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The *Sorbus latifolia* (Lam.) Pers. aggregate in the British Isles

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ABSTRACT

An account is given of *Sorbus decipiens* (Bechst.) Irmisch, *S. subcuneata* Wilmott, *S. devoniensis* E. F. Warb., **S. croceocarpa** P. D. Sell, **sp. nov.**, *S. bristoliensis* Wilmott, *S. latifolia* (Lam.) Pers. and *S. vagensis* Wilmott. All are thought to have been derived from hybridization between *S. aria* (L.) Crantz sensu lato and *S. torminalis* (L.) Crantz and are characterized by their broad, grey-felted leaves and yellow, orange or brownish berries. Detailed descriptions are given of *S. decipiens*, *S. croceocarpa* and *S. latifolia*, and specimens seen are listed.

INTRODUCTION

Warburg (1962) and Warburg & Kárpáti (1968) have grouped together a number of species related to *Sorbus latifolia* (Lam.) Pers. They are characterized by having broad leaves grey-felted below and fruits yellow, orange or brownish when ripe. In these respects they are morphologically intermediate between *S. aria* (L.) Crantz sensu lato and *S. torminalis* (L.) Crantz and are almost certainly derived from hybridization. *S. vagensis* Wilmott is at least sometimes a fertile diploid, while the remainder are probably all apomictic and in most years produce copious fruit. Flavone O-glycosides have been found in *S. torminalis* and not in *S. aria* sensu lato or *S. aucuparia* L. (Challis & Kovanda 1978). Their presence in *S. decipiens*, *S. bristoliensis* and *S. devoniensis* supports a relationship between these species and *S. torminalis*.

There is a tendency for taxonomists working on apomictic groups to try to guess at the exact origin of the taxa. All the species described here almost certainly have as one parent the diploid *S. torminalis*. On purely morphological grounds it would seem to me that the large-leaved, usually large-fruited *S. croceocarpa* and *S. devoniensis* had as the other parent the diploid *S. aria* sensu stricto. In the case of *S. devoniensis* there would have to have been a doubling of chromosomes. The chromosome number of *S. croceocarpa* is unknown. The narrow-based leaves of *S. subcuneata* perhaps suggest that *S. rupicola* is the other parent. Its chromosome number has not been counted. The triploid *S. bristoliensis* with small, broad leaves could perhaps have as its other parent the tetraploid cytodeme of *S. porrigentiformis*. *S. latifolia*, which is diploid, presumably has as its other parent *S. aria* sensu stricto. Its leaves, however, are much nearer *S. torminalis*. *S. vagensis* is of the same origin and same chromosome number and has both its leaves and fruit nearest to *S. torminalis*. A similar tree grows on the calcareous plateaux of Burgundy and Lorraine and has been called *S. confusa* Gremli by the French. It is possible that these three taxa should be regarded as nothomorphs of a sexual hybrid, but until their biology is better understood I recommend that they are best treated as species. I do not know *S. decipiens* in its native habitat and do not care to make any guess as to its exact origin.

I agree with Warburg (1962) on the taxonomy of the local endemics. The introduced species, which until now have been referred to *S. latifolia* aggregate, are sorted out here; three clearly separable species are involved: *S. decipiens*, *S. croceocarpa* (which has had to be described as new) and *S. latifolia* sensu stricto. Detailed descriptions of these three species are given below. The best leaves to consider are on the short shoots although most leaves on a mature tree are adequate for this group of *Sorbus*.

Contrary to the usual procedure for rare species exact localities for the trees have been given. Whole trees cannot be put in a herbarium and a little pruning probably does no harm. On the other hand if the exact sites of the trees are not known they could easily be cut down without anyone being aware of their interest.

S. decipiens (Bechst.) Irmisch in Petzold & Kirchner, *Arbor. Muscav.* 301 (1864).
Crataegus hybrida Bechst. in *Diana* **1**: 81 (1797). Neotype: J. M. Bechstein, *Forstbot.*, 5th ed, 321, taf. 7 (1843), designated here; non *Sorbus hybrida* L., *Sp. Pl.*, 2nd ed., 684 (1762).
Pyrus decipiens Bechst., *Forstbot.* 236, 614 (1815), nom. nov. pro *Crataegus hybrida* Bechst., non *Pyrus hybrida* Moench, *Verz. Ausland. Bäume* 90 (1785).

Vernacular name: Sharp-toothed Whitebeam.

Illustration: Bechst., *Forstbot.*, 5th ed., 321, taf. 7 (1843).

Description: Tree up to 10 m with a rather narrow crown. Trunk up to 1·3 m in circumference. Bark greyish-brown, fissured and cracked horizontally. Branches ascending and arching, the lower pendulous; twigs thick and rigid, dull brown or greyish-brown with numerous lenticels; young shoots paler brown, more or less tomentose, with numerous lenticels. Buds 6–10 × 2–6 mm, ovoid, acute at apex; scales green with a narrow brown margin, more or less tomentose. Leaves (3–) 4–12 × 2–8 cm, 1·3–1·8 (–2·5) times as long as broad, dark green above, greyish-green beneath, turning deep yellow in October, elliptical or ovate, acute at apex, lobed up to 1/5 of the way to the midrib, serrate-dentate, the teeth at the end of the lobes larger than the adjacent ones, rounded to cuneate at the base, glabrous above, evenly but not densely tomentose beneath; veins 10–13 pairs; petiole 10–30 mm, tomentose. Inflorescence with 5–144 flowers, with a sweet sickly smell; pedicels 2–10 mm, tomentose at least when young. Sepals 2·5–3·5 mm, triangular-lanceolate, acute at apex, tomentose. Petals 6–8 × 4–5 mm, subrotund or broadly ovate, concave. Stamens 18–24; filaments 4–8 mm, whitish; anthers greenish-cream. Styles 2, greenish, connate at base. Fruit 8–17 × 8–16 mm, turning orange when ripe, ellipsoidal or subrotund, mostly longer than broad, but some slightly broader than long, with scattered large and medium lenticels.

I have had much trouble trying to determine the correct name of this species. It seems to have been first named *Crataegus hybrida* Bechst. in the journal *Diana* in 1797. Johann Matthaeus Bechstein (1757–1822) is mentioned neither in Stafleu & Cowan (1976) nor Lanjouw & Stafleu (1954), and I have been unable to find out if he has an extant herbarium. I eventually obtained photocopies of the relevant pages in the rare journal *Diana* from Freiburg, W. Germany. Bechstein starts off by saying the species originated as a hybrid between *Crataegus* (i.e. *Sorbus*) *aria* and *Crataegus* (*Sorbus*) *torminalis* and is more intermediate between these species than *Crataegus hybrida* L. *Crataegus hybrida* L. was published on page 557 of the Appendix to the second edition of *Flora Suecica* in 1761 from Gotland and Finland. The diagnosis is "Species hybrida e Sorbo 435 & Crataego 433, ut vix dicerem cuinam propius accedat", which translated says: "A species hybrid between Sorbus 435 and Crataegus 433, so that I would hardly like to say to which it approaches closer". This does not, in my opinion, constitute a validating description. *Crataegus hybrida* L. is thus a nomen nudum. Bechstein's plant must therefore be regarded as a valid and legitimate new species which comes from a mountain at Walterhausen near Gotha, E. Germany. The description is long and detailed and accurately fits the species under discussion. He then talks about there being two kinds, that in which *C. aria* is the male parent and whose offspring are nearer to *C. torminalis*, and that in which *C. torminalis* is the male parent and whose offspring are nearer to *C. aria*. The leaves illustrated on Taf.II, 1 and 2, are clearly those nearest to *C. torminalis* and I cannot see how they differ from the earlier described *Sorbus latifolia* (Lam.) Pers. They do not fit the description of *C. decipiens*, in particular as regards the doubly serrate margin. It cannot be argued that it is a bad drawing as such a margin is clearly illustrated as 3 (*aria*) on the same plate. A leaf (and plant) that clearly illustrates Bechstein's description and which is the plant under discussion, is given on taf. 7 of the fifth edition of Bechstein's *Forstbotanik* in 1843 as *Pyrus decipiens*. In normal circumstances two variants of a hybrid with the same parents must be included under the same binomial. In the genus *Sorbus*, however, apomixis is prevalent and many apomicts which probably have the same origin are given separate binomials. The International Code of Botanical Nomenclature does not really cover this point except perhaps in that H3.4 Note 1 says that taxa believed to be of hybrid origin need not be designated as nothotaxa. It would be useful to have an extension of this note to cover apomicts and to have an example. The exact reproductive method of the species under discussion and *Sorbus*

latifolia is not known, but both seem to reproduce themselves and be morphologically stable as in other known apomictic species of *Sorbus*.

One is then faced with the typification of *Crataegus hybrida* Bechst. The illustrations on Taf. II of the *Diana* account must be regarded as syntypes, although they are clearly not the variant on which Bechstein placed most emphasis as they do not fit the detailed description. Article 7.8 of the International Code of Botanical Nomenclature states that "A neotype is a specimen or other element selected to serve as nomenclatural type as long as all of the material on which the name of the taxon was based is missing". Some let-out is needed to this in cases where a later author considers more than one taxon was included in a protologue. The truth of the matter is that when a description or diagnosis is included it is the most important part of a protologue and an author quite frequently placed emphasis on a particular plant so that it is often clear which specimen or illustration should be chosen as the lectotype. The late J. E. Dandy in fact used the term 'obligate lectotype'. In this case there are two taxa and no syntypes of the one on which the author places the most emphasis. It seems to me to be both illogical and unscientific to choose one of the figures in *Diana* as the lectotype, and I therefore designate Taf. 7 of the fifth edition of Bechstein's *Forstbotanik* as the neotype of *Crataegus hybrida* Bechst. I could have chosen the description as a lectotype, but in *Sorbus* the shape and toothing of a leaf are best indicated by a specimen or illustration. Although Bechstein was long dead, the author of the fifth edition of his work is most likely to know the plant he meant and it does accurately fit the description.

In the first edition of Bechstein's *Forstbotanik Pyrus decipiens* Bechst. is mentioned twice, on pages 236 and 614. In Pritzel (1871) the date of the first edition is given as 1810, but the copy at Kew (**K**) is clearly dated on the title page as 1815. I suppose there is a possibility that the volume was issued in parts and that the first part was in 1810. If this is found to be true and that the diagnosis on page 236 is found to be in it, I propose that, as no synonyms are given, the same plate selected as the neotype of *Crataegus hybrida* also be designated as the neotype of *Pyrus decipiens*. However, there is no indication in the Kew copy that it was published in separate parts, so the total work is regarded as being published in 1815. On page 614, as *Crataegus hybrida* is given as a synonym, *Pyrus decipiens* is regarded as a new name, *Pyrus hybrida* Moench being already occupied in that genus. Its type is therefore the type of *Crataegus hybrida*. The long description and general account of the species that follows make it clear that *Pyrus decipiens* and *Crataegus hybrida* are the same thing with the same amount of variation. Irmisch's transference of *Pyrus decipiens* to *Sorbus* is also correct as *Sorbus hybrida* L. is already in use in that genus.

Sorbus decipiens is planted and has regenerated in the Avon Gorge, v.c. 6, (**CGE**) and has been collected from Ashtead Park, Surrey, v.c. 17, 4 Sept. 1949, *A. E. Ellis* (**LANC**), and on a railway cutting at Achnashellach, GR 28/014.488, W. Ross, v.c. 105, 15 August 1980, *H. J. Killick & J. O. Mountford* (**CGE**). There is a large tree in the Botanic Garden at Cambridge (*Sell 82/255* in **CGE**) which fruits profusely every year. Doubtless it will be found planted elsewhere. It is a native of C. Europe in France and Germany. *Pyrus latifolia* var. *decipiens*, *Pyrus rotundifolia* var. *decipiens* and *Sorbus latifolia* var. *decipiens*, based on *Pyrus decipiens*, were wrongly applied to *Sorbus subcuneata* on the labels of many herbarium specimens.

Sorbus decipiens has dark green, shallowly lobed, cuneate-based leaves with sharp teeth, and orange fruits with scattered lenticels. It differs from *S. subcuneata* in its leaf toothing and fruit colour and from *S. latifolia* in its narrow-based leaves.

S. subcuneata Wilmott in *Proc. Linn. Soc. London* **146**: 76 (1934). Holotype: Greenaleigh Wood, near Minehead, S. Somerset, v.c. 5, 10 June 1914, *E. S. Marshall 4027* (**BM**).

S. minima × *latifolia* sensu E. S. Marshall in *J. Bot. (Lond.)* **54**: 14 (1916); *Pyrus latifolia* var. *decipiens* auct.; *Pyrus rotundifolia* var. *decipiens* auct.; *Sorbus latifolia* var. *decipiens* auct.

Vernacular name: Slender Whitebeam.

Illustration: A. R. Clapham, Tutin & E. F. Warb., *Ill.* **2**: 26, no. 649 (1960).

Description: see E. F. Warburg in A. R. Clapham, Tutin & E. F. Warb., *Fl. Brit. Isl.*, 2nd ed., 436 (1962).

Distribution: *v.c. 4, N. Devon*. Waters Meet, near Lynton, 3 July 1850, *C. C. Babington* (**CGE**); 14 June 1906, *A. Ley* (**CGE**, **NMW**); 25 August 1917, *W. C. Barton* (**CGE**, **K**, **NMW**); 13 June 1956, *H. Gilbert Carter* (**CGE**); 28 June 1957, *B. A. Miles* (**CGE**); 7 June 1974, *P. D. Sell 74/22, 74/25, 74/27* (**CGE**); 15 June 1974, *O. M. Stewart* (**E**); 20 September 1976, *Q. O. N. Kay* (**UCSA**). North facing slope above river, Myrtleberry Cleave, Lynmouth, GR 21/733.488, 20 September 1976, *Q. O. N. Kay* (**UCSA**); GR 21/743.489, 7 July 1978, *J. Bevan* (**Herb. J.B.**). Near Barnstaple, May 1933, *Miss E. Young H1095* (**K**).

The following detailed information of trees seen in v.c. 4 is given by M. E. Proctor. All are in the 100 km Grid Square SS (21). Representative specimens are in **CGE**.

11 October 1984. No. 2. GR 7350.4880. Tall tree at 110 m altitude with western aspect, in oak wood, on east side of track, on right bank of East Lyn, about 100 m south of the New Bridge.

11 October 1984. No. 4. GR 7347.4889. Small tree at 100 m altitude with eastern aspect, on left bank of East Lyn, 26 m downstream (north) from the New Bridge.

11 October 1984. No. 5. GR c. 7345.4887. At 50 m altitude with eastern aspect, 20 m up slope on western side of path, on left bank of East Lyn near the New Bridge.

11 October 1984. No. 6. GR 7338.4900. Good tree 7 m with three trunks, at 90 m altitude with south-western aspect, on right bank of East Lyn, c. 15 m upstream from small picnic site near former Old Chiselcombe Bridge.

11 October 1984. No. 8. GR 7344.4901. Lowest of three trees at 100 m altitude with south-western aspect, c. 20 m up eastern edge of scree, just east (upstream) of former Old Chiselcombe Bridge on right bank of East Lyn.

11 October 1984. No. 31. GR c. 7345.4901. Second tree up eastern edge of scree, at 110 m altitude with south-western aspect, just east of former Old Chiselcombe Bridge on right bank of East Lyn, more in the oaks.

11 October 1984. No. 9. GR c. 7346.4902. Third tree up eastern edge of scree and further into the oaks, at 130 m altitude with south-western aspect, just upstream of former Old Chiselcombe Bridge on right bank of East Lyn.

15 October 1984. No. 1b. GR c. 7380.4870. At 120 m altitude with north-western aspect, between the path and left bank of the East Lyn, c. 200 m north-east of the limekiln and west of the Waters Meet water tank.

15 October 1984. No. 2. GR 7310.4878. Tall tree 12 m, and one sapling, at 180 m altitude with northern aspect, Barton Wood near the junction of the bridlepath and the footpath to Rockford from Waters Meet.

11 October 1984. No. 7. GR 7340.4876. Slender young tree, at 140 m altitude with eastern aspect, c. 20 m down path to East Lyn from the tarmac road, about 50 m north from Waters Meet Car Park.

15 October 1984 & 26 October 1984. No. 4. GR 7350.4884. Lowest tree on eastern side of scree at edge of the oaks at 130 m altitude with western aspect, on the scree opposite (north) the New Bridge over the East Lyn.

26 October 1984 & 14 June 1985. No. 2. GR 7336.4879. Tall tree at 60 m altitude with northern aspect, on left bank of East Lyn, c. 50 m upstream of Vellacott's Pool near Fisherman's Car Park.

26 October 1984. No. 34. GR 7333.4893. At 120 m altitude with northern aspect, on north of road between Myrtleberry Drive and top of path to East Lyn, c. 50 m north of Waters Meet Car Park.

26 October 1984. No. 35. GR 7333.4892. At 130 m altitude with northern aspect, on south of road opposite last locality.

15 October 1984. No. 27. GR 7348.4867. Tree c. 7 m high, with five trunks, two c. 15 cm in diameter, three 3–5 cm in diameter, six strides below a point 22 m east from large white rock by Horner Neck Wood boundary, along path from East Lyn to Raven Seat Farm, above Waters Meet House.

15 October 1984. No. 28. GR 7347.4867. Tree 8 m high, c. six strides below no. 27.

15 October 1984. No. 50. GR 7348.4866. Tree 5 m high, with a very slender single trunk c. 8 cm in diameter, around six strides south of no. 27.

15 October 1984. No. 51. GR 7348.4864. On knoll c. 18 strides south down slope from no. 27.

15 October 1984. No. 52. GR 7350.4870. c. eight strides below sharp bend in East Lyn to Ravens Seat path.

15 October 1984. No. 3. GR 7406.4898. At 130 m altitude with southern aspect, north side of path on right bank of East Lyn near Crook Pool, Trilly Wood.
15 October 1984. No. 36. GR 7406.4895. Two trees at 130 m altitude, near the river on the right bank of the East Lyn near Crook Pool.
14 June 1985. No. 30. GR 7399.4855. At c. 250 m altitude with northern aspect, on Myrtleberry Hangings, Myrtleberry Cleave, East Lyn valley.
26 October 1984. No. 13. GR 6330.4854. c. 4 m tall with six trunks, at 60 m altitude with northern aspect, towards tip of Neck Wood near Trentishoe, on northeast side c. 3 m from sheer cliff, above *Taxus* in oaks and near Rowan.
26 October 1984. No. 40b. GR 6335.4843. c. 5 m tall at c. 100 m altitude, with northern aspect, rooted on a ledge c. 6 m down cliff to east, seen from the neck of Neck Wood, Trentishoe. At least two more trees near here.
30 January 1988. No. 40c. GR 6335.4843. Tree c. 4 m high with a slender sinuous trunk, near No. 40b. on the east side of neck of Neck Wood.
30 January 1988. No. 40a. GR 6335.4843. Tree c. 4 m high with slender sinuous trunk, between 40b and 40c.
17 October 1984. No. 12. GR 6740.4865. Inside bend of main road, c. 30 m west of Woody Bay Car Park near Inkerman Bridge, Martinhoe.
31 January 1988. No. 58. GR 6690.4940. Tree c. 4 m tall, with two trunks dividing into three c. 9 m above path, 101 m west of National Trust stile, West Woody Bay Wood.
31 January 1988. No. 59. GR 6691.4942. Small tree c. 3 m high, below the path, 90 m west of National Trust stile as above.
31 January 1988. No. 60. GR 6692.4943. Tree c. 5 m high with one trunk c. 12 cm in diameter, with dense branches, 3 m below path, 83 m from National Trust stile as above.
31 January 1988. No. 61. GR 6698.4940. Tree c. 5 m tall with one trunk c. 15 cm in diameter, dividing into four with dense branching, c. 2 m above path, 4 m from National Trust stile as last.
7 February 1988. No. 63. GR 6680.4945. Dense ovoid tree c. 4.5 m high, with two trunks c. 10 cm in diameter, on edge of sea-cliff, c. 20 m into oaks, at west end of West Woody Bay Wood.
v.c. 5, S. Somerset. Greenaleigh Wood area near Minehead, July 1874, *T. B. Blow* (**CGE**, **E**); 5 September 1894, *R. P. Murray* (**CGE**, **LANC**); 4 August 1898, *C. E. Salmon* (**CGE**); 12 June 1906, *E. S. Marshall* (**CGE**, **E**); 19 June 1906, *S. H. Bickham & A. Ley* (**CGE**, **E**, **K**, **LANC**); 15 June 1908, *S. H. Bickham (***CGE**, **NMW**); 10 June 1914, *E. S. Marshall 4026* (**CGE**, **NMW**, **E**); Sept. 1933, *E. F. & J. W. Warburg* (**LANC**); 1935, *W. Butt* (**K**); 17 June 1942, *J. E. Lousley* (**K**, **RNG**); 20 May 1953, *N. Y. Sandwith 4087* (**K**, **NMW**); 5 September 1978, *J. Bevan* (**Herb. J.B.**).
v.c. 35, Mons. A single large tree with seven boles, found in Lady Park Wood, GR 32/547.144, on a B.S.B.I. Excursion on 18 September 1982, had some of its leaves resembling *S. subcuneata*. Leaves collected the following year were much more like *S. vagensis*. The only fruits seen were immature and like *S. vagensis* at that stage. To be sure one would like to see ripe fruits, but with present information I would prefer to call the tree *S. vagensis*. Specimens in **Herb. J. Bevan**.

S. subcuneata was originally identified as *Pyrus latifolia* var. *decipiens*, *Pyrus rotundifolia* var. *decipiens* or *Sorbus latifolia* var. *decipiens*. These names, however, are based on *Pyrus decipiens* Bechst. (= *Sorbus decipiens* (Bechst.) Irmisch), a native of France and Germany but recorded in Britain as a cultivated tree and naturalized in the Avon Gorge. The specimens collected by A. Ley at Waters Meet in 1906 and published by Marshall (1916) as *S. minima* × *latifolia*? are *S. subcuneata*.

At Minehead *S. subcuneata* grows in thickets on the rocky hillside from the edge of the town along the coastal cliffs to Greenaleigh Wood. The rock is Lower Lias. On the Devon coast it grows in oak woods above the cliffs in the Martinhoe and Trentishoe areas (fide M. E. Proctor). At Waters Meet it grows with *S. devoniensis* on the slopes of the East Lyn valley, by the river, on cliffs and on the margins of screes. In this locality it is on the Lower Old Red Sandstone. There is a single record from near Barnstaple.

