale* × *S. tuberosum*, an example of a trispecific hybrid, one of its parents being *S. × uplandicum*.

C. A. STACE

SOME HYBRIDS FROM SOUTH-WESTERN SCOTLAND

The exhibit showed five specimens of hybrid grasses all found in Kirkcudbright, v.c. 73, for the first time during the last three years: *Agropyron junceiforme* × *A. repens*, *Lolium multiflorum* × *L. perenne*, *Bromus hordeaceus* × *B. lepidus*, *Festuca arundinacea* × *F. gigantea*, and *F. ovina* var. *hispidula* × *F. tenuifolia*. The last was found in 1975 in a disused quarry near Dundrennan, having been previously found in the British Isles only on cliffs on the Mull of Kintyre, v.c. 101.

Specimens of *Ranunculus flammula* × *R. reptans* from Kirkcudbright, v.c. 73, and of *Stachys palustris* × *S. sylvatica* from Dumfries, v.c. 72, were also shown, along with some water-colour paintings of other hybrid plants.

O. STEWART

CONSERVATION OF PLANTS BY ROADSIDES

See *B.S.B.I. News*, 11: 13–14 (1976).

J. M. WAY

The following also exhibited:

- M. E. BRAITHWAITE. The railway flora of Teviot Dale.
- B. S. BROOKES. Two plants from East Perthshire.
- B. EVERARD. Vanishing flowers of the world.
- J. H. FREMLIN. Stereophotographs of flowers of the Isles of Scilly.
- A. N. GIBBY. Some new botanical stamps.
- C. G. HANSON. Bird-seed aliens at Ware, 1975.
- R. W. MELLORS & S. M. WALTERS. The Cambridge conservation collection.
- Y. L. MOSCHATI. Postal flora of some European islands; Trees on postage stamps.
- R. RANDALL. *Lathyrus japonicus*.
- P. M. TASCHEREAU. *Atriplex praecox* Hülpf., a taxon new to the British Isles.

In the lecture hall the following members gave short talks illustrated by colour-slides:

- J. I. BYATT. Plants of the Crimea.
- J. W. CARR & H. H. FOWKES. Andalusian plants.
- S. R. EDWARDS. Lighting in plant photography.
- J. E. LOUSLEY. Slides from two B.S.B.I. meetings.
- J. L. MASON. Wild flowers of Hungary.
- R. J. PANKHURST. Plants of Galloway.
- R. PARKS. Mountain rarities.
- F. H. PERRING. *Eucalyptus* and Australian Myrtaceae.

The names of administrative counties and vice-counties in *Watsonia*

The purpose of the following note is to explain, particularly for the benefit of foreign readers, the relationship between vice-counties and administrative counties, and to state the present policy of *Watsonia* with regard to the recent profound changes in the latter in Britain.

Over a period of about 30 years from the publication of his *Cybele Britannica* in 1852, Watson conceived and elaborated upon his now familiar system of vice-counties for recording plant distribution. He recognised 112 vice-counties in Britain and Praeger (1901) subsequently established 40 in Ireland. Despite the name vice-county, many are the same as the then existing counties, but small counties were assimilated in neighbouring vice-counties and large counties were subdivided.