S. subcuneata is a rather slender tree up to 8 m with elliptical or narrowly ovate leaves which are shallowly lobed in the upper two thirds. When young the leaves are greenish-white beneath, but they get greyer as they get older. They are always narrowed towards the base, which may be cuneate or rounded. The fruits are brown or brownish-orange when ripe. M. E. Proctor considers the fruits to be sometimes nearly orange, but I have not seen any that I would call pure orange, and certainly not the colour of *S. bristoliensis*, *S. croceocarpa*, *S. decipiens* or *S. latifolia*. From *S. devoniensis* it

may be distinguished by its narrower leaves with more tapered base and whiter lower surface, and the rather smaller, narrower, more orange and somewhat translucent fruits. Where *S. devoniensis* and *S. subcuneata* grow together at Waters Meet, they can be distinguished by the density of the canopy. *S. devoniensis* has a dense crown through which little or no sky can be seen and *S. subcuneata* a much more open crown through which much sky can be seen. Additionally, when the leaves are newly expanded and raised by a light breeze, the whiter lower surfaces separate *S. subcuneata* from *S. devoniensis*.

S. devoniensis E. F. Warb. in *Watsonia* **4**: 46 (1957). Holotype: c. 1/4 mile from Hoo Meavy, S. Devon, v.c. 3, 28 September 1934, *E. F. Warburg 115* (**BM**).

Vernacular names: French Hales, Devon Whitebeam.

Illustration: A. R. Clapham, Tutin & E. F. Warb., *Ill.* **2**: 26, no. 650 (1960).

Description: see E. F. Warburg in A. R. Clapham, Tutin & E. F. Warb., *Fl. Brit. Isles*, 2nd ed., 436 (1962).

Distribution: *v.c. 2., E. Cornwall.* Bushy hedgebank, Bridgerule West, 31 May 1882, *W. Moyle Rogers* (**BM**); Rogers (1886) gives three localities "Between Marhamchurch and Titson", "About half a mile from N. Tamerton, on the Bridgerule Road, in two or three places", "Tetcott, several together in wooded lane south of the church". Beardon, Boyton, 12 October 1881, *T. Archer Briggs* (**BM**) (cf. Briggs 1881). Margetts & David (1981) say there are no subsequent records for Cornwall to the three given above. However, in 1986 they refound it at Bearden, GR 20/305.935, (**CGE**), though repeated searching in the Marhamchurch area had no success.
v.cc. 3 & 4. S. & N. Devon. A detailed account of the distribution in v.cc. 3 and 4 is given in Keble Martin & Fraser (1939) as *S. latifolia*. A map of the present distribution is given in Ivimey-Cook (1984).

The following detailed Devon localities have been supplied by M. E. Proctor. All the Grid References are in the 100 km square SS (21). Specimens are in **CGE**.
17 October 1984. No. 6. GR 6665.4935. Small tree, 120 m altitude with north northeastern aspect, 50 m west of Hollow Brook, c. 4 m above lower coast path, Martinhoe.
17 October 1984. No. 5. GR 6720.4895. 6 m tall, one trunk, c. 20 cm diameter, at 80 m altitude with northeastern aspect, top of cutting on outside of bend on road to Martinhoe Manor.
17 October 1984. GR c. 672.491. c. ten trees at c. 60 m altitude with northeastern aspect, in windblown area of West Woody Bay Wood, Martinhoe.
7 February 1988. No. 62. GR 6682.4945. Slender tree in a gorse bush, 30 m below path, c. 4 m west of Woody Bay Wood.
7 February 1988. No. 64. GR 6685.4945. Big sprawling tree c. 5 m high, at cliff edge, top of gully, c. 30–40 m into Woody Bay Wood.
31 January 1988. No. 56. GR 6690.4943. Tree c. 5 m high with several trunks and a dense crown, 108 m west of National Trust stile, near the path from Hollow Brook Beck through Woody Bay Wood.
31 January 1988. No. 57. GR 6690.4940. 103 m west of National Trust stile, see no. 56.
26 October 1984. No. 8. GR 6720.4880. c. 6 m tall with seven trunks, at 200 m altitude with north-eastern aspect, 250 m along Old Coast Road from gate at bend on road, west of Inkerman Bridge, north of track, near Martinhoe.
10 June 1985. No. 41. GR 6742.4860. Small tree at 210 m altitude with north-eastern aspect, 50 m uphill from first bend on south side of road west of Inkerman Bridge.
6 August 1985. No. 37. GR 7390.4955. About 1·5 m tall with one trunk, at 140 m altitude with northern aspect, c. 50 m below small *Acer pseudoplatanus* to east and above a point 50 m west of top of zigzag on path to Sillery sands, Lynmouth.
26 October 1984. No. 38. GR 6325.4843. Small tree at 60 m altitude with south-western aspect, on western side of and well below top of waterfall on western side of Neck Wood, Trentishoe.
26 October 1984. No. 39. GR 6327.4842. At 90 m with northern aspect, above waterfall, western side of Neck Wood, Trentishoe.

26 October 1984. No. 11. GR 6331.4844. c. 5 m tall with six trunks, at c. 120 m altitude with western aspect on c. 40° slope, c. 20 m north along 'neck' and 3 m down, western side of Neck Wood, Trentishoe.
11 October 1984. No. 1. GR 7341.4879. Large old tree with split trunk at 150 m altitude with eastern aspect, top of path to East Lyn from road, c. 50 m north from Waters Meet Car Park at 'No Parking' site.
11 October 1984. No. 3. GR 7347.4884. c. 3 m tall with one trunk, at 100 m altitude with eastern aspect, 2 m above the New Bridge over the East Lyn, on the left bank between the river and the footpath.
11 October 1984. No. 10. GR 7341.4878. Separate small tree, at 150 m altitude with eastern aspect, adjacent to no. 1, top of path to East Lyn from road, c. 50 m north from Waters Meet Car Park.
15 October 1984. No. 8. GR 7365.4866. Tree c. 11 m growing out of rocks c. 2 m above path on right bank of East Lyn above Waters Meet.
7 February 1988. No. 70. GR 7367.4866. Near no. 8., but c. 10 m upstream and 6 m below path.
15 October 1984. No. 9. GR 7365.4865. Tree c. 12 m high, below path and no. 8 and c. 4 m from the East Lyn.
7 February 1988. No. 71. GR 7365.4864. Just before a large rock outcrop below path, south-west of no. 8.
7 February 1988. No. 72. GR 7362.4865. Tree c. 7 m, growing out of rock 2 m above path, near no. 8.
7 February 1988. No. 73. GR 7361.4864. To west of no. 72.
7 February 1988. No. 74. GR 7363.4865. Tree c. 10 m, opposite outcrop, just below path.
15 October 1984. No. 11. GR c. 7360.4885. At c. 200 m altitude with western aspect, just below Raven Nest viewpoint in Horner Neck Wood, East Lyn valley.
15 October 1984. No. 24. GR c. 7352.4884. c. 3m tall, at 130 m altitude with western aspect, above path between Raven Nest and riverside track and on ridge near scree opposite New Bridge.
15 October 1984. No. 25. GR c. 7350.4883. Good 15 m tree at 130 m altitude with western aspect, in oaks, south of scree above New Bridge between riverside track on right bank and higher narrow footpath.
26 October 1984. No. 6. GR 7374.4868. About 7 m tall with six trunks, at 120 m altitude with northern aspect, c. 100 m east of the limekiln on the left bank of the East Lyn, 3 m up the slope on the eastern side of the path.
11 October 1984. No. 26. GR 7343.4901. Tall tree at 120 m altitude with southern aspect, near top of western side of scree above former Old Chiselcombe Bridge near Picnic site.
3 January 1988. No. 54. GR 7344.4901. Near western side of scree above former Chiselcombe Bridge near no. 26.
3 January 1988. No. 55. GR 7344.4901. Young tree c. 60 cm, below no. 54.
14 October 1984. No. 29. GR 7390.4857. At c. 250 m with northern aspect, on Myrtleberry Hangings in Myrtleberry Cleave, East Lyn valley.
v.c. 71, Man. Specimens collected on 18 June 1987 by T. C. G. Rich from a large tree in a wood in an old quarry near Ballasalla, GR 24/267.701, during a B.S.B.I. field meeting have been provisionally (but almost certainly) identified as *S. devoniensis*, but ripe fruits are required for confirmation.
v.c. H6, Co. Waterford. Near the shrine, on the road to Dunmore, Tramore, 18 August 1975, *L.F. & I.K. Ferguson 3426* (**CGE**, **DBN**).
v.c. H11, Co. Kilkenny. Bank of River Nore, 2 miles above Kilkenny, 20 May 1926, *R. A. Phillips* (**DBN**). By the Waterford Road near New Ross, just within Co. Kilkenny, 13 June 1952, *N. Y. Sandwith 3989* (**K**). Roadside near Rosbercon, 29 May 1909, *M. C. Knowles* (**DBN**).
v.c. H12, Co. Wexford. In native scrub with Ash, Oak, Thorn, Hazel, Willow and Poplar, along the shores of the estuary, Pilltown, 18 Sept. 1921, *A. W. Stelfox* (**DBN**). Pilltown estuary, 25 May 1958, *H. J. Hudson* (**DBN**). Roadside near Pilltown House, about 4 miles due south of New Ross, 5 July 1962, *N. D. Simpson & C. West* (**CGE**). Roadside, north end of New Ross, Aug. 1932, *R. L. Praeger* (**DBN**). Hedgerow 1 mile south of New Ross, on west side of river, 5 May 1971, *D. A. Webb* (**TCD**). One fair-sized tree on the east side of the road c. 1 km north of New Ross, 23 May 1981, *D. A. Webb* (**TCD**). Pilltown, 11 Aug. 1958, *S. M. Walters* (**TCD**).
v.c. H13, Co. Carlow. Carrigleade Wood, near Craignamangh, 16 October 1934, *M. O'Leary* (**DBN**).

v.c. H38, *Co. Down*. Below bridge at Raleagh, east of Ballynahinch, 31 August 1986, *W. J. Harron* (sterile); fruit from same tree, 24 Oct. 1987 (both in **CGE**).

S. devoniensis has broad, shallowly lobed, grey-tomentose leaves and large, rounded, brown to orange-brown fruits. It is distinguished from *S. subcuneata* by its larger, rounded-based leaves, dense crown and usually larger, browner fruits. The fruits, however, vary in size, the smaller remaining more orange when ripe, but duller than in *S. subcuneata* (fide M. E. Proctor). The leaves of *S. croceocarpa* are very similar to *S. devoniensis*, but are even more shallowly lobed, have more veins and the teeth terminating the main veins are broader. The fruits of *S. croceocarpa* are bright orange or reddish-orange when ripe.

Several trees at Waters Meet, near Lynton, Devon have the leaves sharply and more deeply lobed. It has been suggested that these are either a distinct taxon, called *admonita* by E. F. Warburg, or a variant of *S. subcuneata*, but they have the broad rounded leaf base and dense crown of *S. devoniensis* and are in my opinion best included in that species. The apparently native distribution of this endemic species in the south-western peninsula of Great Britain and south-eastern Ireland is interesting and further consideration needs to be given to the trees in Co. Down and Isle of Man. It does not seem to be a tree which is much planted.

A plant grown from seed of a specimen of typical *S. devoniensis* collected at Waters Meet and examined by Q. O. N. Kay was tetraploid with 2n = c. 68.

Sorbus croceocarpa P. D. Sell, **sp. nov.** Holotype: The Mound, Lleiniog, Anglesey, v.c. 52, GR 23/620.791, 1 October 1980, *R. Hattey L2* (**CGE**).

Vernacular name: Orange-berried Whitebeam.

Illustration: Ross-Craig, *Draw. Brit. Pl.* **9**: 33 (1956) as *S. latifolia.*

S. devoniensis E. F. Warb. affine, a quo foliis lobatis obscurioribus, venis lateralibus numerosioribus, fructibus maturescentibus croceis differt. Ab *S. latifolia* (Lam.) Pers. quo nomen id plerumque false cognita, foliis magnioribus obtusiore serratis venis lateralibus numerosioribus distinguibilis.

Arbor ad 21 m alta, corona lata rotundata compacta adornata. Truncus ad 1·7 m in ambitu. Cortex griseo-brunnea, aspera, vade fissurata. Rami patentes vel ascendentes; ramuli griseo-brunnei, crassi; ramuli hornotini rubro-brunnei, plus minusve tomentosi pilis arachnoideis vestiti, lenticellis subrotundis ellipticis numerosis praediti. Gemmae 5–12 mm longae, 4–7 mm latae, ovoideae; squamae virides marginibus angustis brunneis. Folia 7·5–15 cm longa, 5·5–12 cm lata, 1·2–1·6(–1·8) –plo longiora quam lata, supra hebete obscure viridia, subtus griseo-viridia, in Octobris aurescentia, utiliter ovata, interdum elliptica, rare obovata, apice plus minusve acuta, basi utiliter late rotundata interdum late cuneata, duplicato-serrata dentibus latis acuminatis (sed obtusiusculis) nervos primarios terminantibus prominentibus, aliis multo minoribus, aliquot folia lobis vadis, supra glabra, subtus aequaliter tomentosa pilis arachnoideus vestita; vena laterales utrinque (8–) 9–11; petioli 1·5–3·5 cm longi, plus minusve tomentosa pilis arachnoideus vestiti. Inflorescentia floribus 8–85, dilute odoratis; pedicelli 5–27 (–40) mm longi plus minusve tomentosi pilis arachnoideis vestiti. Sepala 2–3 mm longa, triangulari-ovata, apice plus minusve acuta, plus minusve tomentosa pilis arachnoideis vestita. Petala 6–9 mm longa, 5·0–6·5 mm lata, late ovata, acetabuliformes. Stamina 18–22; filamenta 7–10 mm longa, albiuscula; antherae cremeae. Styli 2, viridiusculi, basi connati. Fructus 11–22 mm longus, 11–16 mm latus, subglobosus vel leviter longior quam latus vel leviter latior quam longus, maturescens flaviusculo-croceus vel saturate croceus interdum rubro-complano, lenticellis parvis mediocribusque numerosis et basin versus paucis maxima praeditus.

Tree up to 21 m with a broad, rounded, compact crown. Trunk up to 1·7 m in circumference. Bark greyish-brown, rough, shallowly fissured. Branches patent or ascending; twigs greyish-brown, thick; young shoots reddish-brown, more or less tomentose, with numerous subrotund and elliptical lenticels. Buds 5–12 × 4–7 mm, ovoid; scales green, with narrow brown margins. Leaves 7·5–15 × 5·5–12 cm, 1·2–1·6 (–1·8) times as long as broad, dull dark green above, greyish-green beneath, becoming deep yellow in October, mostly ovate, sometimes elliptical, rarely obovate, more or less

acute at apex, usually broadly rounded, sometimes broadly cuneate at base, doubly serrate with broad prominent, acuminate (but rather blunt) teeth terminating the main veins, the other teeth much smaller, some leaves often with very shallow lobes, glabrous on upper surface, evenly tomentose on lower surface; veins (8–) 9–11 pairs; petioles 1·5–3·5 cm, pale green to reddish-brown, more or less tomentose. Inflorescence with 8–85 flowers, with a faint, sweet smell; pedicels 5–27 (–40) mm, more or less tomentose. Sepals 2–3 mm, triangular-ovate, more or less acute at apex, more or less tomentose. Petals 6–9 × 5–6·5 mm, broadly ovate, concave. Stamens 18–22; filaments 7–10 mm, whitish; anthers cream. Styles 2, greenish, connate at base. Fruit 11–22 × 11–16 mm, subglobose, or slightly longer than broad or broader than long, ripening yellowish-orange or deep orange, sometimes flushed red, with numerous small and medium lenticels and a few larger ones towards the base.

In all specimens of which I have seen living ripe fruit they are bright orange. They are marked below with an asterisk. T. C. G. Rich has seen a tree in which the fruits are brown and the leaves of which neither he nor I can distnguish from *S. croceocarpa*. It is marked below with a dagger. The taxonomic position of this tree is not clear, but for the present it is best included in *S. croceocarpa*. Local recorders should attempt to establish fruit colours of those records based on pressed specimens.

Distribution: *v.c. 6, N. Somerset*. *A large tree, Leigh Woods, Avon Gorge, 30 June 1957, *P. J. M. Nethercott* (**OXF**); still there (GR 31/561.733) with saplings nearby, 1980, *C. M. Lovatt*. Lovatt also records other trees by the Leigh Woods quarries at GR 31/564.739, 31/559.744 and 31/558.744.
v.c. 11, S. Hants. In a plantation, West Meon, 3 June 1935, *A. N. Cater* (**BM**); 1 September 1935, *E. C. Wallace* (**RNG**).
v.c. 17, Surrey. Near Burgh Heath, 30 July 1916, *C. E. Salmon* (**BM**, **RNG**) (see Salmon, *Fl. Surrey* 303 (1931) as *S. latifolia*); 4 June 1935, *E. C. Wallace* (**E,K**) as *S. latifolia* var. *decipiens*; 3 June 1939, *A. E. Ellis* (**LANC**). Leatherhead Downs, 16 July 1916, *J. Fraser* (**K**); 13 June 1935, *E. C. Wallace* (**Herb. J. Bevan**). Appearing quite wild in scrub, mainly *Crataegus*, with *S. aria* & *S. intermedia*, north side of Leatherhead – Tothill Road, near Tyrell's wood, 15 May 1957, *A. E. Ellis* (**LANC**). Between Leatherhead and Mickleham Downs, near Tyrell's wood, 4 October 1949, *A. E. Ellis* (**LANC**). Woodland Addington Hills, 12 July 1942, *A. E. Ellis* (**LANC**). *Planted Cameron Road, Croydon, 1986, *T. C. G. Rich 320–86* (**Herb. T.C.G.R.**). (Specimens in **LANC**, from Leatherhead Downs, 1938, *A. E. Ellis*, suggest *S. latifolia* sens. strict. also grows there, but the specimens appear to be from young hedgerow saplings and I cannot be sure. Yet another specimen from 1939 may be a hedgerow *S. decipiens*.)
v.c. 20, Herts. Opposite Preston School, in the grounds of Temple Dinsley, Hitchin, 11 June 1912, *J. E. Little* (**CGE**) as *Pyrus aria*.
v.c. 29, Cambs. *A tree 14 m high, beside Grange Farm Bridge, GR 53/296.085, 9 July 1955, *A. O. Chater* (**CGE**); 17 October 1986, *R. Payne* (**CGE**). *Tree c. 8 m planted on roadside outside 118, Brooks Road, Cambridge, GR 52/475.577, 9 October 1982, *R. D. I'Ons* (**CGE**). *On Cambs. bank of Old South Eau, near Falls Bridge, GR 53/275.092, 17 October 1986, *R. Payne* (**CGE**). *Planted near Ely railway station, GR 52/543.794, 19/7/1986, *C. D. Preston*; ripe fruits 19/10/1986, *C. D. Preston & T. C. G. Rich* (**CGE**).
v.c. 32, Northants. Two trees presumably planted, east side of Bedford Purlieus, 25 July 1955, *S. M. Walters* (**CGE**); 6 August 1958, *J. Rishbeth* (**CGE**).
v.c. 33, E. Gloucs. Haresfield Hill, near Stroud, 28 September 1934, *H. J. Riddelsdell* (**BM**).
v.c. 34, W. Gloucs. *Tree at back of Clifton Parish Hall, 13 June and 21 October 1935, *H. S. Thompson* (**BM**, **OXF**, **K**, **RNG**); still there 1980 (C. M. Lovatt, pers. comm.). *Tree c. 14 m high, Bridge Valley Road, by the Portway, GR 31/564.734, with frequent seedlings round about, 1980, *C. M. Lovatt*; this is presumably the same tree labelled Avon Gorge, collected by Mr Lavender (**OXF**): 16 May 1957, *P. J. M. Nethercott* (**OXF**) and 8 September 1960, *B. A. Miles 60/133* (**CGE**). *Planted tree 40–50 years old Durdham Downs, Bristol, GR 31/561.749, 2 November 1980, *C. M. Lovatt*. Nethercott (1988) writes: "There is one large tree in Leigh Woods and several other small trees and saplings on both sides of the Avon Gorge. A small number of trees, from large to saplings are present in Sneyd Park, of which a few of the large trees have been felled in the course of residential development. There are two large trees on Durdham Down and a sapling on Tickenham Hill. The population in the Bristol area probably arose from the planted trees in Sneyd Park." *Symonds Yat,

E. F. Warburg. A small tree so labelled was found in E. F. Warburg's garden after his death and was transplanted to the University Botanic Garden at Cambridge where it now flowers and fruits freely (*Sell 77/249* (**CGE**)).

v.c. 40, *Salop*. Old mine workings, Wombridge, GR 33/690.117, August 1974, *F. H. Perring* (**CGE**). Lincoln Hill, Coalbrookdale, GR 33/669.039, Oct. 1985, *W. E. Wiggins* (**CGE**). Numerous trees up to 5 m tall, mostly in scattered clumps along rim of old limestone quarry. Self-sown *Laburnum* also present, together with older and larger Beech, Ash, Oak, Sycamore and some Hazel. The geology is the Wenlock series of the Silurian.

Beverley Pit Mound, near Oakengates, GR 33/688.108, Oct. 1985, *W.E. Wiggins* (**CGE**). Many specimens, ranging from young saplings c.1m to three older (30–40 years) trees which must be the parents. These form a small copse with *Betula pendula* of similar age and stature. Where self-seeding (prolific) has occurred the ground vegetation is pure *Calluna vulgaris* with occasional self-sown *Crataegus monogyna*. The soil is a clay loam with a pH 3·9.

v.c. 44, *Carms*. One tree by roadside near Carreg Cennen (road from Derwydd) GR 22/65.19, 21 May 1970, *Mrs I. M. Vaughan* (**NMW**) (cf. *Watsonia* **9**: 380 (1973) as *S. latifolia*).

v.c. 46, *Cards*. *One large tree 21 m high with a trunk 130 cm in girth, copse by lane and stream, 100 m E.S.E. of Rhosgellan-Fawr, Wallog, GR 22/597.855, 10 July 1977 (vegetative), 5 October 1980 (fruiting), *A. O. Chater* (**CGE**). *S. latifolia* (Lam.) Pers. is also planted in this locality.

v.c. 49, *Caerns*. *Nantporth Nature Reserve (North Wales Naturalists' Trust), GR 23/570.720, October 1977, *S. Ward 1–3* (**CGE**); 1 October 1980, *R. Hattey 4* (**CGE**). R. H. Roberts (pers. comm.) says there are a number of young trees there and the site appears to be more acid than the Anglesey ones. Edge of shore, west of University boathouse, Menai Straits, Bangor, GR 23/567.723, 19 September 1985, *T.C.G. Rich* (**Herb. T.C.G. R.**).

v.c. 51, *Flints*. Caergwrle Castle rocks, 30 September 1942, *J. A. Webb* (**NMW**).

v.c. 52, *Anglesey*. *There are ten to twelve trees up to 14 m high with trunks up to 70 cm in girth on and about the Mound, Lleiniog, GR 23/620.791. R. H. Roberts (in litt., 1980) says the Mound is a hillock of very calcareous boulder-clay, which incorporates pebbles and boulders of Carboniferous Limestone, and that several calcicole species such as *Rubia peregrina* occur there. Roberts goes on to say that the trees of *Sorbus* on the Mound are clearly of different ages, grow in a more or less random fashion and certainly do not suggest having been planted in what is a wild unfenced area of ground. In addition to the mature trees there are several seedlings.

*A few trees also occur in a narrow belt of woodland around 200 m to the south-west (GR 23/617.791) and there are two or three younger ones on the cliff above the beach further south (GR23/618.787). Both these areas are calcareous boulder-clay. R. Hattey, writing to me on 7 November 1980, says "Regarding the conservation of *S. croceocarpa*: since a good concentration of the species (around a dozen trees) occurs on the Anglesey shore side of the Menai Straits and is now included in the extended Friar's Road Shore Site of Special Scientific Interest, this is the obvious population to try to conserve. The owner, as I mentioned I think, has a large mature specimen of *S. croceocarpa* (my sample *LG*) in her garden; she believes that the adjacent population was derived from this tree, which she says was planted about 50 years ago." There are specimens of these trees in **CGE** collected by R. H. Roberts and S. D. Ward (*no. 1, 2, 3, 5, 5c*) on 13 October 1977 and by R. Hattey (*LG, L1–4*) on 1 October 1980.

*Hedgerows in lane leading to Tyddyn Isaf, near Gaerwen, GR 23/502.717 and 23/504.714, October 1977, *G. Howells & R. H. Roberts nos. 1–4* (**CGE**). Roberts says that the soil in this locality is a brown loam and is generally acidic, with a pH 5·5 to 5·8.

Limestone outcrop between Llanfairpwll and Brynsiencyn, GR 23/496.682, 6/1979, *R.H. Roberts*.

*Two small trees on Church Island, Menai Bridge, GR 23/552.718, 1 October 1984, *R.H. Roberts*.

v.c. 58, *Cheshire*. Small tree in wood, Newton, near Chester, 12 August 1936, *C. Waterfall* (**OXF**, **BM**, **RNG**) (cf. *Rep. botl Soc. Exch. Club Br. Isl.* **11**: 400 (1937); *ibid* **11**: 476 (1938) as *S. latifolia*); not refound, 1983, A. Newton (pers. comm.).

v.c. 60, *W. Lancs*. †One fruiting shrub c.4 m tall, (five shrubs in all), limestone pavement, Warton Crag, Carnforth, GR 34/495.726, 12 September 1983, *M. Baecker, L. Rose & T. C. G. Rich* (**Herb. T.C.G. R.**). Youngish shrub, c.2 m, edge of limestone pavement, Scout Wood, Silverdale, September 1983, *T. C. G. Rich* (**Herb. T.C.G. R.**). Yealand Hall Allotment, Silverdale, September 1983, *M. Baecker* (**Herb. T.C.G. Rich**).

v.c. 64, *Mid-W. Yorks*. Cultivated Skipton, 1983, *L. Rose* (**Herb. T.C.G. Rich**).

v.c. 69, *Westmorland*. Large tree in limestone field with outcrop, west side of Leighton Beck, Cold Well, Hazelslack, GR 34/477.782, 12 August 1986, *G. Halliday* (**LANC**).
v.c. 69b, *Furness*. Young shrub on shore near Roanhead, Dalton-in-Furness, 14 June 1985, *M. Baecker* (**Herb. T.C.G. Rich**).
v.c. 80, *Roxburghs*. One large tree c.14 m, by the main road (A6091) at Melrose, GR 36/54.34, 18 July 1959, *P. D. Sell 59/31*, *N. D. Simpson & C. West* (**CGE**).
v.c. 96, *Easterness*. Among alders etc., by a burnside between Loch-an-Eilean and Aviemore, September 1909, *E. Armitage* (**OXF**). Planted near the farm, Glen Affric Lodge, GR 28/1.2, 23 July 1971, *M. McCallum Webster* (**CGE**).
v.c. 99, *Dunbarton*. Delmuir, 26 May 1883, *L. Watt* (**CGE**).
v.c. 103, *Mid Ebudes*. Planted near Pennyghael, Mull, 22 May 1971, *A. G. Kenneth & A. McG. Stirling* (**BM**) (see Jermy & Crabbe, *Island of Mull* 11.26 (1978), as *S. latifolia*).

This species will be known to most British botanists from the note by Warburg (1962), where he refers to it as an allied form of *Sorbus devoniensis*, rather frequently planted and sometimes naturalized. It has, however, been known to gardeners for a much longer period. The Lawson Company of Edinburgh were offering '*Pyrus theophrastii*' as early as 1874. It appeared in the 3rd and 4th editions of the *Hand-list of trees and shrubs at Kew* (Hill 1925; Bean 1934) as *Pyrus aria* var. *Theophrasta* and *Sorbus aria* var. *theophrasta*, but no descriptions were given. In Pierre Lombarts' *Beschrijvende Prijscourant* of 1947–8 it was called *Sorbus theophrasta*, but only a few descriptive words in Dutch were given. The name is thus invalid under Art. 36 of the *International Code of Botanical Nomenclature*. K. J. W. Hensen has described it as *Sorbus devoniensis* cv. Theophrasta in *Dendroflora* **3**: 62, fig. 1 (1966). The type is a plant received from the Dutch nurseryman, P. Lombarts, which originally came from a tree at Kew (no. 695), which in turn was received from the Edinburgh Botanic Garden in 1922 as *S. aria* var. *theophrasta*. The tree at Edinburgh still exists, as does its offspring at Kew, but is of unknown provenance. In the fourth volume of edition 8 of Bean's *Trees and Shrubs* it is called *Sorbus* 'Theophrasta', and an excellent account of it as a garden tree is given. The epithet '*Theophrasta*' means 'food of the gods', in reference to its large and abundant fruit.

In my opinion this taxon is not a cultivar as is generally understood by the term, but is as distinct as any other of the apomictic species of *Sorbus*. For this reason I wish to dissociate it from the gardeners' epithet *Theophrasta* and to give it the new name of *S. croceocarpa*, based on the population of trees occurring in a natural habitat by the Menai Straits but almost certainly introduced. I have listed all the known localities for it, but fully expect it to be found elsewhere. Nowhere is it known with certainty as a native plant. There is some indication that in Cambridgeshire it has been planted as a street tree.

Sorbus croceocarpa is nearest to *S. devoniensis* in the shape of its leaves, but they have more numerous veins and are less distinctly lobed. Warburg's statement (1962) that the leaves are scarcely ever lobed is misleading. At least some leaves on nearly every specimen or tree I have seen have some shallow lobing, but it is not as clear-cut as in *S. devoniensis*. The illustration given by Henson (1966) also seems to over-emphasize the non-lobing of the leaves. The clear orange, sometimes flushed red, fruits are quite distinct from those of *S. devoniensis* which are brown turning orange-brown. The fruits of the true *S. latifolia* are similar to those of *S. croceocarpa*, but usually have fewer, larger lenticels, and the leaves are quite distinct, being smaller, more ovate, distinctly lobed and with fewer veins.

S. bristoliensis Wilmott in *Proc. Linn. Soc. London* **146**: 76 (1934). Holotype: Clifton Down, Bristol, W. Gloucester, v.c. 34, 16 September 1933, *A. J. Wilmott 3980* (**BM**).

Vernacular name: Bristol Whitebeam.

Illustration: A. R. Clapham, Tutin & E. F. Warb., *Ill.* **2**: 25, no. 648 (1960).

Description: See E. F. Warburg in A. R. Clapham, Tutin & E. F. Warb., *Fl. Brit Isl.*, 2nd ed., 435 (1962).

Distribution: Endemic to rocky woods and scrub on Carboniferous Limestone crags and slopes on both sides of the Avon Gorge near Bristol. Trees are difficult to count, but P. J. M. Nethercott reckons there might be about a hundred with more on the Leigh Woods side than on the Clifton side.

S. bristoliensis has more or less obovate leaves which are shallowly lobed mainly above the middle with a broadly cuneate base, which distinguish it from all the other species of British *Sorbus* with berries which are yellow or orange when ripe. The glossy leaves are almost translucent in bright sunlight, like those of *Fagus sylvatica*, especially when they are young.

Warburg (1962) records this species as being triploid, 2n = 51.

S. latifolia (Lam.) Pers., *Syn. Pl.* **2**: 38 (1806).
Crataegus latifolia Lam., *Fl.Fr.* **3**: 486 (1779). Lectotype: Prés. dans la forêt de Fontainebleau, France, Herb. Lamarck (**P**), designated here.
Pyrus latifolia (Lam.) Syme in *Rep. botl Soc. Exch. Club Br. Isl.* **1872–4**: 19 (1875).

Illustration: Keble Martin, *New Concise Br. Fl.* pl. 31 (1982).

Description: Tree up to 20 m with a broad pyramidal crown. Trunk up to 1·3 m in circumference. Bark greyish-brown, rough, shallowly fissured. Branches patent, the lower often drooping; twigs strongly divaricate, greyish-brown, thick; young shoots reddish-brown, more or less tomentose, with scattered elliptical lenticels. Buds 8–10 × 4–5 mm, narrowly ovoid; scales green, with narrow brown margins. Leaves (6·8–)8–11·5 × (6–)7–9·2 cm, 1·1–1·3 times as long as broad, dark green above, greyish beneath, becoming deep ochre in October, broadly ovate, acute at apex, usually broadly rounded, sometimes broadly cuneate at base, shallowly lobed (up to 1/4 of the way to the midrib) with broadly triangular, acute lobes, the lowest lobes often patent, doubly serrate with prominent, acuminate teeth terminating the main veins, the other teeth smaller but acute or acuminate and sometimes with curved sides, glabrous or with very occasional hairs on upper surface, rather evenly, but not very densely tomentose on lower surface; veins 7–9 pairs; petioles 1·5–3 cm, pale green to reddish-brown, more or less tomentose. Inflorescences with 10–50 flowers, with a sweet sickly smell; pedicels 2–10 mm, tomentose at least when young. Sepals 2·5–3·5 mm, triangular-ovate or lanceolate, more or less acute at apex, tomentose. Petals 6–10 × 5–7 mm, subrotund or ovate, concave. Stamens 18–22; filaments 4–8 mm, whitish; anthers greenish-cream. Styles 2–3, greenish, connate at base. Fruit 14–17 × 15–17 mm, subglobose or slightly longer than broad, yellowish-orange to deep orange when ripe, with few to numerous mostly rather large lenticels.

Distribution: *v.c. 6, N. Somerset*. Leigh Woods, C. M. Lovatt (pers. comm.).
v.c. 10, Wight. Planted in interior of Carisbrooke Castle, September 1869, *P. Stratton* (**BM**, **OXF**).
v.c. 17, Surrey. Single tree near the Keeper's Cottage, Box Hill, 30 August 1934, *E. F. Warburg* (**BM**). One sapling on steep slope, south side of Box Hill, July 1985, *T. C. G. Rich* (**herb. T.C.G. R.**). Kew Gardens, 28 October 1938, *A. E. Ellis* (**LANC**).
v.c. 22, Berks. In grassland, Windsor Home Park, 25 September 1933, *C. E. Hubbard* (**K**).
v.c. 23, Oxon. Oxford Botanic Garden, October, 1911, *G. C. Druce* (**CGE**, **NMW**, **OXF**).
v.c. 29, Cambs. Two large trees about 13 m high in the grounds of Newnham College, Cambridge, GR 52/441.577, 6 October 1977, *P. D. Sell 77/250* (**CGE**) (in fruit); flowers from the same tree 29 May 1979, *P. D. Sell 77/250b* (**CGE**).
v.c. 33, E. Gloucs. Plantation edge, Clapton to Sherborne, 12 September 1935, *H. J. Riddelsdell* (**K**).
v.c. 34, W. Gloucs. Single old tree above tennis courts on a steep slope with *Pinus nigra* nearby, Clifton Down, 18 September 1966, *S. M. Walters* (**CGE**). The Gully, Clifton Down, Avon Gorge, 7 July 1957, *P. J. M. Nethercott* (**OXF**). On rocks above the New Zigzag, near Bridge Valley Road, Bristol, 8 September 1960, *B. A. Miles 60/135* (**CGE**). Both sides of the Avon Gorge, P. J. M. Nethercott (Nethercott 1980).
v.c. 46, Cards. Seven large trees apparently planted in a line, in a copse immediately north-west of Rhosgellan-Fawr farmyard, 4 km N.N.W. of Aberystwyth, 45 m alt., GR 22/5972.8555, October 1980, *A. O. Chater* (**CGE**).

v.c. 61, S. E. Yorks. Two large bushes, not obviously planted, on 60° chalk cutting slope of railway, Sewerby, Bridlington, GR 54/195.696, 9 August 1977, *J. O. Mountford* (**CGE**).
v.c. 62, N. E. Yorks. York, *W. Ingham* (**NMW**).
v.c. 63, S. W. Yorks. Old tree in Weston Park, Sheffield, GR 43/339.873, October 1985, *C. D. Pigott* (**CGE**).
v.c. 83, Midlothian. Near Logan House, Pentlands, May 1866, *A. Craig-Christie* (**E**). Glencorse, 31 July 1868, *A. Craig-Christie* (**E**).
v.c. 86, Stirlings. Single tree, not obviously planted, at S.W. corner of water basin east of Police Station, Grangemouth. GR 26/923.822, 7 October 1987, *C. D. Preston, N. F. Stewart & S. D. Webster* (**CGE**).
v.c. 96, Easterness. Single tree in a lane between Croy village and Holme Rose, 10 October 1966, *M. McCallum Webster* (**ABD**, **CGE**). Almost certainly planted, on the rough river-bank, Ness-side, 8 August 1931, *G. C. Druce & R. H. Corstorphine* (**K**, **NMW**, **OXF**). Island in River Ness, Inverness, 29 September 1930, *Mrs Wedgwood* (**BM**); The Islands, GR 28/664.439, 20 June 1947, *U. K. Duncan* (**E**).
v.c. 97, Westerness. Planted Arisaig, August 1903, *H. J. Riddelsdell* (**E**).
v.c. 106, E. Ross. One fine old tree about 14 m high by the Conan River, about a mile above the bridges, near Conan, 10 August 1892, *E. S. Marshall* (**BM**, **CGE**); and 16 July, 1909, *E. S. Marshall 3370 & W. A. Shoolbred* (**BM**, **CGE**, **E**, **GL**, **K**, **LANC**, **NMW**, **OXF**) (cf. Marshall 1910; Marshall & Shoolbred 1910). U. K. Duncan (1980) says the tree is no longer there and remarks that the record by Marshall of *S. aria* (L.) Crantz from the same locality probably refers to the same tree. This is not true as there are perfectly good specimens of *S. aria* in **CGE** collected as *Marshall 3371* from the same locality on the same date.

Sorbus latifolia was first described as *Crataegus latifolia* Lam. A clear description of the species is supplied and *Crataegus folio subrotundo, serrato vel laciniato* Vaill. *Paris*. 42 is given as a synonym. The locality is given as "On trouve cet arbre dáns la forêt de Fontainebleau". I wrote to Paris on 30 October 1980, requesting photographs of any type material in the herbaria of Lamarck and S. Vaillant. I received photostat copies of three specimens in Lamarck's herbarium, but nothing from that of Vaillant. All three sheets from the Lamarck herbarium are labelled *Crataegus latifolia* and come from Fontainebleau, but bear no date. They are, in my opinion, all the same taxon and must be regarded as syntypes of *Crataegus latifolia* Lam. I have designated one of the sheets as the lectotype of that species.

Sorbus latifolia has a broadly ovate leaf with few veins, and shallow, but definite lobes which become gradually smaller upwards and have small sharp subsidiary teeth. The fruit is yellowish-orange to deep orange when ripe and has rather few large lenticels. It has been gathered by later authors in the woods about Fontainebleau, where it is a native characteristic of sandstone block ridges (fide C. D. Pigott, specimen in **CGE**). It is the least frequently planted tree that has been called *S. latifolia* in the British Isles. The new species, *S. croceocarpa*, described in this paper, is the species most frequently called *S. latifolia* in Britain. The largest tree of the true *S. latifolia* in the grounds of Newnham College at Cambridge is about 13 m high and the trunk 149 cm in circumference. The seven trees at Rhosgelan-Fawr in Cardiganshire are up to 20 m high and the trunks are from 60 to 130 cm in girth (fide A. O. Chater). As the species occurs in native habitats, as in Leigh Woods and Clifton Downs near Bristol and by the Conan River in E. Ross, where it has probably been bird-sown, it seems wise to include it in the list of British naturalized trees. Its characteristic leaf-shape and lobing distinguish it from all other British species.

According to Poucques (1951) the Fontainebleau *Sorbus latifolia* is diploid with 2n = 34 and its pollen mostly poorly developed. Nevertheless it produces abundant well-formed fruit.

S. vagensis Wilmott in *Proc. Linn. Soc. London* **146**: 78 (1934). Holotype: large tree just inside Mrs Harris's tea garden, Symonds Yat, W. Gloucester, v.c. 34, 18 September 1933, *A. J. Wilmott 4492* (**BM**).

Vernacular name: Wye Whitebeam

Illustration: *Proc. Linn. Soc. London* **146**: 78 (1934).

Description: See E. F. Warburg in A. R. Clapham, Tutin & E. F. Warb., *Fl. Brit. Isl.*, 2nd ed., 436 (1962).

Distribution: *v.c. 6, N. Somerset*. Weston Big Wood, GR 31/45.75, 1968, J. F. Archibald (D. Ratcliffe, *Nat. Conserv. Rev.* **2**: 69 (1977)). Three trees were seen by P. J. M. Nethercott in 1978 (Nethercott 1980). Two coppiced trees, Kings Wood, Yatton, 1984, P. J. M. Nethercott (Nethercott 1986).
v.c. 34, W. Gloucs. Coldwell Rocks, near Symonds Yat, Oct. 1877, *B. M. Watkins* (**CGE**, **OXF**); 24 July 1916, *E. Armitage* (**NMW**); Sept. 1935, *E. F. Warburg* (**BM**); 5 Sept. 1956, *B. A. Miles* (**CGE**). Bicknor Walks, Symonds Yat, 9 June 1874, *A. Ley* (**CGE**); 23 June 1877, *A. Ley* (**E**); June, 1888, *E. Armitage* (**NMW**); 27 Oct. 1892, *A. Ley* (**E**, **OXF**); 13 June 1899, *A. Ley* (**BIRM**). Below the Symonds Yat Rock, 29 Sept. 1975, *P. D. Sell 75/139 & D. Briggs* (**CGE**). Symonds Yat, June 1871, *A. Ley* (**CGE**); 12 Aug. 1872, *A. Ley* (**E**); 25 May 1875, *A. Ley* (**CGE**, **E**, **K**); 12 Oct. 1882, *A. Ley* (**NMW**); 13 June 1899, *A. Ley* (**E**, **K**, **NMW**, **OXF**); 12 June 1901, *W. A. Shoolbred* (**NMW**); 8 June 1907, *S. H. Bickham & A. Ley* (**CGE**); May 1909, *A. Ley* (**K**). Woods near Stanton, 28 June 1881, *A. Ley* (**CGE**).
v.c. 35, Mons. The Wyndcliffe, 23 June 1873, *A. Ley* (**BIRM**); 9 June 1878, *W. A. Shoolbred* (**NMW**); 25 June 1894, *W. A. Shoolbred* (**NMW**); 20 Aug. 1903, *S. H. Bickham* (**CGE**, **E**); Sept. 1935, *E. F. Warburg* (**BM**). Near Well Head, Usk Road, Chepstow, 7 June 1909, *W. A. Shoolbred* (**NMW**). Near Temple Door, Piercefield Park, 23 June 1932, *A. J. Wilmott* (**BM**).
v.c. 36, Herefs. Great Doward, 1880, *B. M. Watkins* (**CGE**); 11 June 1888, *A. Ley* (**CGE**); Sept. 1935, *E. F. Warburg* (**BM**).

S. vagensis has ovate to elliptical or rhombic-elliptical leaves variously lobed from 1/7 to over 1/4 of the way to the midrib with a finely serrate margin with small teeth. The fruit is brownish-orange to brown with a few small to moderate lenticels and variable in size.

The area of the Wye valley in which most *S. vagensis* occurs is one of the few places where its presumed parents, *S. aria* sensu stricto and *S. torminalis*, grow together. Warburg (1962) gives the diploid chromosome number, 2n = 34. Although the species is variable and can apparently be either sterile or fertile and sexual I have seen no Continental material that matches its morphology exactly. It is therefore, at least for the time being, best treated as a species.

ACKNOWLEDGMENTS

The late E. F. Warburg went through all the **CGE** material with me and gave his opinion of the *S. latifolia* aggregate. It was in accord with the conclusions I have reached here, except that he had not typified *S. latifolia* and *S. decipiens* and had no name for *S. croceocarpa*. M. E. Proctor has allowed me to include much of the detailed work she has done on *S. devoniensis* and *S. subcuneata* in Devon. Other contributors were: R. K. Brummitt, A. O. Chater, R. W. David, R. Hattey, C. King, P. J. M. Nethercott, C. D. Preston, T. C. G. Rich, R. H. Roberts, N. K. B. Robson, C. Turner, S. M. Walters and D. A. Webb, to all of whom I extend my thanks. I am also grateful to the curators of **ABD**, **BM**, **E**, **K**, **LANC**, **NMW** and **OXF** for the loan of specimens, and the librarian of the Albert Ludwigs University, Freiburg, for assistance.

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Thlaspi perfoliatum L. (Cruciferae) in the British Isles: distribution

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ABSTRACT

The distribution of *Thlaspi perfoliatum* L. in the British Isles is analysed. The plant is restricted to the Cotswolds as a native on screes and open grassland. It readily colonizes suitable ground such as that created by quarrying from local sites. Seed appears to be randomly distributed in association with railways. It occurs elsewhere as a casual, but only persists when associated with oolite baserock. The origin of the native distribution is a phytogeographical puzzle.

INTRODUCTION

Thlaspi perfoliatum L., Perfoliate Pennycress, has long been noted for its very restricted distribution in the British Isles (Boulger 1877). It is a small, spring-flowering annual particularly characteristic of open, oolitic limestone soils in the Cotswolds, where, although evidently once locally abundant (e.g. Riddelsdell *et al.* 1948), it is now becoming very scarce. The purpose of this paper is to analyse the distribution of the plant in the British Isles.