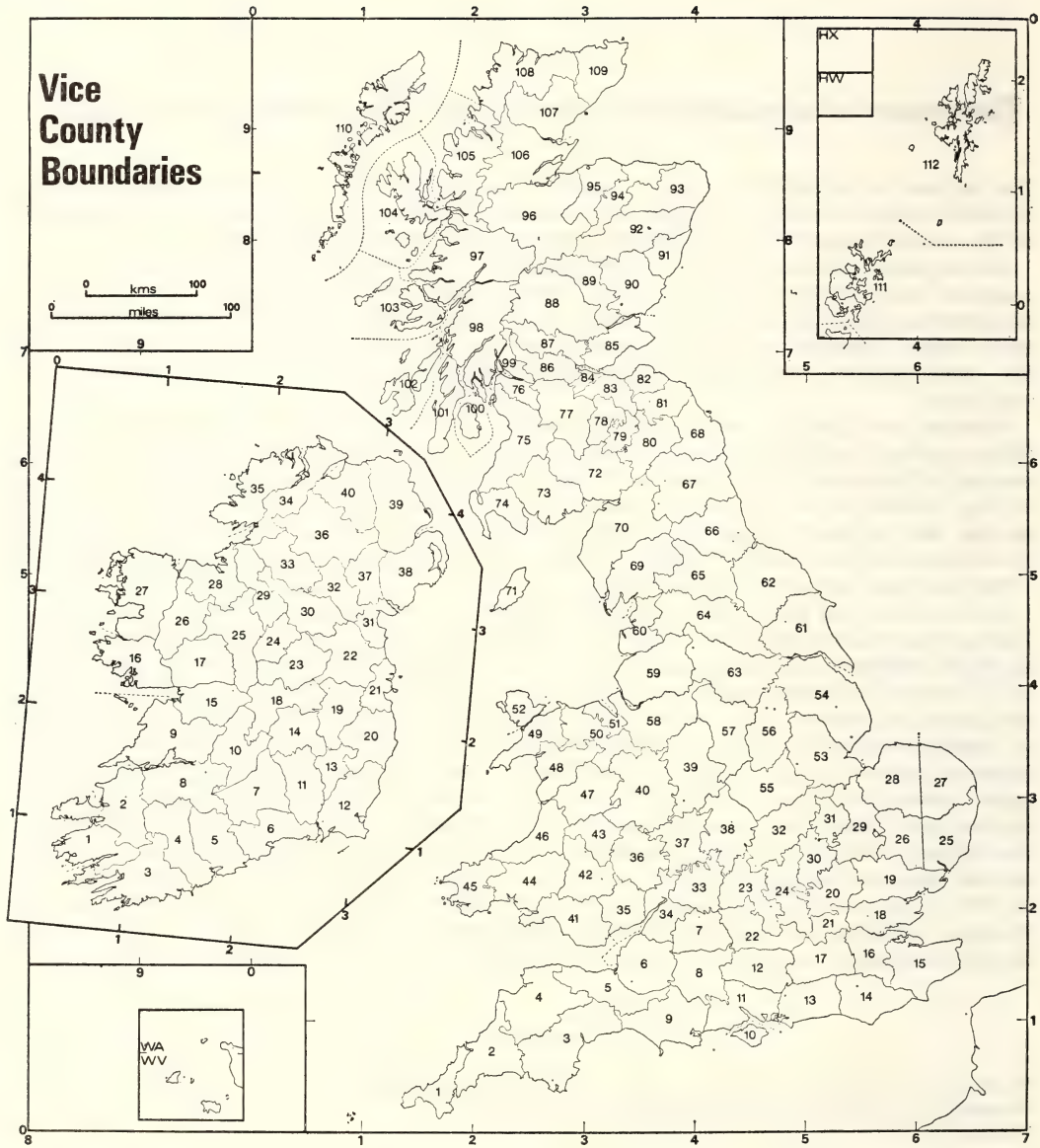
However, with periodic revisions of administrative county boundaries, the counties came to differ more and more from the vice-counties. In some cases, e.g. v.c. 21, Middlesex, the county eventually disappeared as an administrative area. Not unnaturally there were pressures to use the existing administrative counties as recording units, despite their long-term instability, simply because they are easily recognised on a map. Despite these pressures, the vice-county system has survived and the problem of recognising their boundaries has been largely overcome by Dandy's (1969) two maps and explanatory booklet.

Until recently the policy of *Watsonia* had been to use vice-county names (or abbreviations) when giving details of distributions but to use the administrative county names for more general purposes. However, the local government boundary changes in 1974 (England and Wales) and 1975 (Scotland) affected almost every county. The number of counties was considerably reduced, particularly in Scotland where they have been replaced by 9 regions. It has therefore been necessary to consider whether to use only the old familiar county names, to leave the choice of old or new names to authors, or to use only the new names. Vice-county names would still be used where more appropriate. It was eventually decided to use the new administrative county names in England and Wales, despite the large size of some of the Welsh counties, but to continue to use the old ones in Scotland, chiefly because of the size of the new Scottish regions. A map of the old and new counties and regions, on a scale of 1:1,200,000, was published by Geographia Ltd in 1975. A map of the vice-counties and a list of their numbers and abbreviations, as used in *Watsonia*, are given below. Since it is envisaged that the vice-counties will continue to be by far the most frequently used system in *Watsonia*, this map will appear in all future issues of *Watsonia*.