Four species of *Thlaspi* occur in the British Isles: *T. alliaceum*, *T. arvense*, *T. caerulescens* (*T. alpestre*) and *T. perfoliatum*. *T. perfoliatum* is easily distinguished from the other species by its 2–4(–6) ovate, perfoliate stem leaves and small (3·0–5·5(–7·5) mm), broadly obovate fruits which are narrowly winged above. Depauperate plants of *T. arvense* have occasionally been mistaken for *T. perfoliatum* but have fruits broadly winged all round.

Morphologically, British *T. perfoliatum* varies little except in size. Plants in the U.S.S.R. with conspicuously remotely dentate leaves have been distinguished as var. *denticulatum* N. Busch (Busch 1939), but in Britain there is continuous variation from entire to toothed leaves and hence the variety is not recognized. British *T. perfoliatum* is also morphologically indistinguishable from the bulk of European material examined at **LTR** and **K** and is therefore considered taxonomically identical.

Outside the British Isles, *T. perfoliatum* occurs as a native throughout Europe to northern France, Belgium and central Germany with a few scattered localities around the southern Baltic, and occurs eastwards to south-western Russia, Afghanistan and the Near East, and in N. Africa (Meusel *et al.* 1965).

SOURCES OF RECORDS AND ASSESSMENT OF DATA

Records have been collated from national and county floras, journals, unpublished manuscripts, correspondence with B.S.B.I. vice-county Recorders and other botanists, the Biological Records Centre, Monks Wood and from the following herbaria: **ABRN**, **BM**, **BRIST**, **BRISTM**, **CGE**, **CHM**, **DZS**, **E**, **GL**, **GLR**, **K**, **LANC**, **LIV**, **LSR**, **LTR**, **NMW**, **OXF**, **PLH**, **RNG** and **WARMS**. Many sites

from which *T. perfoliatum* had been recorded in the past have been re-visited, and field data were collected in 1986 and 1987 from extant sites.

A number of records, mainly in Druce (1934), have been rejected. Records for v.cc. 30 and 53 are regarded as errors for *T. arvense* (Dony 1953; Gibbons 1975), and records for v.cc. 64 and 70 errors for *T. caerulescens* (Lees 1888; Hodgson 1898). A specimen of *Lepidium perfoliatum* collected at Frodsham, Cheshire in 1929 (**LIV**) mis-named as *Thlaspi perfoliatum* may be the source of the v.c. 58 record (A. Gunn, pers. comm. 1986). The record for v.c. 38 is due to confusion of Kineton, Warwickshire with Kineton, Gloucestershire (Bagnall 1891). Worcestershire records from Bearborough (Butcher 1921) and Benborough (Harris 1928) probably refer to Scarborough, Cutsdean (J. Day, pers. comm. 1987) in v.c. 33, not v.c. 37. Another Worcestershire record from Evenlode (Amphlett & Rae 1909) is also in v.c. 33. Records for Bristol and Devon have also been rejected by White (1912) and Martin & Fraser (1939) respectively, and we have been unable to trace the origin of the "wall in Buckinghamshire" record in Lousley (1950). The Cleeve Hill, Cheltenham record (Ratcliffe 1975) is an error (T. C. E. Wells and D. A. Wells, pers. comm. 1987).

Because of the fragmentary, inconsistent, historical nature of many of the records used here, we have adopted a constant reductionist approach in assessment and acceptance of records, preferring caution to over-estimation. A record is considered here to be any unique combination of site (and habitat if stated), date and recorder. Records such as "Oaksey" and "near Oaksey" have been taken to be the same site unless other information indicates the contrary. Some records have been interpreted in the light of other records; for instance, specimens labelled "Tetbury" are assumed to refer to the classic Tetbury Road railway station site (cf. Boulger 1877) and not to the town itself. Literature records corresponding with herbarium specimens have been amalgamated to avoid duplication. Although there is a degree of subjectivity in interpretation, the resulting records are assumed to be representative. Details are lodged at the Biological Records Centre.

One other record is noted here but not included in any further analysis. *T. perfoliatum* was introduced to Cumnor Hill, Berkshire in about 1861 (Druce 1927), where, fortunately, it did not persist. As far as we are aware this is the only instance of deliberate introduction.

DISTRIBUTION AND HABITATS

We have accepted records for 35 10-km squares. There are no reliable records for Ireland. The records have been assessed on a consideration of ecology and habitat information (both past and present), site history and dates of records, recorders' comments and associated species. As many of the records have habitat information (Table 1; Figs 1A–C), the records for various habitats have been investigated further.

Thlaspi perfoliatum is usually considered a natural component of the vegetation on open screes, banks and pastures on oolitic limestone. Typically, the plant occurs in rubble virtually devoid of other vegetation or on shallow, bare rendzina soils with *Erophila verna* sensu lato and *Hieracium pilosella*, and is evidently dependent on the maintenance of open conditions for long-term survival.

TABLE 1. NUMBER OF RECORDS AND NUMBER OF 10-KM SQUARES FOR THE HABITATS IN WHICH *T. PERFOLIATUM* HAS BEEN RECORDED

Habitat	No. of records	No. of 10-km squares
Open pastures, screes, etc.,	44 (13·5%)	9
Quarries	51 (15·6%)	9
Railways	65 (20%)	17
Arable	4 (1·2%)	3
Walls	3 (0·9%)	3
Riverbanks	2 (0·6%)	2
Other	4 (1·2%)	4
Not recorded	155 (47·5%)	20

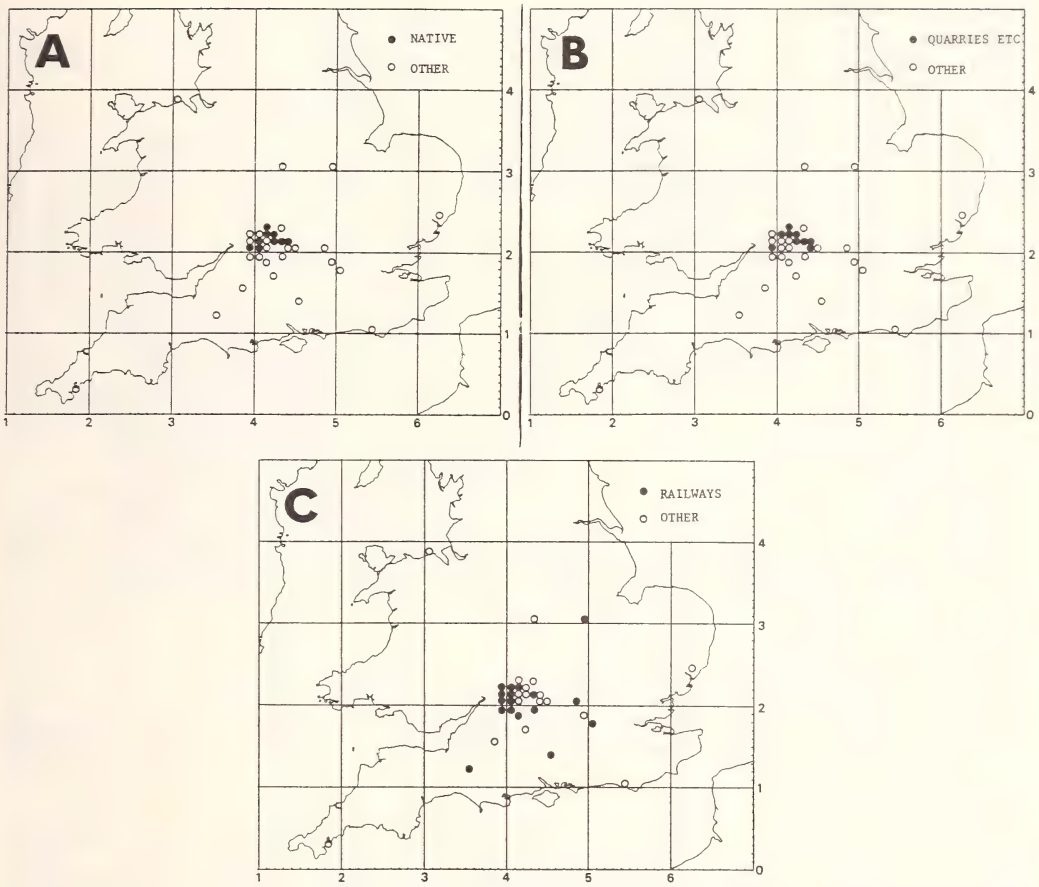

FIGURE 1. 10-km square records of *T. perfoliatum* (the Scottish record for Forres (Webster 1978) is not included on the maps). A: squares where it is thought to be native; B: squares in which it has been recorded in quarries, stone pits, etc.; C: squares where it has been recorded associated with railways.

It usually occurs in or near grassland containing other rare calcicoles characteristic of old grassland such as *Pulsatilla vulgaris*, *Thesium humifusum* and *Astragalus danicus*.

Fig. 1A is a map showing what we consider to be the native distribution. The plant may be native elsewhere in this area too. It is not considered native on quarry spoil heaps or railways as these are artificial habitats, even if seeds have spread by their own accord. Note that this is a stricter interpretation of the native range than that of Perring & Walters (1962).

When the records are plotted on a larger scale map (Fig. 2) they show that the native range can be divided into three regions: the area from which the plant was originally recorded in v.c. 23, and two areas in v.c. 33 – one to the north-west of Bourton-on-the-Water and the other to the south-west of Foss Cross extending to Cirencester and Sapperton. These are generally hilly areas with exposed, oolite rocks and shallow soils. Whether these three regions are the remains of a more continuous distribution in the Cotswolds or expansions from localized refugia (cf. Pigott & Walters 1954) is unknown.

Quarrying creates much habitat eminently suitable for the plant, and the records associated with quarries, stone pits, spoil, etc., are plotted in Fig. 1B. The map is similar to Fig. 1A, suggesting colonization from local native populations but little tendency to spread between such sites. *T. perfoliatum* has no specialized seed dispersal mechanisms.

Fig. 1C shows the distribution of records from railways, where *T. perfoliatum* is usually recorded

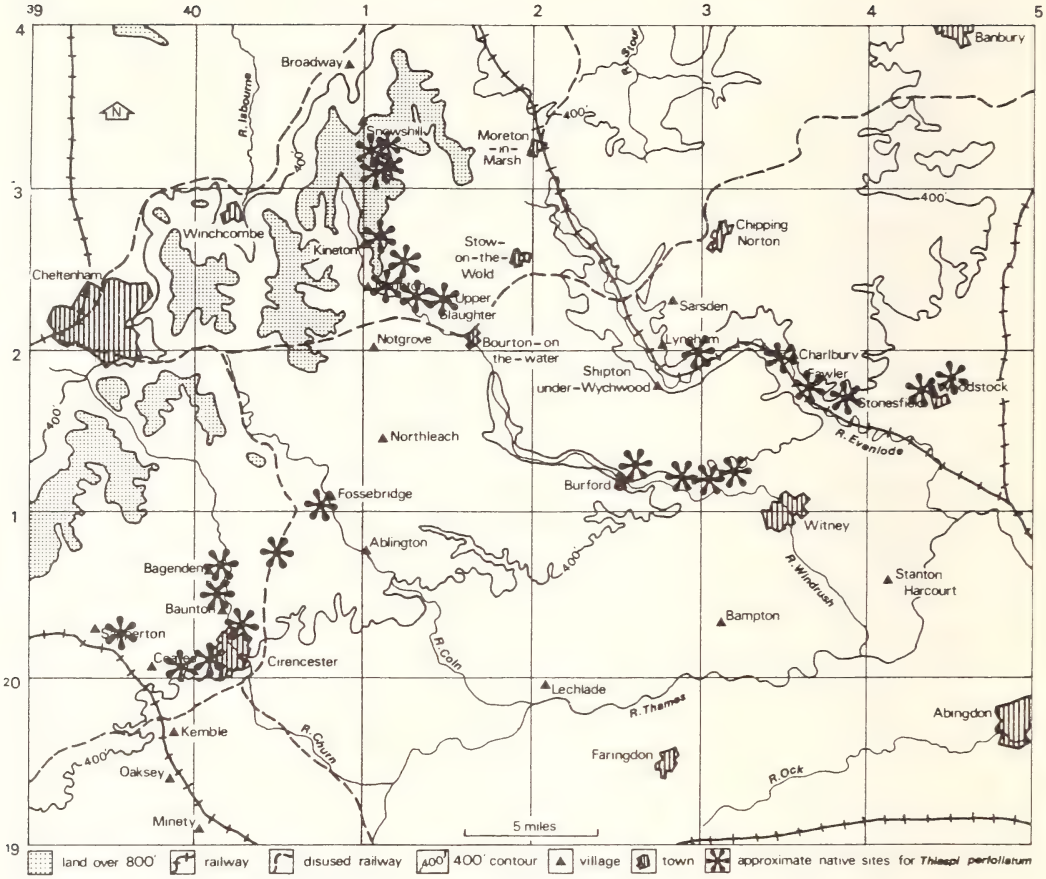

FIGURE 2. Approximate locations of sites where *T. perfoliatum* is thought to be native.

on chippings and cinders on the tracks, cuttings, embankments and old stations (e.g. Boulger 1877; Druce 1897; Messenger 1971; Holland *et al.* 1986). A comparison of the map with Fig. 1A indicates that the plant has been widely dispersed in association with the railways, probably as seeds transported in ballast and in the slipstream of passing trains. Twelve of the 17 10-km records are from outside the native range. When the number of 10-km square records per unit (1 km^2) area is plotted as a function of distance from the centre of the native range, there is an inverse exponential relationship (Fig. 3). This is similar to seed and pollen rain observed in other plants (Harper 1977; Janzen 1970; Pigott & Huntley 1980) and suggests that seed dispersal in association with railways is largely a random process.

Three other habitats in which *T. perfoliatum* has been recorded but where it does not persist also deserve mention. Four records are from farms where it probably occurred as a weed in crops (e.g. Brenan 1946). The plant is a common weed in southern and eastern Europe (Busch (1936) describes it as a "noxious" weed in the U.S.S.R.) and hence seed could have been introduced with foreign grain, as presumably happened at Falmouth Docks (Davey 1909). However, the fact that the records are from within or at the edges of the known distribution and are absent from elsewhere in the country, and the war-time date of the Brenan (1946) record, suggest that the seed is more likely to have been of local origin. There are three records from walls, surprisingly few in view of the abundance of walls constructed with oolite rock in the Cotswolds, an apparently suitable habitat. Finally, there are two records from riverbanks, the populations presumably originating from seed

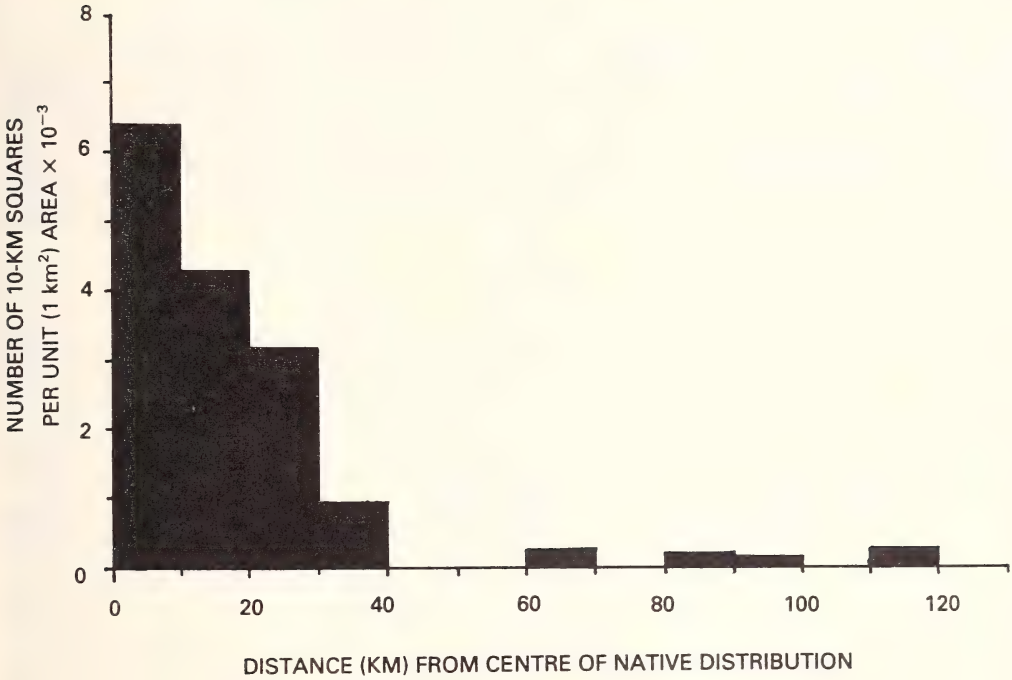

FIGURE 3. A graph showing, for records of *T. perfoliatum* associated with railways, the relationship between distance from the centre of distribution and the number of 10-km square records per unit (1 km^2) area.

washed down the catchment, as is also reported for *T. caerulescens* (cf. Gilbert in Milne-Redhead 1963).

Elsewhere, the plant occurs as a casual (e.g. Arnold 1907; Webster 1978) and there are a number of exasperating records without habitat information, e.g. Prestatyn (*W. Harrison*, 1923, **LIV**), Twycross (*Rev. A. Bloxam*, 1842, **K**) and Woodbridge (*W. R. Roberts*, in *Countryside N.S.* **3**: 184, 1921).

A characteristic feature is the association of the plant with oolitic limestone. Fig. 4 shows 10-km squares in which the plant has been recorded for periods of 10 years or more. The correlation of persistence with the occurrence of oolite is very marked and is statistically significant ($p<0.01$, using χ^2). Of the sites at which the plant persisted away from oolite baserock, one (v.c. 12) was probably introduced with oolite ballast and the other two are on limestone very similar to oolite. This strict association may result from very specific ecological requirements of the plants in the British Isles. On the continent, *T. perfoliatum* also occurs on other types of limestone and seems more catholic in its requirements.

DISCUSSION

Most features of the distribution can be explained by analysis of the habitat data. What can not be explained is the restriction of the plant as a native to the Cotswolds. This is as much a phytogeographical puzzle as is the distribution of *Pulsatilla vulgaris* (Wells & Barling 1971). The Cotswold localities are disjunct from the plant's range on the Continent, as are the localities around the Baltic. Pigott & Walters (1954) have interpreted the disjunct distributions of a number of species of open habitats in terms of widespread reductions of range during the post-glacial period, and it is possible that a similar explanation could be applied to *T. perfoliatum* too.

The plant appears to be restricted to oolitic soils in the British Isles by some unknown ecological

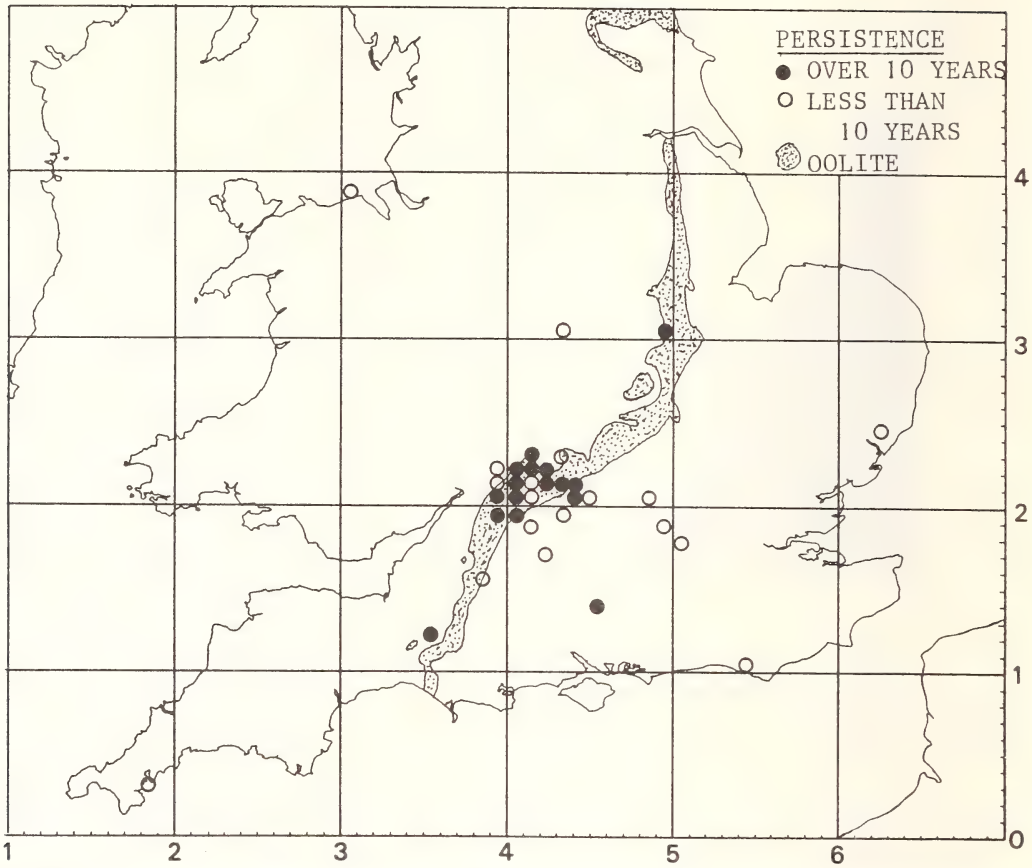

FIGURE 4. 10-km squares for which *T. perfoliatum* has been recorded for periods of 10 years or more in relation to the distribution of oolitic limestone baserock.

factor(s), but it is not currently restricted to the Cotswolds by climate, as introduced railway colonies in Somerset and Rutland have both persisted for over 20 years. It has not been recorded as a native on the other extensive areas of oolite in Purbeck and Dorset, Northamptonshire, Leicestershire and Lincolnshire, and East Yorkshire.

The occurrence of other calcicoles with restricted distribution growing in association with the *Thlaspi* suggests that the general areas in which the plant occurs have been open grassland for a long period of time. At a 10-km square level, the correlation between the occurrence of *T. perfoliatum* and the other rare grassland calcicoles is statistically highly significant ($p<0{\cdot}001$, using χ^2). Whether these other species have quaternary phytogeographic histories similar to that of *T. perfoliatum* remains to be seen, but it is interesting to note that the two other plants with their centres of distribution also on the Cotswold oolite, *Carex tomentosa* and *Stachys germanica*, occur there in quite different habitats. Further understanding will have to await detailed studies both of the autecology of *T. perfoliatum* and of the vegetation history of the Cotswolds.

Finally, two points arise out of our experience in compiling the data base for *T. perfoliatum*. First, our analysis of distribution by habitat shows the potential of this type of data; habitat information ought to be collected systematically with other site details. Second, it is very worthwhile checking original sources of references; it is surprising how often records have been copied incorrectly (e.g. first records for v.cc. 7, 33 and 34), or missed (e.g. records for v.cc. 51 and 55 in **LIV** and **K** respectively).

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A multivariate analysis of the trichomes of *Hedera* L.

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ABSTRACT

Measurements were taken from scanning electron micrographs of representative trichome arms of selected taxa of *Hedera* L. (Araliaceae) and the data were subjected to principal components and cladistic analyses. This was done in order to contrast taxonomic opinions and determine evolutionary trends in trichome attributes. Based on these analyses, specimens from North Africa and the Azores, Madeiras and Canary Islands do not constitute a single species, as has been proposed, but instead consist of at least two species of rather distant relationship; there are perhaps more. *Hedera hibernica*, which has been segregated from *H. helix*, is not strongly differentiated from the latter and the two taxa form a monophyletic group; thus strong support for the recognition of *H. hibernica* as a species is not found in this study. The group of ivies characterized by having large white hairs is natural whereas that which has small red hairs appears to be paraphyletic, i.e. unnatural. The most rapid trichome evolution is seen in taxa of Europe, and more especially in those that occur in North Africa and the Azores, Madeiras, and Canary Islands.

INTRODUCTION

In a previous study on *Hedera* L., Lawrence & Schulze (1942) recognized five species, *H. canariensis* Willd., *H. colchica* K. Koch, *H. helix* L., *H. nepalensis* K. Koch and *H. rhombea* (Miq.) Bean, based on gross morphology, trichome type and geographic distribution. More recent studies on *Hedera* (McAllister & Rutherford 1983; Rutherford 1984; Rutherford & McAllister 1983) have indicated that these five species should be, at least in part, subdivided into more species. These authorities split *H. helix* of Lawrence & Schulze (1942) into *H. helix* and *H. hibernica* (Kirch.) Bean, which is found along the Atlantic Coast of Europe from Spain through France and England to Ireland and Scotland, and *H. canariensis* into *H. canariensis*, *H. algeriensis* Hibb., *H. azorica* Carr., *H. maderensis* K. Koch and *H. "Morocco"*, each of the segregate taxa occupying more restricted distributions at the western end of the Mediterranean or on islands in the eastern Atlantic. The last name was one used by McAllister & Rutherford (1983) to refer to a possible new species related to *H. canariensis*. These species have also been placed in two groups by McAllister & Rutherford (1983), those with large white trichomes (*H. azorica*, *H. helix* and *H. hibernica*) and those with small reddish ones (*H. canariensis*, *H. maderensis*, *H. nepalensis*, *H. rhombea* and *H. colchica*).

There were two purposes to this study. The first was to compare the contrasting taxonomic opinions of Lawrence & Schulze (1942) and McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). The second was to evaluate the naturalness of groups based on gross trichome features, using data derived from scanning electron microscopy (SEM) of trichomes and analysed by multivariate methods. The trichomes of *Hedera*, which have yet to be studied under SEM, are well known for their richness of form and usefulness in the systematics of the genus (Dehgan 1981). The general usefulness of trichomes in systematic studies is also well known (e.g. Carolin 1971; Cowan 1950; Gornall 1986; Hardin & Bell 1986; Hunter & Austin 1967; Jones 1986; Tucker 1963). Multivariate analysis has the advantage of simultaneously evaluating both variable variances and covariances in order to describe the relationships within and amongst taxa. If the groups recognized by Lawrence & Schulze (1942) are natural, although more inclusive than those recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983), there are two predictions that would follow. First, the within species variation would approximate that of other species. Second, specimens of *H. helix* and *H. canariensis* sensu Lawrence & Schulz (1942) would occupy close positions in graphic displays of the results of multivariate analysis. If *H. helix* and *H. canariensis* as recognized by Lawrence & Schulze (1942) are not natural,

then the converse predictions would hold, i.e. the within species variation for their taxa would be high and the segregate taxa of McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983) would occupy disparate positions in the graphic displays derived from multivariate analysis. Furthermore, if the split into two groups based on hair size and colour (McAllister & Rutherford 1983) is appropriate, then such groups should also appear as distinct entities in the results of multivariate analysis.

It is acknowledged that we are comparing classifications of *Hedera* using only trichomes but one way to contrast different classifications is a detailed comparison of one part of the organisms under study, what Simpson (1961) has referred to as the criterion of "minuteness of resemblance", to arrive at conclusions about relationships sensu lato. The assumption in such an approach is that, known anomalies aside, if taxa and their relationships are real, they should be revealed in whatever feature is analysed.

MATERIALS AND METHODS

PLANT MATERIAL

The material used in the analysis was mainly living material obtained from the American Ivy Society, British Ivy Society and the Botanical Gardens of the University of British Columbia. Herbarium specimens were used when living material was not available. Certain species such as *H. pastuchovii* were not included due to the lack of specimens from which trichome data could be gathered. The taxa analysed and the source of the material is presented in Table 1. Geographic locations of the source material are shown in Fig. 1. Identifications were, for the most part, based on

FIGURE 1. Map showing location of samples used in this study. Taxa as recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). 1, *H. nepalensis*; 2, *H. rhombea*; 3, *H. colchica*; 4, *H. maderensis* (*H. canariensis* of Lawrence & Schulze 1942); 5, *H. azorica* (*H. canariensis* of Lawrence & Schulze 1942); 6, *H. canariensis*; 7, *H. algeriensis* (*H. canariensis* of Lawrence & Schulze 1942); 8, *H.* "Morocco" (*H. canariensis* of Lawrence & Schulze 1942); 9, *H. helix*; 10, *H. hibernica* (*H. helix* of Lawrence & Schulze 1942).

TABLE 1. SOURCE OF MATERIAL ANALYSED. TAXA AS RECOGNIZED BY MCALLISTER & RUTHERFORD (1983), RUTHERFORD (1984) AND RUTHERFORD & MCALLISTER (1983)

Species	Origin of material
H. algeriensis	
(AIS 82–238)[1]	Montasterre, south of Sousse, Tunisia.
H. azorica	Sao Miguel, Azores, Portugal.
H. canariensis	La Mercedes, Tenerife, northeast end of Canary Islands, Spain.
H. maderensis	Miel Valley, Algeciras, Cadiz Prov., Spain.
H. "Morocco"	Between Ifrane and Ketama near Fes, Middle Atlas Mts., Morocco.
H. colchica	
(AIS 82–256)	Turkey.
(AIS 82–268)	Caucasus between Telavi and Zagodeki, USSR.
(AIS 81–149)	Hillside above Novy Afron, Black Sea, USSR.
(LG 305–10)[2]	Batumi Botanical Garden, Georgia, USSR.
(LG 62–1125)	Cultivated from American Ivy Society.
H. helix	Dybeso, Rorvig, Denmark.
	On road to Zalamen, between Clanas and El Villar, Huelva Prov., Spain.
	Samaria Gorge, Crete.
H. hibernica	South of Balonnart Farm, Ayrshire, Scotland.
	Glen Mayo, Isle of Man.
H. nepalensis	
(LG 83–0227)	Mt. Omei, Sichuan Prov., China; Yunnan Prov., China.
(AIS 87–202)	Cultivated in Univ. British Columbia Botanical Garden.
	Shennongjia Forest, Hubei Prov., China.
	Cultivated by Calif. Acad. Sci.
H. rhombea	
(LG 85–0359)	Ryukyu Island, Japan.
	Honshu pref. Shizuoku, western slope of Mt. Monju-dake, Japan.
	Honshu; Shirahama in Awa Prov., Japan.
	Mt. Taiping, I-lan Hsien, Taiwan.
	Cultivated in Koishidawa Botanical Garden, University of Tokyo, Tokyo, Japan.

[1] American Ivy Society accession number; [2] Longwood Gardens accession number.

comparisons with published descriptions and geographic distributions. Specimens of *H. hibernica* were those identified by H. McAllister.

In order to determine that part of the plant from which to obtain trichome data, preliminary observations were made under a dissecting microscope, on ab- and adaxial surfaces of both young and old leaves, petioles, stems, and inflorescences. Based on these preliminary observations, it was decided that the abaxial surfaces of juvenile leaves, usually the second or third leaf from a shoot tip, was the most appropriate for further study. It was these leaves that had the most trichomes. In some cases, juvenile leaves of *H. nepalensis* were absent and adult leaves had to be used. In choosing specimens for analysis, representation from as many geographical areas as possible was attempted.

DATA ACQUISITION

Five samples from each species, as recognized by Lawrence & Schulze (1942), were chosen so that the species also recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983) were represented. The classification of Lawrence & Schulze (1942) was used as a starting point since it is the better known, being commonly referred to in general references (Rose 1980), and is the one whose naturalness we wanted to assess.

The leaves chosen for analysis were removed from the plant and air dried. Then, a small piece, approximately 5 mm × 5 mm was cut from each sample and mounted abaxial side up on an aluminium stub with silver paste. The stub and mounted leaf sample were air dried for another 24 hours to allow the fumes to dissipate from the paste and then coated in a gold sputter coater. The samples were observed and photographed in a Cambridge 250 ET SEM.

There are advantages and disadvantages to using SEM in such a study. The advantage is a clear display, which recaptures a certain three-dimensional component of the trichomes that facilitates

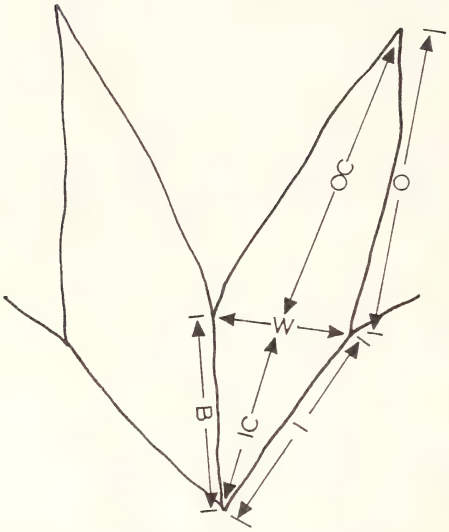

FIGURE 2. Variables measured shown on part of the trichome of *H. colchica*. O, length of arm along its edge from the point of fusion with other arms to its tip; I, length over which one side of trichome arm is fused; B, length over which other side of trichome arm is fused; W, width of arm along line connecting points of fusion on opposite side of trichome arm; OC, distance from line along which W was measured to tip of trichome; IC, distance from line along which W was measured to centre of trichome.

accurate measurement. The disadvantage is the time and cost of preparing material for, and producing pictures from SEM, which means that there will be a restriction on sample size.

From each specimen five trichomes were chosen for photographing and the data were gathered from these photographs. The variables measured were those shown in Fig. 2. In addition, the number of arms per stellate trichome was also noted. The measurements were designed to assess the length of the portion of the trichome arms that are free from each other (OC and O), the relative amount of trichome arm that is fused (I, B, and IC) and the width of the trichome arm (W). It is acknowledged that there is a certain amount of interdependency in the variables measured. That, however, is not wholly undesirable since the interdependency allows the assessment of attributes beyond those measured. For example, the relationship among B, I and W will reflect the angle formed at the junction of the arms of a trichome as will the relationship among O, OC and W capture the angle at the free tip of each arm. The relationship between IC and OC will reflect the relative size of the fused portion of the stellate trichome. These interrelationships are revealed by multivariate methods through the use of variable correlations.

DATA ANALYSIS

The main method of data analysis was principal components analysis (PCA) of a correlation matrix, a method which describes the relationships among objects analysed. These relationships are mathematically depicted as statistics, which summarize the relationships between the variables, and graphically by PCA axis scores, summary variables that display the relationships among the objects analysed. The PCA axis scores more accurately describe relationships than the original variables measured.

In this study, the objects subjected to PCA were individual trichome arms. The PCA axis scores were then displayed as means and standard deviations for taxa on the first two principal component axes. The taxa so presented were those recognized by Lawrence & Schulze (1942) and McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). With such a display we could compare the treatment of *H. helix* and *H. canariensis* of Lawrence & Schulze (1942) with that of McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). If the

taxa of Lawrence & Schulze (1942) are natural, then all trichomes from those taxa should have a comparable amount of within-species variation to other species and occupy a similar position on the first two principal axes. This would be revealed by those taxa having a standard deviation similar to other species and by the segregate taxa of McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983) existing as a tight cluster on the first two axes.

The different classificatory opinions were also compared by subjecting the PCA axis scores to analysis of variance (ANOVA). Two separate ANOVAs were performed. In one, the groups of trichomes compared were based on the taxa recognized by Lawrence & Schulze (1942) and in the other, the groups compared were defined by the taxa perceived by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). The ANOVAs were used as a description device, i.e. in the context of exploratory data analysis (Hoaglin *et al.* 1983, 1985). The interest was not in testing specific hypotheses but in terms of how well the different classifications agree with the data. The amount of agreement between the data and the different classifications is revealed in the amount of variation accounted for by each group (i.e. taxa) in an ANOVA. The assumption is that the classification which best agrees with the data, i.e. is the most natural, would be that in which the groups (taxa) account for more variation in the data. The amount of variation in the ANOVAs was determined as a ratio of sums of squares (eta^2).

The data were also subjected to cladistic analysis using PHYSYS (Farris & Mickevich 1983). The cladistic analysis was applied in order to establish which trichome features are most plesiomorphic as well as the evolutionary trends seen in the trichome characters. Since an appropriate outgroup for cladistic analysis was not available, each taxon, in turn, was treated as the outgroup and the cladistic analysis chosen for inclusion in this paper was that one which gave the most parsimonious results.

The cladistic analysis was conducted on the taxa recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983) and the character values used for each taxon were the average of the variable values for all individuals in that taxon. Before the data were subjected to cladistic analysis, they were transformed from real to ranked numbers in order to facilitate presentation and interpretation of results. By analysing the taxa recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983), the naturalness of *H. helix* and *H. canariensis* as recognized by Lawrence & Schulze (1942) can be tested; if they are natural, then the taxa segregated out by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983) will form monophyletic groups.

RESULTS AND DISCUSSION

The measurements were converted to means and standard deviations and are presented in Tables 2 and 3. Table 2 has statistics for the taxa recognized by Lawrence & Schulz (1942) and Table 3 for the

TABLE 2. MEANS AND STANDARD DEVIATIONS (IN PARENTHESES) OF TRICHOME CHARACTERS OF *HEDERA* TAXA RECOGNIZED BY LAWRENCE & SCHULZE (1942)
All measurements are in μm.

	Characters						
Taxa	O	I	W	OC	IC	B	No. of arms
H. nepalensis	56·5	54·6	25·1	52·0	56·6	62·0	13·0
	(43·3)	(18·7)	(8·4)	(38·9)	(17·0)	(18·9)	(2·2)
H. rhombea	45·3	56·8	28·4	42·3	56·6	59·3	13·0
	(29·7)	(19·9)	(14·5)	(30·4)	(18·1)	(15·2)	(2·7)
H. colchica	78·6	63·9	30·4	75·3	64·7	69·4	13·0
	(29·4)	(20·0)	(7·8)	(28·3)	(19·8)	(20·5)	(2·4)
H. canariensis	162·8	45·8	30·7	141·3	49·0	57·9	11·0
	(146·1)	(18·5)	(11·4)	(134·7)	(18·3)	(32·6)	(3·2)
H. helix	241·1	26·9	29·2	224·7	25·9	31·9	6·0
	(92·2)	(12·8)	(10·8)	(94·5)	(13·5)	(16·3)	(1·6)

TABLE 3. MEANS AND STANDARD DEVIATIONS (IN PARENTHESES) OF TRICHOME CHARACTERS OF *HEDERA* TAXA RECOGNIZED BY MCALLISTER & RUTHERFORD (1983), RUTHERFORD (1984) AND RUTHERFORD & MCALLISTER (1983)

All measurements are in μm.

	Characters						
Taxa	O	I	W	OC	IC	B	No. of arms
H. nepalensis	56·5	54·6	25·1	52·0	56·6	62·0	13·0
	(43·3)	(18·7)	(8·4)	(38·9)	(17·0)	(18·9)	(2·2)
H. rhombea	45·3	56·8	28·4	42·3	56·6	59·3	13·0
	(29·7)	(19·9)	(14·5)	(30·4)	(18·1)	(15·2)	(2·7)
H. colchica	78·6	63·9	30·4	75·3	64·7	69·4	13·0
	(29·4)	(20·0)	(7·8)	(28·3)	(19·8)	(20·5)	(2·4)
H. maderensis	171·0	45·4	32·4	165·3	49·1	73·1	9·0
	(65·3)	(12·5)	(9·4)	(62·0)	(14·5)	(60·8)	(1·3)
H. azorica	426·7	31·1	28·9	343·3	153·3	40·0	7·0
	(42·0)	(9·3)	(6·1)	(168·9)	(280·8)	(14·9)	(0·5)
H. canariensis	54·7	41·8	24·8	56·2	39·0	36·6	12·0
	(13·2)	(15·0)	(10·1)	(16·3)	(11·6)	(11·3)	(4·3)
H. algeriensis	58·8	52·3	29·7	48·7	59·1	67·6	14·0
	(24·9)	(11·7)	(12·9)	(15·4)	(12·0)	(19·0)	(2·6)
H. "Morocco"	102·8	58·8	37·9	93·0	62·4	72·0	11·0
	(39·3)	(29·2)	(16·5)	(39·2)	(22·0)	(18·7)	(0·7)
H. helix	282·1	30·0	32·1	253·9	29·6	33·8	5·4
	(73·5)	(13·2)	(11·0)	(94·8)	(14·0)	(18·1)	(1·6)
H. hibernica	179·5	22·3	24·9	180·8	20·4	29·1	6·3
	(85·2)	(11·1)	(9·2)	(79·3)	(10·9)	(13·5)	(1·6)

the taxa recognized after McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). The main point of comparison between Tables 2 and 3 is *H. canariensis* where in some variables measured, O and OC, the standard deviations greatly exceed the standard deviations for the same variables in the other taxa. When *H. canariensis* is split into the species recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983), the standard deviations for the above mentioned variables are greatly reduced.

The results of the PCA are presented in Table 4. Only the first two axes are presented since only these have eigenvalues >1·0, the average eigenvalue for the PCA of a correlation matrix. We followed the convention of using only those axes with eigenvalues greater than the average (Legendre & Legendre 1983). All variables have a rather high value on the first axis with the exception of W. This indicates a strong relationship between most variables and the overall correlation structure for the trichome data. As well, the presence of both positive and negative values on the first PCA axis, that which reflects most of the variation in trichome data, indicates that the features measured do not all show the same trends in variation; as certain values decrease (O and OC), others will increase. This indicates that the trichomes of *Hedera* differ not only in size but also in shape.

Graphic results of PCA are presented in Figs. 3 and 4. Fig. 3 shows the means and standard deviations on the first two axes for the taxa recognized by Lawrence & Schulze (1942) and Fig. 4 the taxa recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). In Fig. 3, *H. nepalensis* and *H. rhombea* are very close to each other and to *H. colchica*. *Hedera helix* is the most distantly removed from the above group of species and *H. canariensis* occupies an intermediate position in the ordination. Even more interestingly, in Fig. 3 the variation in *H. canariensis* is greater than that seen in the other species, as indicated by the larger standard deviations on the first PCA axis; *H. helix* shows the same on the second axis. The same basic pattern is seen in Fig. 4 with respect to *H. nepalensis*, *H. rhombea*, *H. colchica* and *H. helix*. However, at least some of the taxa split out of *H. canariensis* by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983) occupy extreme positions in the scatterplot,

with *H. algeriensis* being to one side and close to *H. nepalensis* and *H. rhombea*, and *H. azorica* being on the opposite side and close to *H. helix*. *Hedera helix* and *H. hibernica* are close to each other on the first PCA axis but are separated on the second. *Hedera maderensis* and *H. canariensis* are in the middle portion of the ordination and *H.* "Morocco" is close to *H. nepalensis*, *H. rhombea*, *H. algeriensis*, and *H. colchica*. Fig. 4 also reflects the split in ivies based on trichome size and colour (McAllister & Rutherford 1983) with *H. hedera*, *H. hibernica* and *H. azorica*, the taxa with large white trichomes, being separated from the rest on the first PCA axis.

These results indicate that *H. canariensis* of Lawrence & Schulze (1942) is a highly heterogeneous taxon most likely consisting of more than one species. Our data and analyses will not allow us to say how many taxa should be recognized but those that stand out are *H. azorica*, *H. canariensis* and, perhaps, *H. maderensis*. *Hedera* "Morocco" and *H. algeriensis* are fairly close, a point of interest since McAllister & Rutherford (1983) hypothesized a relationship between *H.* "Morocco" and *H. canariensis*, which are not close in Fig. 4. Any difference between *H. helix* and *H. hibernica* is not clear-cut.

The comparison of the classifications of Lawrence & Schulze (1942) and McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983), as they are depicted by the results of the PCA (Figs. 3 & 4), indicate that the latter classification is likely to be superior, at least in its general structure. The same is indicated by the ANOVAs. Eta^2 for the ANOVA based on taxa recognized by Lawrence & Schulze (1942) (59·76 and 10·04 for the first and second axes respectively) is lower than that for the taxa recognized by McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983) (72·29 and 30·25 respectively).

The most parsimonious result of the cladistic analysis was that using *H. rhombea* as the outgroup and this is illustrated in Fig. 5. The first aspect to be commented on is the two groups of ivies recognized by McAllister & Rutherford (1983) based on trichome type. The taxa with large, white trichomes form a monophyletic group; those with small red trichomes a paraphyletic group, i.e. an unnatural one.

With respect to relationships depicted by the cladogram, the first striking aspect is that *H. canariensis* of Lawrence & Schulz (1942) is not natural, its segregates occurring in different monophyletic lines, ranging from one of the most plesio- to the most apomorphic. The situation is different with *H. helix* and *H. hibernica*. These two taxa form a monophyletic group thus indicating that *H. helix* of Lawrence & Schulze (1942) is a natural taxon. Thus the trichome data presented here will not allow a definitive statement on the appropriateness of recognizing *H. hibernica*. However, the indication that *H. helix* and *H. hibernica* are monophyletic and that they are separated only on the second PCA axis means that support for the recognition of the two species may well have to be found elsewhere. Also, *H. canariensis* and *H.* "Morocco" are not monophyletic indicating, like the results of PCA, that these two taxa are not close. We realize that our sampling is not extensive and therefore our conclusions must be tentative.