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 PRAEGER, R. L. (1901). *Irish topographical botany*. Dublin.
 WATSON, H. C. (1852). *Cybele Britannica*, 3. London.

G. HALLIDAY & F. H. PERRING



ENGLAND, WALES AND SCOTLAND

- | | | |
|----------------|-------------------|---------------------|
| 1. W. Cornwall | 39. Staffs. | 76. Renfrew |
| 1b. Scilly | 40. Salop | 77. Lanark |
| 2. E. Cornwall | 41. Glam. | 78. Peebles |
| 3. S. Devon | 42. Brecon | 79. Selkirk |
| 4. N. Devon | 43. Radnor | 80. Roxburgh |
| 5. S. Somerset | 44. Carms. | 81. Berwick |
| 6. N. Somerset | 45. Pembs. | 82. Haddington |
| 7. N. Wilts. | 46. Cards. | 83. Edinburgh |
| 8. S. Wilts. | 47. Montgomery | 84. Linlithgow |
| 9. Dorset | 48. Merioneth | 85. Fife |
| 10. Wight | 49. Caerns. | 86. Stirling |
| 11. S. Hants. | 50. Denbigh | 87. W. Perth |
| 12. N. Hants. | 51. Flint | 88. Mid Perth |
| 13. W. Sussex | 52. Anglesey | 89. E. Perth |
| 14. E. Sussex | 53. S. Lincs. | 90. Forfar |
| 15. E. Kent | 54. N. Lincs. | 91. Kincardine |
| 16. W. Kent | 55. Leics. | 92. S. Aberdeen |
| 17. Surrey | 55b. Rutland | 93. N. Aberdeen |
| 18. S. Essex | 56. Notts. | 94. Banff |
| 19. N. Essex | 57. Derbys. | 95. Moray |
| 20. Herts. | 58. Cheshire | 96. Easternness |
| 21. Middlesex | 59. S. Lancs. | 96b. Nairn |
| 22. Berks. | 60. W. Lancs. | 97. Westernness |
| 23. Oxon. | 61. S.E. Yorks. | 98. Main Argyll |
| 24. Bucks. | 62. N.E. Yorks. | 99. Dunbarton |
| 25. E. Suffolk | 63. S.W. Yorks. | 100. Clyde Is. |
| 26. W. Suffolk | 64. Mid-W. Yorks. | 101. Kintyre |
| 27. E. Norfolk | 65. N.W. Yorks. | 102. S. Ebudes |
| 28. W. Norfolk | 66. Durham | 103. Mid Ebudes |
| 29. Cambs. | 67. S. Northumb. | 104. N. Ebudes |
| 30. Beds. | 68. Cheviot | 105. W. Ross |
| 31. Hunts. | 69. Westmorland | 106. E. Ross |
| 32. Northants. | 69b. Furness | 107. E. Sutherland |
| 33. E. Gloucs. | 70. Cumberland | 108. W. Sutherland |
| 34. W. Gloucs. | 71. Man | 109. Caithness |
| 35. Mon. | 72. Dumfries | 110. Outer Hebrides |
| 36. Hereford | 73. Kirkcudbright | 111. Orkney |
| 37. Worcs. | 74. Wigtown | 112. Shetland |
| 38. Warks. | 75. Ayr | |