With respect to evolution of trichome attributes, generally speaking, with the exception of *H. canariensis* sensu McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister

TABLE 4. PCA OF TRICHOME CHARACTERS RECORDED FOR *HEDERA* TAXA

Principal component	1	2
Eigenvalue	3·8	1·6
Percentage of total variance accounted for	54·7	23·2
Trichome characters	Eigenvectors	
O	−0·366	0·465
I	0·436	0·255
W	0·003	0·516
OC	−0·357	0·468
IC	0·456	0·288
B	0·392	0·369
No. of arms	0·432	0·120

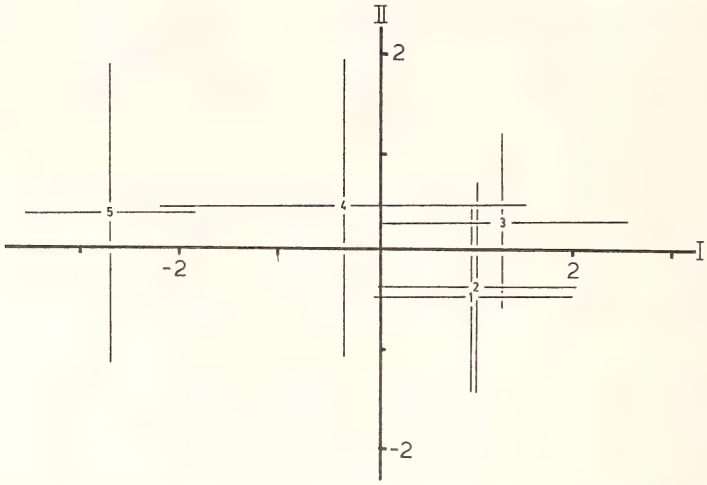

FIGURE 3. Ordination of PCA axis scores based on classification of Lawrence & Schulze (1942). Numbers identify taxa, their positions denote average values, horizontal and vertical lines indicate one standard deviation on the first (I) and second (II) PCA axes respectively. 1, *H. nepalensis*; 2, *H. rhombea*; 3, *H. colchica*; 4, *H. canariensis*; 5, *H. helix*.

(1983), the most plesiomorphic taxa are those of Asia, *H. nepalensis* and *H. rhombea*, with the taxa of Europe being the more apomorphic.

The most rapid evolution of trichome features, as indicated by the number of character state changes, occurs in the taxa of North Africa and the islands offshore from there, with the exception of *H. algeriensis*. These data suggest an Asiatic origin followed by the evolution of taxa in the western Mediterranean and then by those in Europe.

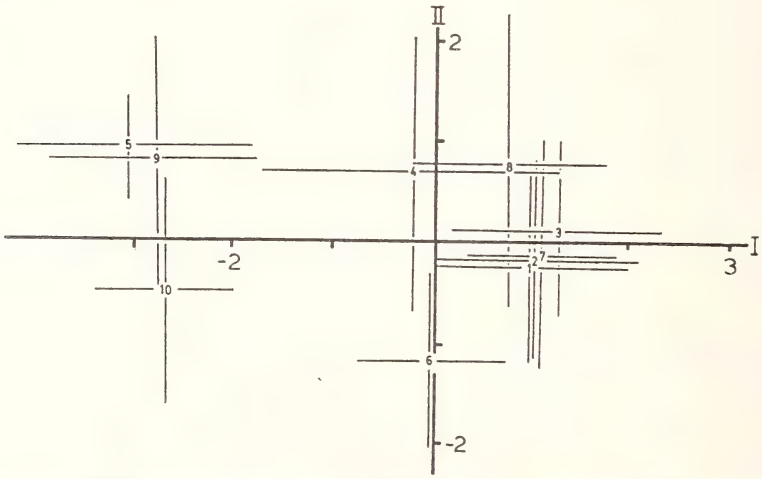

FIGURE 4. Ordination of PCA axis scores based on classification of McAllister & Rutherford (1983), Rutherford (1984) and Rutherford & McAllister (1983). Numbers identify taxa, their positions denote average values, horizontal and vertical lines indicate one standard deviation on the first (I) and second (II) PCA axes respectively. 1, *H. nepalensis*; 2, *H. rhombea*; 3, *H. colchica*; 4, *H. maderensis*; 5, *H. azorica*; 6, *H. canariensis*; 7, *H. algeriensis*; 8, *H.* "Morocco"; 9, *H. helix*; 10, *H. hibernica*.

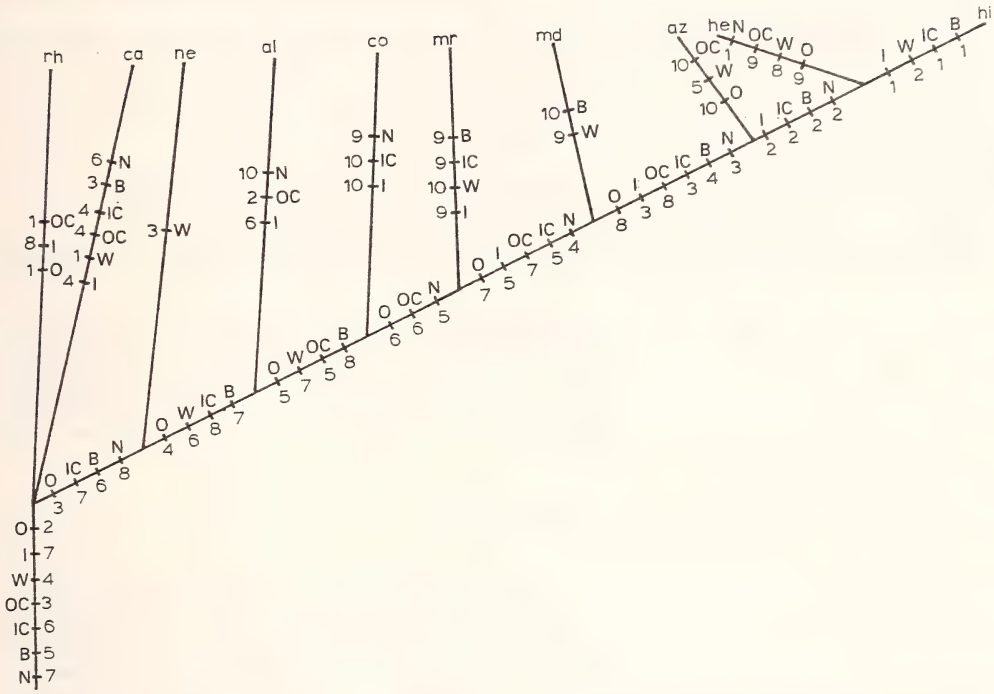

FIGURE 5. Cladistic analysis of trichome characters of taxa of *Hedera*. Characters are designated O, I, W, OC, IC, B (see Fig. 2) and N = number of arms. Character states represent ranked variables and are numbered. Taxa are abbreviated as follows: ne, *H. nepalensis*; rh, *H. rhombea*; co, *H. colchica*; md, *H. maderensis*; az, *H. azorica*; ca, *H. canariensis*; al, *H. algeriensis*; mr, *H.* "Morocco"; he, *H. helix*; hi, *H. hibernica*.

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The flower of *Koenigia islandica* L. (Polygonaceae): an interpretation

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ABSTRACT

It is suggested that the structure of the flower of *Koenigia islandica* L. can be linked with that of *Polygonum* sensu lato through a number of intermediate species that have been included under *Koenigia*. The flower is derived from a structure with five tepals, eight stamens and a trimerous gynoecium, by the fusion of two pairs of tepals and the consequent loss of two stamens. The two inner stamens are lost through lack of space in the small flowers during development; the remaining stamens belong to the outer whorl.

INTRODUCTION

Koenigia (Polygonaceae) was for a long time known only by a sole representative, *Koenigia islandica* L. The isolation of this species was reduced by Hedberg (1946), who removed a number of species from *Polygonum* to *Koenigia* on the basis of pollen similarity. Several authors before him had tried to link the anomalous flower of *K. islandica* with that of other Polygonaceae (e.g. Gross 1913; Jaretzky 1928; Edman 1929; Laubengayer 1937). The normal polygonaceous flower has a generalized pattern of five tepals, eight stamens in two whorls and a trimerous gynoecium (Ronse Decreane & Akeroyd 1988; Gross 1913; Galle 1977). The flower of *K. islandica*, however, consists of three tepals, alternating with three stamens and a trimerous or dimerous ovary (Fig. 1, 2D), and is generally thought to be strongly reduced. This reflects the habit of the plants, i.e. low-growing annuals with tiny flowers. The tepal vasculature is reduced to a minimum, consisting of one main vein flanked by two laterals (Vautier 1949), or a single small vein only (Laubengayer 1937; Ronse Decraene & Akeroyd 1988). The species is mostly described as having three outer tepals and three alternating stamens, which are regarded as belonging to an inner whorl (Laubengayer 1937). This interpretation is strengthened by the occasional occurrence of tetramerous flowers (Gross 1913; Bauer 1922; Laubengayer 1937). Juel (1886; see Edman 1929) compared the three tepals of *K. islandica* with the outer perianth whorl of *Rumex*. Bauer (1922) compared the trimerous perianth of *Koenigia* with strongly reduced flowers of *Polygonum* sensu lato. Occasionally a trimerous flower is produced in nutrient-low culture. Gross (1913) linked the species with *Persicaria* (*Polygonum* sect. *Persicaria*) because of the loss of two outer tepals and associated stamens. Vautier (1949) described the unequal splitting of vascular bundles in two of the three tepals and considered that they were bivalent through the fusion of four tepals, the third inner remaining unaltered. She concluded from the stamen insertion that they belong to an outer whorl: "Leur filet est court et soudé assez haut dans le receptacle, elles sont le plus souvent exsertes et ne s'appuient jamais contre les parois de l'ovaire comme le font les internes." Vautier (1949) linked *K. islandica* with the hexamerous Eriogoneae. In her view, the three alternating stamens have not undergone doubling up ("dédoublement") as in other Polygonaceae, for example *Rumex*, *Rheum*, *Polygonum* sensu lato, *Fagopyrum*, *Fallopia* (Jaretzky 1928; Galle 1977; Ronse Decraene & Akeroyd 1988).

I have had the opportunity to study the six species included in *Koenigia* on the basis of pollen similarity by Hedberg (1946). Other characters have been found and described that stress the distinctness of the enlarged genus (Ronse Decraene & Akeroyd 1988). In the present paper I have

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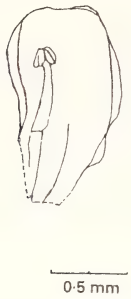

FIGURE 1. *Koenigia islandica* L., stamen with tepal. Note filament adnate to tepal and short vein.

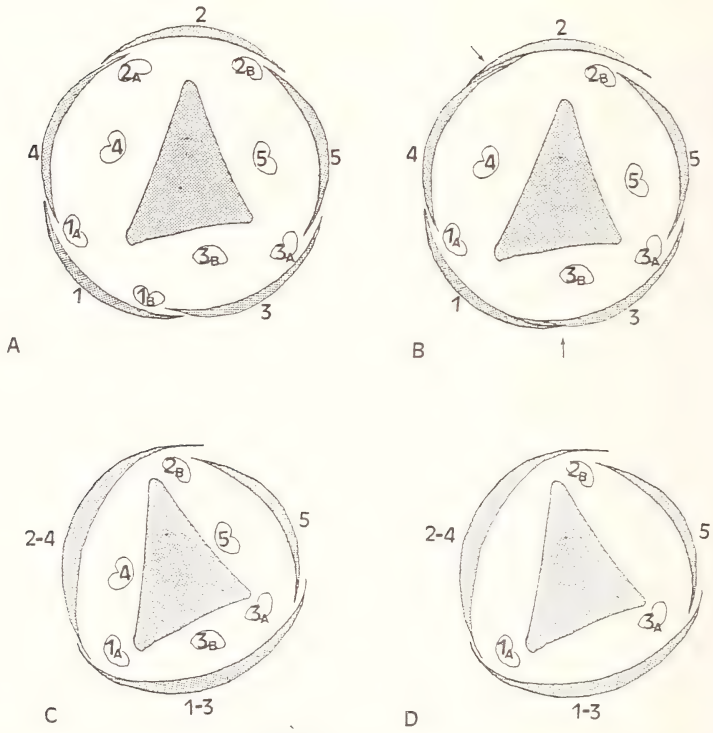

FIGURE 2. Diagrammatic representation of a putative reductive trend in the genus *Koenigia*. Numbers are according to position and appearance in ontogeny (Galle 1977).
A, Regular polygonaceous flower, such as *Koenigia forrestii* (Diels) Hedb., with floral formula P5A8G3.
B, Fusion of tepals 2–4 and 1–3 (arrows) and consecutive loss of stamens opposite to point of fusion, e.g. *Koenigia pilosa* Maxim.
C, Complete fusion of Tepals 1–3 and 2–4 but inner stamens still present.
D, The situation in *Koenigia islandica* L. The inner stamens are lost due to lack of space or nutrients for their development.

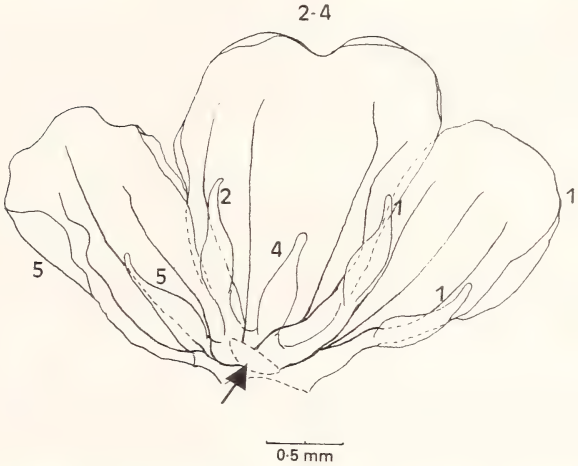

FIGURE 3. *Koenigia pilosa* Maxim., view of opened flower. Numbers according to position and appearance of tepals in ontogeny (Galle 1977). Note fusion of tepals 2 and 4 and their irregular venation. Arrow pointing to position of gynoecium. The third tepal and stamens are lost.

tried to link the unusual, strongly reduced, trimerous flower of *K. islandica* with these other species and with *Polygonum* in general.

METHODS

The floral morphology of the following species was studied (see Ronse Decraene & Akeroyd 1988 for provenance): *Koenigia islandica* L., *K. delicatula* (Meissn.) Hara f. *brevistyla* (Meissn.) Hedb., *K. pilosa* Maxim., *K. nummularifolia* (Meissn.) Mesicek & Soják, *K. forrestii* (Diels) Hedb. and *K. filicaulis* (Wall. ex Meissn.) Hedb. Flowers were soaked in boiling water, cleared in a diluted solution of sodium hydroxide and stained in saffranin before observation under a dissecting or light microscope.

RESULTS AND DISCUSSION

All species of *Koenigia* share the same habit, being low growing alpines or annual weeds of arctic or montane regions. *K. forrestii* always shows a constant number of floral parts, arranged as in the generalized polygonaceous flower (floral formula, P5A8G3). Other species have a more variable floral diagram, as reductions affect the tepals and stamens in relation to dimery in the gynoecium (*K. pilosa*, *K. nummularifolia*, *K. filicaulis*; Fig. 3). In *K. nummularifolia* no inner stamens are present except for one occasional transitional. In the case of *K. pilosa* and *K. delicatula*, the tepal number is often four, and two outer stamens are always present. I have been able to confirm Vautier's interpretation that the stamens of *K. islandica* belong to an outer whorl, as reductions seem to affect especially the inner stamens of related members of the genus. In *K. pilosa* one flower was found with a trimerous perianth, one tepal being much larger with two apices and an irregular venation, which is clearly the result of fusion. The position in the flower reveals that these tepals are '2' and '4'. One of the outer stamens is lost in the process (Fig. 3). Similar fusions occur in other families, e.g. Cruciferae and Capparidaceae (Merxmüller & Leins 1967; Leins & Metzenauer 1979), and are probably the basis of many tetramerous flowers.

Further evidence is provided by the zones of trichomes occurring in relation to the nectaries. Tutin (1964) described them as three gland-like staminodes, Vautier (1949) as nectaries ("écailles nectarifères"). The other genera show a continuous central disc around the inner stamens with

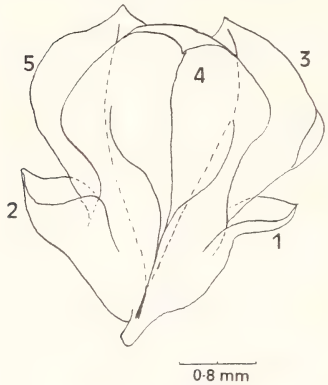

FIGURE 4. *Koenigia delicatula* (Meissn.) Hara, lateral view of flower. Tepals numbered according to their position and appearance in ontogeny (Galle 1977). Note smaller outer tepals without veins.

trichomes spreading on the receptacle behind (Ronse Decraene & Akeroyd 1988). The outer stamens are inserted clearly higher, alternating with these zones. The nectaries, which occur as receptacular protuberances or 'mamillae', are not fused with the filament bases. This would be the case in *K. islandica* if the existing stamen whorl were the inner one. The fact that the anthers are introrse is further evidence for their origin as outer stamens, as the inner stamens are mostly extrorse (Fig. 2).

However, it is difficult to accept the assumption of Vautier (1949) that the three stamens of *K. islandica* are primitively single structures and are not part of a stamen pair, one of which has been lost. Their position would be opposite to the tepals and not lateral, as is the case (Fig. 1). Interpretation by Gross (1913) of a loss of outer tepals seems valid (compared with its occurrence in some related species), but he is incorrect in stating that the associated stamens are also lost. The remaining stamens would be in the centre of a tepal if that were the case.

I was also able to confirm Vautier's interpretation of the fusion of four outer tepals in pairs by examples which have an outer tepal fused with an inner (*K. nummularifolia*, *K. pilosa*: Fig. 3). However, other cases point to a reduction of the outer tepals (Fig. 4). *K. delicatula* and *K. pilosa* sometimes have much smaller outer tepals without venation. In one flower an outer tepal was missing, together with the associated stamens.

A model can be conceived for *K. islandica* based on a comparison with the other species with a pentamerous perianth, and the acceptance of fusion of tepals and consequent loss of stamens. The fusion of two tepal pairs (1–3 and 2–4) is linked with the loss of a stamen on each side of the point of fusion between two tepals (Figs. 2B, 3). The innermost stamens (3b, 4 and 5) have been lost in the reductive process by lack of space for their development (Fig. 2D; similar cases occur in *K. pilosa* and *K. nummularifolia*). The remaining stamens are 1a, 2b and 3a. In the case of *K. pilosa* and *K. delicatula* the tepal number is often four, and two outer stamens are always present.

Another reason for reduction in stamen number is found in the transgression of the gynoecium from trimery (trigonous nut) to dimery (lenticular nut). In the process the transitional stamens and tepal are often lost. Other evidence might suggest the progressive loss of two outer tepals, which are reduced and may be lost altogether. Crowding may be the cause of the loss of more parts, the inner stamens by the pressure of the gynoecium against the tepal surface, the outer by a lack of space for their inception. This last interpretation is less plausible as it is difficult to explain which stamen of the pair is to disappear, unless one postulates an absence of dédoublement. This is inconsistent in comparison with the generalized occurrence of stamen pairs in the Polygonaceae and would contradict other evidence of a close relationship between *K. islandica* and species of *Polygonum* sensu lato.

It is therefore postulated that *K. islandica* has been derived from an ancestor like *K. nummularifolia* or *K. pilosa* by the fusion of two outer tepal pairs and the consequent loss of five stamens.

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'Lost and Found' – *Alopecurus bulbosus* Gouan in S. E. England

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ABSTRACT

Alopecurus bulbosus Gouan (Gramineae) is a local species of damp maritime grasslands in southern England and Wales. Comparison of historic and recent records for the species in the south-east of England suggested that it might be under-recorded. Searches made in 1987 confirmed this and suggested that the plant is very inconspicuous and easily overlooked. Field characters, habitat and associated species are discussed.

INTRODUCTION

Alopecurus bulbosus Gouan, the Bulbous Foxtail, is a halophilic grass of southern Britain, found in most coastal vice-counties from S. Wales to E. Norfolk. Historical sources in the south-east of England record this grass as widespread and locally abundant in saltings along river estuaries and at the rear of saltmarshes (Arnold 1887; Hanbury & Marshall 1899), but since about 1930 there have been very few records (Hall 1980; Philp 1982). Destruction of its habitat by sea-defence works, improvement of grassland, draining of land for cereal growing and construction of leisure facilities have been blamed, but during 1987 searches were made in Kent (v.cc. 15 and 16) and Sussex (v.cc. 13 and 14) to see if the apparent decline of this species might have a more straightforward basis, merely that it has been overlooked.

Grasses have not always been outstandingly popular amongst British botanists, and *A. bulbosus* is not a generally well-known species. The estuarine grazing marshes which are its most characteristic habitat are often bleak and featureless, with large expanses of rather uniform vegetation. Botanical interest is often confined to the ditches, and except for individuals irresistably drawn to batrachian buttercups, there is little reason to visit these places until well into the summer season, by which time the flower-spikes of *A. bulbosus* will have long since broken up, and the plant become extremely inconspicuous in well-grown vegetation. A survey in 1987, which was by no means an early season, indicated that the grass was in prime flowering condition in the south-eastern counties during the last two weeks in May and the first week in June. At this time the flowers are clearly visible among the later-flowering grasses. This paper summarizes the results of the 1987 survey, which was organized by the author with field assistance from local B.S.B.I. members.

1987 SURVEY

THE HABITAT OF *A. BULBOSUS*

The typical habitat for *A. bulbosus* is the damper areas of unimproved grazing marshes, and along the spaces between ditch and wall base, sometimes used as droves, known as the berms of sea and river walls. Some sites are brackish, but the plant is not found in actual saltmarsh. A common situation is at the interface of *Juncus gerardi* swards and slightly more open *Festuca rubra – Carex divisa* turf. Only one rather unusual site on the river side of the wall of the tidal Cuckmere at Litlington, E. Sussex (v.c. 14) had *A. bulbosus* with halophytic species like *Althaea officinalis* and *Aster tripolium*. Association with winter-standing water is strong, and suitable territory can often be picked out by looking for the white flowers of *Ranunculus baudotii* marking shallow channels and wet hollows. *A. bulbosus* does not grow in the very wettest spots (the muddy centre of a hollow is

usually filled with *A. geniculatus*) but fringes damp areas, and typically the grass is perched on tussock 'islands' in wet places where cattle have trampled.