IRELAND

- | | | |
|-------------------|------------------|------------------|
| H1. S. Kerry | H15. S.E. Galway | H29. Leitrim |
| H2. N. Kerry | H16. W. Galway | H30. Cavan |
| H3. W. Cork | H17. N.E. Galway | H31. Louth |
| H4. Mid Cork | H18. Offaly | H32. Monaghan |
| H5. E. Cork | H19. Kildare | H33. Fermanagh |
| H6. Waterford | H20. Wicklow | H34. E. Donegal |
| H7. S. Tipperary | H21. Dublin | H35. W. Donegal |
| H8. Limerick | H22. Meath | H36. Tyrone |
| H9. Clare | H23. W. Meath | H37. Armagh |
| H10. N. Tipperary | H24. Longford | H38. Down |
| H11. Kilkenny | H25. Roscommon | H39. Antrim |
| H12. Wexford | H26. E. Mayo | H40. Londonderry |
| H13. Carlow | H27. W. Mayo | |
| H14. Leix | H28. Sligo | |

Botanical Society of the British Isles Conference Reports

1. **BRITISH FLOWERING PLANTS AND MODERN SYSTEMATIC METHODS**
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Ed. M. G. Morris and F. H. Perring. Pp. 376, 8 plates. 1974.
15. **EUROPEAN FLORISTIC AND TAXONOMIC STUDIES**
Ed. S. M. Walters, with the assistance of C. J. King. Pp. 144, 4 plates. 1975.

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Hybridization and the Flora of the British Isles

Edited by C. A. STACE

A comprehensive account of each of the 975 hybrids that has been recorded from the British Isles based on accounts prepared by over 80 specialists and skilfully edited and brought together in a single volume by Dr Stace. Up-to-date data are provided on their appearance, identification, fertility and distribution, and on the results of any experimental work which has been carried out on them. Many of the so-called hybrids are mere fanciful identifications; the evidence in such cases is assessed. A literature list is given for each hybrid, and an introductory section provides a general background to the whole subject of hybridization. In addition, 464 hybrids between British species which have been found abroad but not yet in the British Isles are listed.

This reference work is an authoritative source of information for field botanists who wish to discover hybrids in the wild, and for professional botanists who wish to use hybrids for both research and teaching purposes. It also provides a stimulus for further research, as for the first time the gaps and deficiencies in our knowledge are precisely defined. The introductory section is a more complete synthesis of information on hybridization than has hitherto been available, and for the most part uses British and Continental examples to illustrate the principles discussed.

Published in collaboration with the Botanical Society of the British Isles by Academic Press, London, New York, San Francisco. Pp. xiv+640. 1975. Price £14.80/\$39.25. Obtainable from Academic Press, London, etc., 24-28 Oval Road, London, NW1 7DX.

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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*

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 are invited.

Manuscripts must be submitted in duplicate, typewritten on one side of the paper only, with wide margins and double-spaced throughout. They should follow recent issues of *Watsonia* in all matters of format, including abstracts, headings, tables, keys, figures, references and appendices. Note particularly use of capitals and italics. *Only underline where italics are required.*

Tables, appendices and captions to figures should be typed on separate sheets and attached at the end of the manuscript. Names of periodicals in the references should be abbreviated as in the *World List of Scientific Periodicals*, and herbaria as in Kent's *British Herbaria*. Line drawings should be in Indian Ink, preferably on good quality white card, but blue-lined graph paper or tracing paper are acceptable. They should be drawn at least twice the final size and they will normally occupy the full width of the page. Lettering should be done in Lettraset or by high-quality stencilling, though graph axes and other more extensive labelling are best done in pencil and left to the printer. Photographs can only be accepted in exceptional cases.

Contributors are strongly advised to consult the editors before submission in any cases of doubt. Manuscripts will be scrutinized by the editors and a referee and a decision communicated as soon as possible. Authors receive a galley proof for checking, but only errors of typography or fact may be made. 25 offprints are given free to authors of papers. Further copies, and copies of Short Notes, may be purchased in multiples of 25 at the current price.

The Society takes no responsibility for the views expressed by authors of articles.

Papers and short notes should be sent to Dr G. Halliday, Dept. of Biological Sciences, University of Lancaster, Lancaster LA1 4YQ. Books for review should be sent to Dr N. K. B. Robson, Dept. of Botany, British Museum (Natural History), Cromwell Road, London, SW7 5BD. Plant records should be sent to the appropriate vice-county recorders.



Watsonia

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