A. geniculatus grows in close proximity to *A. bulbosus* in the majority of sites examined, and although they keep quite a strict zonation, the closeness can give rise to the hybrid *A.* × *plettkei* Mattfield. This is a vigorous plant, which is sometimes said to be out-competing *A. bulbosus* at certain sites, though P. J. O. Trist notes that *A.* × *plettkei* "will not be in an area of soil where the saline content is at the peak of tolerance for *A. bulbosus*" (pers. comm. 1987). Confirmed specimens of the hybrid collected in 1987 were both from sites of probably low salinity. Associated species are all characteristic of good quality estuarine grassland in the south-east of England. *Carex divisa* is really the most typical plant, accompanied at more than half the sites by *Poa pratensis*, *Festuca rubra*, *Juncus gerardi* and *Trifolium fragiferum* and sometimes by *Poa subcaerulea*, or by *Puccinellia distans* in the most brackish areas. *Ranunculus sardous* is often present in drier areas. Interesting associates on the Thames estuary are the annual clovers *T. micranthum* and *T. ornithopodioides*, and in the Isle of Harty, Sheppey, where *A. bulbosus* is very local, these clovers are indicator plants for areas of turf which may contain the foxtail. Other closely associated species in at least three of the eleven sites examined were *Agrostis stolonifera*, *Bellis perennis*, *Plantago major* and *Trifolium repens*. Uncommon species are sometimes locally abundant on dry banks bordering *A. bulbosus* sites, including *Ononis spinosa*, *Petroselinum segetum* and *Trifolium squamosum*, while *Eleocharis uniglumis* occurs on ditch banks by the Cuckmere, E. Sussex (v.c. 14).

DISTRIBUTION AND CONSERVATION

Study of literature and herbarium records suggested localities where *A. bulbosus* had been recorded and these were searched accordingly. Limited time only allowed a 'present or absent' verification without establishing the full extent of the populations. It is hoped that more extended searches by local botanists may identify many more individual populations, as much suitable territory exists, for instance near Chichester, W. Sussex (v.c. 13), and on Cooling and Higham Marshes, W. Kent (v.c. 16). *A.* × *plettkei*, the hybrid between *A. bulbosus* and *A. geniculatus*, was not looked for especially, except on one part of the Cuckmere, but may be found to be widespread, as both parents were usually present. Results from individual sites are listed in Table 1.

In some localities the similarity of the present distribution to historic records was striking. For instance at Lavant Sluice, Appledram, near Chichester, where Druce was shown *A. bulbosus* by Prebend Burdon in 1916 "in great quantity" it still forms an almost continuous sward, visible for some distance when in flower in May. Other records are less precise; only one specimen has been seen from Sheppey (herb. Sir Joseph Banks in **BM**) which must have been collected before 1840, and no more detailed records followed it. In a few cases *A. bulbosus* could not be refound; fields bordering the channel at Dell Quay, Chichester, are all arable now, and sadly Francis Rose's fairly recent site at Upnor, W. Kent (v.c. 16), cannot be precisely relocated after industrial development in this area. But at a time when so many British plants are under threat, it was extremely encouraging to find how closely the historical records could be matched.

The attention of conservation bodies has recently been focussed on the grazing marsh habitat with the 'biggest ever' management payment agreed between the Nature Conservancy Council and Philip Merricks, tenant of the extensive Elmley Marshes S.S.S.I. on Sheppey. Mr Merricks, with great enlightenment, is maintaining the marshes as a nature reserve, and here and on other estuarine S.S.S.I.s there is a rare opportunity for positive conservation. Some unusual species of grazing marsh habitats, such as *A. bulbosus*, *Chenopodium botryodes*, *Polypogon monspeliensis* and *Puccinellia rupestris* are still locally abundant (though *C. botryodes* is almost limited to the Thames estuary). Sympathetic management of areas like Elmley could give them protection *before* they become too rare.

FIELD RECOGNITION OF *A. BULBOSUS*

Diagnostic details of *A. bulbosus* are of course available from the usual sources (e.g. Hubbard 1968; Clark 1980; Tutin 1987) and are usefully illustrated in Holland *et al.* (1986). In the field, apart from the pointed glumes and the bulbs themselves (it is advisable to carry a small tool like a screwdriver for cautious examination of these), *A. bulbosus* has a very distinctive appearance. The flowers show up well in the short May swards, and the upright habit, small narrow, dark heads, and generally neat, delicate look separate it adequately from *A. geniculatus*, which as well as its 'kneeling' habit

TABLE 1. SITES SEARCHED FOR THE OCCURRENCE OF *ALOPECURUS BULBOSUS* IN 1987, IN GRID REFERENCE ORDER FROM WEST

Earlier records exist for many sites; localities with continuous records up to 1986 are not included

Year of last record	Location	Source of record	Results 1987
1916	Nr Lavant Sluice, Appledram, W. Sussex, v.c. 13	R. J. Burden (**BM**), Arnold (1887)	GR 41/84.03. Very abundant in damp meadow by Lavant Sluice.
1877	Dell Quay, Chichester, W. Sussex, v.c. 13	Rev. Arnold (**BM**)	Not found. Saltings converted to arable.
1933	Clymping Golf Course, Littlehampton, W. Sussex, v.c. 13	J. E. Lousley (**RNG**)	GR 52/02.01. In small quantity in damp hollow off fairway. Formerly abundant in 'saltmarsh'.
1905	Lancing, R. Adur, W. Sussex, v.c. 13	T. Hilton (**BM**)	GR 51/20.06. 'Several good patches', 1986, B. & G. Bishop. Found when field was not heavily grazed.
1807	Newhaven, E. Sussex, v.c. 14	W. Borrer (**CGE**), Wolley-Dod (1937)	GR 51/44.02. A few plants on muddy track by boating lake, Piddinghoe, N. of Newhaven.
1907	R. Cuckmere, E. Sussex, v.c. 14	T. Hilton (**SLBI**)	GR 50/51.99–51/51.01. Very abundant along berm of river wall and in damp grazing between Exceat Bridge and Alfriston, E. of R. Cuckmere.
1952	Litlington, E. Sussex, v.c. 14	P. E. Wrighton (**BM**)	51/52.01. Small population at edge of *Juncus gerardi* sward. River side of wall on E. bank.
1890	Below Gravesend, W. Kent, v.c. 16	C. P. Hurt (**MNE**)	Possibly Higham Marshes? Small populations found at GR 51/71.74 and GR 51/70.75 (Three sites).
1938	Oakleigh, Higham, W. Kent, v.c. 16	J. Braybrooke Marshall (**BM**)	GR 51/72.74. Heavily grazed but present in same paddock, inland.
1960	Upnor, Frindsbury, W. Kent, v.c. 16	F. Rose (**MNE**)	Not found. Saltings altered by industrial development but could still be found?
1892	Cooling Marshes, W. Kent, v.c. 16	E. S. Marshall (**BM**)	GR 51/75.77. Abundant in *Cynosurus cristatus* swards on grazing marshes. Site drier than usual for *A. bulbosus*. Probably widespread.
pre-1840	Sheppey, E. Kent, v.c. 15	Herb. Banks (**BM**)	GR 61/03.67. Approx. 100 plants in restricted area of turf (with annual *Trifolium* spp.). Isle of Harty, Swale N.N.R.
1978	Seasalter, near Whitstable, E. Kent, v.c. 15	J. Badmin (**MNE**)	GR 61/07.64, 61/08.64, 61/05.64, 61/06.64. Widespread but heavily grazed in field recorded by J. Badmin. Also found in three other grazing marsh fields.
Sites not previously identified in records:			
	Fishbourne, W. Sussex, v.c. 13		GR 41/83.04 etc. Very abundant in brackish grassland near channel.
	Sidlesham, W. Sussex, v.c. 13		GR 41/85.96. Abundant with *Juncus gerardi* in brackish field bordering lagoon.

has a much coarser and more floppy appearance. The south-eastern populations examined seemed also to have distinct pollen colours; *A. geniculatus* often produced purple anthers maturing to a brick colour while *A. bulbosus* had cream anthers darkening to buff, but before study of many more

populations this can only be recorded as a provisional observation rather than as a diagnostic character. Confusion with *A. pratensis* is not a problem. This is a grass of dry sites, and although sometimes present in adjoining grassland, it was never recorded in the immediate zone of *A. bulbosus*, and even stunted plants of *A. pratensis* have a thick 'tubby' head quite unlike the slender spikes of *A. bulbosus*.

CONCLUSION

It is hoped that these notes will stimulate further search for this attractive and uncommon grass. Too many of our species, once locally abundant, have become very rare, perhaps in part because they are taken for granted until too late. *Oenanthe silaifolia* is an example of such losses, being formerly a notable plant of the Medway hay meadows in W. Kent (v.c. 16), now probably restricted to one locality. The Bulbous Foxtail could still escape this fate if accurate recording now could identify its most important locations, as could another interesting species of brackish grazing marshes, the Saltmarsh Goosefoot, *Chenopodium botryodes*, which has its core populations in the Thames estuary. Entries in several Floras for vice-counties where *A. bulbosus* has been recorded have a doubtful tone: "Possibly elsewhere in the extensive saltmarshes" (Jermyn 1974), "Apparently very rare" (Petch & Swann 1968), while Simpson (1982) mentions several recent rediscoveries of old sites. I would like to suggest that the successful matching of historic records with extant populations found in the south-east of England in 1987 could be achieved in other areas of Britain by searching for *A. bulbosus* at the end of May.

A further encouragement to look for *A. bulbosus* in areas where it seems to have been lost, is the point that it seems to be a successful re-colonizer of disturbed areas where high salinity restricts competition. This characteristic revival of populations from dormant 'bulbs' was first identified by Trist (1981) after examining some E. Suffolk (v.c. 25) sites after severe sea-flooding. Similar results can be observed on the Avon near Bristol, N. Somerset (v.c. 6), where abundant *A. bulbosus* can be found on large areas of barely-vegetated saline earth, spread when a new deep-water dock was excavated from former grazing saltings.

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Three subspecies of Bracken, *Pteridium aquilinum* (L.) Kuhn, in Britain

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ABSTRACT

Two additional native subspecies of *Pteridium aquilinum* (Bracken) are added to the single hitherto known taxon of this genus in the British flora. These are *Pteridium aquilinum* (L.) Kuhn subsp. **latiusculum** (Desv.) C. N. Page, **comb. et stat. nov.**, known previously to have its nearest location in Scandinavia, now found to occur in the Scottish native pinewoods, and *Pteridium aquilinum* (L.) Kuhn subsp. **atlanticum** C. N. Page, **subsp. nov.**, recently discovered on the Atlantic fringes of western Scotland and described here for the first time. Both these brackens are distinct from the widespread and common British bracken, to which the subspecific epithet *Pteridium aquilinum* (L.) Kuhn subsp. *aquilinum* is here restricted, and from which they are distinguished.

The theory is proposed that subsp. *aquilinum* may be the hybrid between subsp. *atlanticum* and subsp. *latiusculum*.

INTRODUCTION

This paper reports the addition of two taxa of bracken new to the British flora. These are *Pteridium aquilinum* (L.) Kuhn subsp. *latiusculum* (Desv.) C. N. Page, comb. et stat. nov., known previously to have its nearest stations in Scandinavia, but which has been found to be present in the Scottish native pinewoods, and *Pteridium aquilinum* subsp. *atlanticum* C. N. Page, subsp nov., recently discovered in limited areas of the Atlantic fringe of western Scotland.

Both have been found by the author in the last few years, and their morphology, ecology and seasonal behaviour have now been followed in the field over a number of seasons. These observations show that each of these brackens differs strongly from the other, as well as from the widespread *P. aquilinum* subsp. *aquilinum*, not only in morphology but also in ecology and seasonal behaviour, with the most diagnostic structural differences apparent during the period of frond emergence in spring and during frond senescence in autumn and winter. Hence the new taxa may be most easy to locate initially at these times of the year.

The morphology of each of these new taxa suggests that subsp. *aquilinum* is strikingly intermediate between them, and the theory is proposed here that subsp. *aquilinum* may be of hybrid origin between subsp. *latiusculum* and subsp. *atlanticum*. The continuing occurrence of some hybridization and very possibly introgression of subsp. *aquilinum* back to both the other taxa is suggested by the field evidence, indicating one possible source of the variability of the widespread and vigorous subsp. *aquilinum*. The native British material of the latter is known to be genotypically as well as phenotypically variable (Page 1982 a & b, 1986; Hadfield & Dyer 1986; Wolf *et al.* 1988), and introgression is a phenomenon which itself is extremely rare in ferns (Walker 1958, 1979; Lovis 1977).

DESCRIPTIONS

Pteridium aquilinum (L.) Kuhn subsp. **latiusculum** (Desv.) C. N. Page, **comb. et stat. nov.**
Pteris latiuscula Desv., *Mem. Soc. Linn. Paris* **6** (2): 303 (1827)
Pteridium aquilinum (L.) Kuhn var. *latiusculum* (Desv.) Underw. ex Heller, *Cat. N. Am. Pl.*, 3rd ed., 17 (1909)

A

B

FIGURE 1. *Pteridium aquilinum*. A, subsp. *latiusculum*; B, subsp. *atlanticum*.

VOUCHER: Scotland: East-Inverness-shire, Rothiemurchus Forest near Loch an Eilean, in native pinewood, 4 June 1983, *C. N. Page 17,049* (**E**, **PTH**, **GL**, **ABD**).

Fronds to 80 cm or somewhat more; stipe usually short, erect, slender (seldom exceeding 4 mm diam.), initially wiry, tough, rigid and remaining so throughout the season, broken stipes only weakly mucilaginous; rachis usually strongly deflexed at the junction of stipe and first pinna-pair into a shallowly ascending to nearly horizontal angle, thereafter remaining inclined and approximately straight for the full length of the blade; pinnae expanding very rapidly and almost simultaneously throughout the frond in spring, their expanding croziers regularly and tightly coiled, with a tomentum of sparse, short-lived white hairs and very numerous and distinctive long, cinnamon-coloured hairs which are long-persistent throughout the rachis, pinna midribs and pinnule midribs during the expansion phases of the frond; newly expanding pinnae and pinnules at once obliquely ascending, stiff and rigid; expanded blades broadly triangular, ternate to subternate, tripinnate to tripinnate-pinnatifid, bright grass green on all surfaces and scarcely glossy above, their pinnae not rotated from the plane of the rachis but pinna midribs and pinnules all constantly somewhat distally angled, each straight (never drooping at the tips even when freshly flushed) and obliquely assurgent; fronds turning bright red-brown in autumn, and usually mostly remaining standing, with rather little decay, until the end of winter or the following spring.

The especially distinctive features of this bracken are its extremely early-season and rapid frond expansion rate (Fig. 1A), harsh and wiry texture of stipe and frond from the outset, nearly simultaneous pinna-pair expansion throughout each blade, steeply inclined blade orientation from the first pinna pair, obliquely ascending rigid pinnae to the expanding fronds, and the very abundant presence of numerous, long, cinnamon-coloured hairs over the frond and pinna croziers, giving them a conspicuously red-brown coloration during their brief expansion phase. Indeed, the simultaneous flushing of the pinnae, the bright green colour of the blade, the angled blade and pinna orientation and the cinnamon-coloured croziers combine to make this plant distinctive and easily recognizable even from a distance.

Pteridium aquilinum (L.) Kuhn subsp. **atlanticum** C. N. Page, **subsp. nov.** TYPE: Scotland: North-east Arran, Clyde Isles (v.c. 100), c. 15 m. alt., on Carboniferous limestone, 4 June 1987, *C. N. Page 29,020* (holotype **E**, isotypes **PTH**, **GL**, **ABD**).

Pinnae frondarum accurate in ordine ad apices versus extendentes; crociae (apices circinnati) tomento denso e squamis longis albo-argenteis indutae, pilis rufis carentibus; laminae extensae ovato-triangulares, numquam ternatae.

Pinnae of fronds expanding in a strongly sequenced acropetal succession, the croziers with a dense tomentum of long, silver-white hairs, without red hairs; the expanded blades ovate-triangular, never ternate.

Fronds to 120 cm or more; stipe usually tall, erect, thick (c. 6–9 mm diam.), initially soft, turgidly succulent with broken surfaces abundantly mucilaginous, eventually becoming toughly succulent; rachis deflexed only slightly and equally at each successive pinna-pair junction, the several lowermost increments of the rachis thus nearly erect; pinnae of the whole blade expanding very slowly and in a strongly sequenced acropetal progression of successive pinna pairs (never simultaneously throughout the frond); frond and pinna croziers large, only loosely and irregularly coiled during expansion phases, and conspicuously covered on the expanding rachis and pinna and pinnule midribs with a very dense and abundant tomentum of long, bright silver-white hairs of silky texture, without any intermixed red hairs, the white tomentum persisting in sparser form through the expansion phases of the frond to become progressively lost by maturity; fully expanded blades ovate-triangular, never ternate, usually bipinnate-pinnatifid, dull green and usually glossy above, paler beneath, the pinnae horizontally inserted on near-vertical rachis (especially those in the lowermost half of the frond); pinnae and pinnules mostly perpendicularly inserted (neither oblique nor assurgent), spreading horizontally from their bases and laxly drooping towards their tips (especially during expansion but remaining arching downward throughout the life of the frond);

fronds turning pale tan-brown in autumn and senescing and decaying rapidly following the first severe frosts.

The especially distinctive features of this bracken are its late-season and sometimes particularly slow frond expansion rate (Fig. 1B), strongly sequenced unrolling of successive pinna pairs, initially vertical orientation of the blade with horizontally inclined pinnae, nearly perpendicular pinna and pinnule insertion angles, very succulent early-season stipe and rachis, soft frond texture and lax pinnae-tips to the expanding fronds, and the very abundant capping to the expanding croziers by silver-white hairs, lacking totally in red hairs, giving the croziers of this subspecies a conspicuously white-capped appearance during their long expansion phase. Indeed, the white croziers coupled with the late-season flushing of vertical fronds make this plant especially conspicuous during its early-season growth.

NOMENCLATURE

The type of the species belongs to the common, vigorous morph which is widespread in Europe (Sheffield *et al.*, 1989). The epithet subsp. *aquilinum* is thus restricted to this morph.

The two taxa added here to the British flora are treated as additional subspecies of *P. aquilinum* because of their strong and largely discontinuous morphological (and corresponding ecological) distinctions from the widespread variant, indicating a more distant relationship to it (see below). Indeed, it might be justifiable to treat each of the three native British brackens as separate species, but I have not done so for lack, as yet, of evidence of sufficient distinction at genetic or cytological level, and because of the occurrence of widespread intergradient variants which I suspect may prove to be fully fertile (although neither the subspecies nor apparent hybrids have been found to be spore-productive through the succession of several climatically dull, wet summers in Scotland, through which they have been studied).

ECOLOGY

Although their distribution is as yet imperfectly known, both these new taxa of bracken appear to be native and are probably ancient members of the British flora. Both also appear to be significantly less vigorous than is subsp. *aquilinum*, and the colonies of both are relatively local and limited in extent. Beyond these basic similarities, however, available information suggests that the ecology of the two new brackens, like their morphology, contrasts in several significant aspects.

Subsp. *latiusculum* is as yet known in Britain only from limited areas of relict Scottish native pinewood vegetation (*Pinus sylvestris* L.) with an understorey of native juniper (*Juniperus communis* L.), in the vicinity of Rothiemurchus, Speyside (Page 1988). Here it forms open, low-canopied stands over small areas, the edges of which abut on to, and partly intermingle with, much more extensive and taller-growing stands of subsp. *aquilinum*, which is present throughout much of the pinewoods around it. Compared with adjacent subsp. *aquilinum*, the stands of subsp. *latiusculum* are lower-growing and notably more open and, despite their more horizontally-inclined blades, more light penetrates to the ground beneath. Here a continuous ground-flora of grasses, mosses and associated pinewood species persists. The soil is deep and acidic, with a peaty surface layer developed over very much deeper fluvio-glacial outwash sands and gravels of largely granitic origin. The persistence of the fronds (and especially their stipes) in a more or less standing position through the winter months probably helps to ensure that ground vegetation beneath is not heavily swamped by a decaying frond-blanket, in contrast to that beneath stands of nearby subsp. *aquilinum*, whose stipes normally readily collapse.

Subsp. *atlanticum*, as here described, is as yet known only from very limited areas of Scottish limestone grassland at very low altitude near western coasts (Arran and Kintyre). In each site it forms fairly open, low to moderately high-canopied stands over little more than a few hundred square metres, abutting on to much denser and generally taller-growing stands of subsp. *aquilinum*, which are locally extensive. Its particularly slow rate of expansion results, in dull summers, in fronds which are still unfurling at their tips (and thus can seem almost indefinitely growing) while the several lower pinnae of the same fronds are senescing at the end of the season. In such summers, fronds may thus fail to expand completely, and this may be a normal condition at its Scottish latitudes. The stands of subsp. *atlanticum* are also rather more open than are those of subsp.

aquilinum nearby, with a more continuous ground flora of basic grassland species. The soil is very shallow in places, with significant areas of outcropping rock. That the whole of the range of this plant appears to correspond exclusively to areas of outcropping Carboniferous limestone rock overlain by a thin limestone soil, appears to be one of the most notable aspects of the ecology of this taxon, and is unusual for bracken anywhere. Indeed, off the limestone, subsp. *atlanticum* is replaced immediately by subsp. *aquilinum* or by hybrids and introgressants with it, all of which appear not to succeed on the limestone. Indeed, it seems likely that it is just this ecological distinction which has been responsible for the survival of subsp. *atlanticum* in these sites, even when closely surrounded by extensive more vigorous subsp. *aquilinum*.

DISCUSSION

The addition of these two new taxa to the British flora, and the presence also of suspected hybrids between each and subsp. *aquilinum*, further supplements the view previously expressed (Page 1982a, 1986) that, in Britain at least, bracken is anything but a totally uniform plant.

The occurrence of subsp. *latiusculum* in Scottish pinewoods suggests that this subspecies is also native and relictual. Indeed, outside the British Isles, the known range of this taxon stretches in a broad band across far northern Europe and Asia to the Orient, and across northern North America (Tryon 1941; Page 1976). It is thus essentially the bracken of the northern boreal conifer forests of the world, and its discovery within the range of an ancient native pinewood in Scotland, and its rapid spring frond extension and apparent substantial frost-hardiness, all seem aspects of its ecology entirely in accord with this general range.

The occurrence of subsp. *atlanticum* in remote sites of relatively undisturbed vegetation on the Atlantic fringes of western Scotland similarly suggests that this taxon is also native. Its apparent total restriction to outcrops of limestone is unusual in the range of the genus, while its late and extremely slow rates of frond expansion and apparent high frost sensitivity seem to indicate also a likely requirement for a long growing season. Further, its known sites, only at low altitude in mild western climates, occur close to sites for other ferns of highly Atlantic range (including on nearby, more acidic rock areas, *Dryopteris aemula* and the three native filmy ferns), and suggest that this bracken too may well be a plant of essentially southerly and Atlantic affinity. In this connection, it is interesting to note that Jermy (pers. comm. 1989) reports similar open bracken stands at 1000 m alt. in the Picos d'Europa, northern Spain, where fronds with characteristically silvery tips were still unfurling in early August. He notes further that these plants too occur in an area where other Atlantic pteridophytes are prevalent, notably the rare *Stenogramma pozoi*, *Trichomanes speciosum* and *Dryopteris guanchica*. The possibility of subsp. *atlanticum* occurring in other southerly localities both within and beyond the British Isles thus now seems an important area to which further field study might be usefully directed.

The report by Löve & Kjellqvist (1972) of an allegedly limestone-dwelling bracken occurring in the western Mediterranean basin (named *Pteridium herediae* (Clemente ex Colmeiro) Löve & Kjellqvist) needs to be mentioned here, although it is, regrettably, impossible from the brief and incomplete published descriptions of this plant and from the lack of any known type material (see Sheffield *et al.* 1989) to compare this plant with subsp. *atlanticum*.

POSSIBLE INTERRELATIONSHIPS

The respective morphologies and ecologies of the two subspecies of bracken reported here are highly distinctive. Between these morphological and ecological extremes, subsp. *aquilinum* appears to be intermediate. Indeed, much of the variability of subsp. *aquilinum*, where other than environmentally induced, reflects different combinations of characters and ecologies which are represented in 'pure' form only by the two taxa discussed here.

For these reasons, the theory is proposed here that the widespread and common *Pteridium aquilinum* subsp. *aquilinum* may be the genetically stabilized hybrid between subsp. *latiusculum* and subsp. *atlanticum*, its vigour and variability resulting from heterosis, presumed polytopic origins and possible widespread superimposed introgression.

Further study of the taxa in question is now proceeding at Edinburgh to investigate their suspected interrelationships experimentally.

ACKNOWLEDGMENTS

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Short Notes

A CHERBOURG BRAMBLE IN HAMPSHIRE

On the Tertiary gravels around Southampton occur several widely-distributed brambles which have not as yet received a name. The New Forest, lying close by to the west, long tended to monopolize the attention of successive *Rubus* specialists and caused them to bypass this hardly less rich part of S. Hants., v.c. 11. As a result its more obtrusive local forms escaped being described in the years when so many regional endemics elsewhere were being given taxonomic recognition.

One of the most distinctive of these forms is locally plentiful even within Southampton itself and predictably featured in the random collection made by J. Groves in 1876 around his home in what is now the inner district of Shirley. Babington, to whom this was submitted, referred it to the then misunderstood *R. fuscoater* Weihe, under which name Rogers left it when the specimen (now in **BM**) subsequently passed into his possession. Inexplicably, the bramble does not seem to have been collected again until 1964, when B. A. Miles encountered it on Southampton Common (**CGE**, no. *64/384*). Watson is known to have visited that locality twice, in 1936 and 1951, and must surely have noticed it there in abundance, as also must J. F. Rayner, who sampled the Common's brambles in the early years of the century; however, the records from there of neither of them (Rayner 1929; J. E. Woodhead unpubl.) include any species for which it could credibly have been mistaken.

Intensive study of *Rubus* in the county as a whole revived in 1968, when E. S. Edees made an extensive collecting tour in connection with the new *Flora of Hampshire* in course of preparation. This produced the bramble for his herbarium (**NMW**, no. *20143*) from West Walk, the main surviving fragment of the one-time Forest of Bere Portchester. It has since proved to be common in that large wood and to occur in many of its satellites in the district centred on Wickham. Its headquarters, however, are in the area just to the north-west of Southampton, where in Nightingale Wood it even becomes the dominant bramble. Further large populations occur between there and the start of the chalk belt north of Romsey and south of Winchester. Altogether I have noted it in seven 10-km squares (41/3.1, 3.2, 4.1, 5.0–5.2, 6.1), a range more than sufficient to qualify it for description as a new species.

Recently, however, while going through the Continental *Rubus* collection in **BM**, I came across two numbers in Sudre's *Batotheca Europaea* (495 and 496 in Fascicule 10) of a bramble collected round Cherbourg by Corbière in 1894 which I immediately recognized as identical. Sudre (1911) cited further Corbière specimens distributed earlier by Boulay through the Association Rubologique (nos. 1085 and 1086 of 1892) and by Magnier in his *Flora Selecta Exsiccata* (no. 3761). The latter I have not seen, but the former I have been able to examine in **P** and I am satisfied that they belong to the same entity. Corbière (1894) described it as "assez commun" in Cherbourg and environs and, although at that time he included at least one quite different bramble under the same name, I found this to be borne out on a visit I made to the area in 1987 to the extent that I met with it almost at once, in some quantity. Like Association Rubologique no. 1085, the specimens I encountered in the field were mainly of a starved form of open ground which apparently has no counterpart in Hampshire, where the plant is confined to shade almost exclusively. This wider tolerance of the French populations is one reason for believing that they represent the parent ones from which the opposite side of the Channel was at some period colonized – probably within the last few centuries, for in many of its Hampshire stations the plant has a recent look and is seemingly still in the course of primary spread.

Boulay sent out the 1892 specimens under the name *R. radula* subsp. *uncinatus* forma, but they bear in fact little resemblance to Letendre's material from Seine-Inférieure, which Boulay had distributed as *R. uncinatus* Mueller in 1885–6 (**P**). Sudre (1912) thought the plant approached, rather, *R. apiculatus* Weihe and *R. menkei* Weihe, remarking that it was a "forme embarrassante". He referred it instead to *R. insericatus* subsp. *truncifolius* (Mueller & Lef.) Sudre, describing it as a new variety for which he coined the epithet *thyrsigeriformis* out of a fancied resemblance to *R. thyrsiger* Banning & Focke. The Cherbourg bramble, however, is clearly a species in its own right and it is accordingly here raised to that rank.

Rubus thyrsigeriformis (Sudre) D. E. Allen, **comb. et stat. nov.**

R. radula subsp. *uncinatus* sensu Corbière, *Nouv. Fl. Normandie* 206 (1894), pro parte, non *R. uncinatus* Mueller in *Flora* **41**: 154 (1858); *R. insericatus* subsp. *truncifolius* var. *thyrsigeriformis* Sudre, *Rubi Europae* 149 (1911).

As Sudre characterized his variety only very briefly, a fuller description now needs to be provided: Stem low-arching, bluntly angled, dark purple, with sparse short to medium simple and tufted hairs and numerous short to medium stalked glands, acicles (some gland-tipped) and pricklets (some also gland-tipped); prickles c.20–25 per 5 cm, chiefly on the angles, unequal, 3–7 mm, declining or curved or a few patent from a long compressed base, slender, red with yellow point. Leaves pedate; leaflets usually 3 (1–5), scarcely contiguous, light green, glabrous above or with sparse adpressed short simple hairs, soft beneath with numerous short simple and tufted hairs; terminal leaflet c. 7–10 × 4–6 cm, ovate or obovate or nearly round, with an often abrupt, acuminate, often curved apex c.1·5–2 cm and entire or emarginate base, more or less evenly serrate with the principal teeth prominent and often patent or retrorse, the petiolule c.$\frac{1}{4}$ to $\frac{1}{3}$ as long as the lamina; petiolules of basal leaflets 1–4 mm; petiole longer than the basal leaflets, coloured and clothed like the stem, with 15–20 slender curved prickles 2–5 mm. Flowering branch with 3-foliolate leaves below and 1–5 simple leaves above, not leafy to the apex; inflorescence long, pyramidal, with ascending or divaricate peduncles decreasing in length upwards, divided at or above the middle and bearing 1–3 flowers, shorter than their leaves, the pedicels up to 3 cm, often subdivided; rachis slightly flexuose, dark purple, not angled, clothed and armed like the stem; pedicels with numerous tufted hairs, numerous stalked glands and gland-tipped acicles of varying lengths, from very short to 1 mm, and several slender prickles 2–4 mm. Flowers c.1–1·5 cm in diameter; sepals greenish-grey, white-margined, with numerous stellate hairs and a few spreading long simple hairs, numerous short to medium stalked glands and few or many short to medium acicles, long- and leafy-pointed, patent at first, then reflexed; petals c. 8–9 × 4–5 mm, pale or deep pink, broad ovate or oblong, with sparse simple hairs on the margin, not contiguous, often sharply erect; stamens level with or slightly longer than styles, filaments white, anthers glabrous; styles yellowish-green, red-based; young carpels glabrous; receptacle glabrous; fruit obovoid, ripening in Hampshire as early as the beginning of July. Flowering from the middle of June into August. Series *Hystrices* Focke.

The diagnostic characters are the dark purple stem and rachis with many unequal stalked glands, acicles (some gland-tipped), pricklets and mixed declining and curved prickles; the usually 3-nate leaves with ovate to roundish terminal leaflet typically terminating abruptly in a long acuminate and often curved apex; the long pyramidal inflorescence with one or more trilobed leaves above; the long- and leafy-pointed reflexed sepals; the small pink flowers with the petals often erect, the short stamens and red-based styles.

Representative specimens have been deposited in **BM** and **RHMC**.

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A NEGLECTED BRAMBLE OF GUERNSEY

On his once-only inspection of the *Rubi* of the Channel Isles in 1897 W. Moyle Rogers came across a bramble new to him which he referred to a variant of *R. dumnoniensis* Bab. (Rogers & Rogers 1898). He recorded seeing it in Guernsey at Petit Bot Bay and in Sark in plenty near Dixcart Hotel.

His specimens from both localities are now in **BM**. Those from Sark are scrappy and do not look convincingly identical with the ones from Guernsey, but the latter are excellent examples of a bramble that I encountered in turn at Petit Bot Bay in 1978. I subsequently saw it elsewhere in Guernsey on that visit, mostly in company with D. McClintock – on the cliff-tops at Icart (in some quantity), in two places, among scrub and in a hedge, east of Hougue des Quartiers, and in Silbe Nature Reserve (a single clump) – but, perhaps significantly, the equivalent of two fieldwork days I spent in Sark failed to disclose it (Allen 1981).

In a note dated March 1917, affixed to the second of the two sheets bearing his Petit Bot Bay material, Rogers proposed the epithet *cordatifolius* for this "conspicuous variety, which I have not seen in England or Ireland", adding by way of description: "terminal leaflet broadly ovate-acuminate, with compound finely pointed teeth and deeply cordate broad base. Panicle when well developed broadly cylindrical with one (or both?) of its two simple leaflets like those of the terminal leaflet on the barren stem." The name was published after his death by Riddelsdell, initially (Riddelsdell 1920) with the barest of descriptions, later (Rogers & Riddelsdell 1925) more fully and with a Latin diagnosis. This expanded on Rogers' note to the extent of describing the leaflets as having lobate-serrate teeth and greenish-ashy felt beneath. To which I can add from my own field notes: stem shining as if varnished, shallowly furrowed; petals pinkish; filaments white, exceeding greenish styles; anthers glabrous; sepals reflexed.

R. dumnoniensis was a much-misunderstood taxon until very recently and its interpretation over-broad. Had W. C. Barton known the true plant, he would surely not have queried the variety, in a 1951 note affixed to one of the **BM** Petit Bot Bay sheets, as merely a luxuriant state of that species. Watson (1958) did not recognize even the species as distinct, aggregating it with two others, and consequently saw no cause to give the variety so much as a mention. Edees & Newton (1988), having had no opportunity of studying the Guernsey bramble in the field, do no more than refer to the taxon's existence.

In my view this bramble is amply distinct from *R. dumnoniensis* sensu stricto – so much so that it never even occurred to me that it could be the variant referred to by Rogers until I saw his specimens – and deserves to stand as a species in its own right. The necessary new combination is accordingly now made:

Rubus cordatifolius (Rogers ex Riddelsd.) D. E. Allen, **comb. et stat. nov.**
R. dumnoniensis var. *cordatifolius* Rogers ex Riddelsd., *J. Bot.* (*Lond.*) **58**: 102 (1920); Rogers & Riddelsd., *J. Bot.* (*Lond.*) **63**: 14 (1925). LECTOTYPE: Petit Bot Bay, Guernsey, v.c. S, 7 July 1897, *W. M. Rogers*, herb. Barton & Riddelsdell no. *9823* (**BM**), des. B. A. Miles 1964. Series *Rhamnifolii* (Bab.) Focke.

Representative specimens of my own collecting have been deposited in **STP**.

I have not seen any material identical with this bramble either from Great Britain or from the adjacent Cotentin Peninsula of France. However, it may well yet prove to occur in the coastal parts of the latter, the *Rubus* flora of which has close affinities to that of these offshore islands.

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CAREX ORNITHOPODA WILLD. IN CUMBERLAND

There has always been some doubt as to the occurrence of *Carex ornithopoda* Willd. in Cumberland, v.c. 70, so it was with considerable satisfaction that R.W.M.C. discovered a single tuft

with 30 inflorescences on a sandstone rock on the banks of the River Eden in the gorge between Lazonby and Armathwaite on 8 May 1986. When the site was revisited on 15 May 1987, the original tuft was yellowed and in poor condition with only a single inflorescence. However any disappointment was dispelled when further searching revealed 40 healthy plants in a 40 m strip parallel to the river. In May 1988 the status of the *Carex* was unchanged.

The Eden gorge is composed of acid red Permian sandstone which supports a calcifuge flora. However the river banks within reach of flooding have a calcicole flora from flushing with lime-laden water and silt deposition. The *Carex* site faces south to south-west at an altitude of 53 m above sea level. *C. ornithopoda* is present between 1·3 m and 2·6 m above the normal river level, well within the flood zone. The habitat is kept relatively open due to the scouring effect of the river, which also uproots trees from the rocks at sapling age. Silt and sand (pH 7·3 with no free carbonate) has been deposited in cracks and ledges of the steep sandstone outcrop and, although partially shaded by *Alnus*, *Betula*, *Corylus* and *Quercus*, the habitat is open to the sun for much of the day and readily dries out. Many of the *Carex* plants are intermixed with and overshadowed by the taller-growing associates, and are well camouflaged but are nonetheless vigorous, robust and mostly fertile.

A total of 45 species was recorded from the *C. ornithopoda* habitat. The following were close associates at the original rock site: *Anthoxanthum odoratum, Brachypodium sylvaticum, Carex caryophyllea*, *Dactylis glomerata*, *Deschampsia cespitosa*, *Festuca rubra*, *Luzula sylvatica*, *Origanum vulgare*, *Poa pratensis*, *Primula vulgaris*, *Senecio jacobaea*, *Trifolium medium* and *Viola riviniana*. Although not an associate, *Galium boreale* was present on rock ledges at the rivers edge.

This colony of *C. ornithopoda* has obviously been established for some time and is being maintained by young plants arising from seed. It is intriguing to speculate on its origins. It must have been derived from seed or rhizomes washed down from colonies upstream. The nearest colonies are at Shap and Orton (David 1980), with a recent discovery from the Pennine limestone above Hilton (G. Halliday pers. comm.). These sites are all some 35 km from the Eden-side locality. It may be derived from a much nearer Pennine limestone source as yet undiscovered or from which it is now extinct. Searching of the Eden above and below the *Carex* site for further colonies has been unsuccessful.

Carex ornithopoda is now confirmed for Cumberland where it is at its most northern site in the British Isles. The habitat is of particular interest as it is the only one known at present off the Carboniferous limestone formation.

ACKNOWLEDGMENT

We wish to thank Dr G. Halliday for the pH determination.

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ON THE LECTOTYPIFICATION OF *PARNASSIA PALUSTRIS* L.

The purpose of this note is to justify the recent lectotypification of *Parnassia palustris* L. published by Hultgård (1987). In his description of *P. palustris*, Linnaeus (1753) cited the binomial without an associated phrase-name (because the distinctions of this species were at generic rank), and referred to six earlier publications: Linnaeus (1737, 1738, 1745), Royen (1740), Haller (1742) and Dalibard (1749). The last three authors referred back to one or other of Linnaeus's publications. Linnaeus also listed three synonyms in the protologue, published by Bauhin (1623), Cordus (1561) and Morison (1699).

There are five relevant specimens in existence which Linnaeus saw prior to 1753 and which must

be considered. The specimen supporting the citation of the species in *Flora lapponica* is housed at the Institut de France in Paris. Although we have seen only its photograph (**BM**), we do not regard it as a suitable choice because it is a small, slender specimen, and its cauline leaf, if present at all, is completely immersed among the basal leaves; these are often regarded as features characteristic of var. *tenuis* Wahlenberg, a taxon from northern latitudes which someone (although not us) may feel inclined to recognize. In order to preserve current usage of var. *palustris*, therefore, we must look elsewhere for a lectotype.

The specimen in **LINN**, labelled "palustris 1" (Sheet 392.1 in Savage 1945), consists of four flowering stems and belongs to what we regard as var. *palustris*, but cannot be chosen because it bears the symbol (ϵ) which indicates that it was collected in western Asia, probably by Gerber, in the district of the River Don or Astrachan (Stearn 1957). This is contrary to the protologue which specifies "in Europae".

There are two specimens in the Hortus Cliffortianus herbarium at **BM**. One of them, labelled "Parnassia palustris et vulga – vid. T. 246", has a clumped habit, rather like that of var. *condensata*, and as we cannot be certain that it does not represent this variety we prefer not to consider it further. The second specimen, labelled "Parnassia sive Cistus palustris humilis Hevera folio, quibusdam Gramen Parnassi vel Hepaticus flos dicitur", consists of four flowering stems inserted in a vase; although it otherwise resembles var. *palustris*, there are no basal leaves, and for this reason we have not chosen it as lectotype.

The fifth specimen is sheet XVII.91 in the Burser herbarium (**UPS**); it is labelled "Gramen Parnassi albo simplici flore Bauh. Weiss leberblumlein. In Lusatia, Misnia, Helvetia, Dania" (see also Juel 1936), and agrees well with the protologue and our concept of var. *palustris*. The phrase-name is the synonym published by Bauhin (1623) and from which Linnaeus presumably derived the name of the genus. This specimen is therefore the one which has been designated as lectotype (Hultgård 1987).

There are no Linnaean specimens of *Parnassia* in **H** (Kukkonen & Viljamaa 1973), **SBT** (Fries 1935) or **S**.

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EXPERIMENTAL EVIDENCE AGAINST THE OCCURRENCE OF AGAMOSPERMY IN THE BRITISH *CRATAEGI*

Where their ranges overlap in Britain *Crataegus laevigata* (Poiret) DC. and *C. monogyna* Jacq. readily form hybrids (Bradshaw 1953, 1971; Byatt 1975; Gosler 1981). Bradshaw (1971) has demonstrated that the two species are obligate outbreeders, are totally interfertile, and that hybrid pollen showed no reduction in fertility. However, Muniyamma & Phipps (1979) have shown that in *C. pruinosa* apomixis in the form of somatic apospory is common, and have suggested that this may be a widespread means of seed formation in North American *Crataegi*. This paper gives the results of an experiment to determine whether apospory was present in *Crataegus laevigata* or *C. monogyna*. The work was carried out as part of a larger survey of introgressive hybridization between the two species in the Thames Valley (Gosler 1981).

Flowering twigs were cut from each of four trees (two of each species) in Open Magdalen Wood, Oxford on 2 May 1981 and were supported in water in the laboratory. At least 100 unopened flowers were obtained of each species. The flowers of *Crataegus* are protogynous so that the anthers may be removed prior to anthesis. The following operations were carried out on flowers of each species:
(a) 50 flowers were emasculated prior to anthesis and bagged. Fruit production in this sample would suggest the presence of apospory.
(b) 25 flowers were emasculated prior to anthesis and then artificially cross-pollinated and bagged. Fruiting in this sample was used as a control for the effect of cutting and bagging.

All specimens were allowed to set fruit, and the percentage of flowers of each group (species and operation) that produced fruit was recorded. The fruiting success of the experimental and control groups was compared using χ^2.

Table 1 shows the results of the experiment. The difference in the number of fruits set between

TABLE 1. FRUIT-SET IN *CRATAEGUS LAEVIGATA* AND *C. MONOGYNA* FOLLOWING EMASCULATION ONLY, AND EMASCULATION THEN CROSS-POLLINATION

	Emasculation only		Cross-pollination	
Species	n[a]	no. fruit set	n[a]	no. fruit set
C. laevigata	50	0 (0%)	25	9 (36%)
C. monogyna	50	0 (0%)	25	11 (44%)

[a]n = no. flowers used.

emasculated and cross-pollinated treatments was highly significant: for *C. laevigata* $\chi^2_{(1)} = 20{\cdot}45$, $p \leq 0{\cdot}001$; for *C. monogyna* $\chi^2_{(1)} = 25{\cdot}78$, $p \leq 0{\cdot}001$. This indicates that the failure of flowers to form fruit in the experimental group was not due to their emasculation.

Assuming that there are no significant differences between trees, and that pseudogamy does not operate (although Muniyamma & Phipps (1979) inferred its occurrence in the triploid *C. pruinosa*), the results suggest that apospory is absent or occurs at a very low frequency (at most less than 1%).

Somatic apospory is likely to be more important in North American than in European *Crataegus* species. Longley (1924) found that of 100 North American species examined, some 75% were triploid, and Camp (1942) suggested that many of the 1100 New World species were dubious, having resulted from complex genetic interactions involving alloploidy and apomixis. This presents a rather different biosystematic situation from that observed in Europe where most species are sexually reproducing diploids, many of which form fertile hybrids, such as *C. laevigata* and *C. monogyna* (Franco 1968).

Although the present results suggest that aposory is probably absent from these species, it is impossible to say that it never occurs and further work is needed to determine whether pseudogamy is necessary for apomictic fruit formation.

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EPIPACTIS PURPURATA SM. REAPPEARS IN DORSET

The Violet Helleborine (*Epipactis purpurata* Sm.) had been thought to be extinct in Dorset, v.c. 9, for many years. It was last recorded in the county in 1926 from a wood in the north, which was largely felled during the Second World War. Although the site has since been replanted with broad-leaved trees, they are still young, and the understorey is dense and overgrown. It will be many years before there is suitable habitat for *E. purpurata* to reappear in its old site, although there is an as yet unconfirmed report that it has been seen recently in another part of the wood. The species' other two former sites have both been clear-felled, one put to the plough, and the other replanted with alien conifers. All three sites were formerly mature beechwoods on clay-with-flints over chalk or other calcareous deposit, and thus broadly accorded with the majority of sites for the species in Hampshire and the Chilterns.

It came as something of a surprise, therefore, when the species was discovered in an ancient hazel coppice with oak standards and a rich ground flora on the Kimmeridge Clay near Sturminster Newton, some 13 km away from any of its former haunts, and in a quite different type of habitat. The site is comparable, in fact, to many of the species' stations in Hertfordshire, where it is characteristic of neglected hazel and hornbeam coppice on clay soils (Bateman 1981). The new site is situated on a north-facing slope ranging from 72 m above sea-level at the boundary to 40 m at the River Stour, and is an S.S.S.I. and reserve managed by the Dorset Trust for Nature Conservation. Rotational coppicing of the hazels is practised in the traditional manner.

One of the authors (A.G.H.) found one plant of an unidentified helleborine in 1986, when a section of the hazels was cut: that plant was incorrectly identified by other local botanists as the Broad-Leaved Helleborine (*E. helleborine* (L.) Crantz). The finder remained convinced, however, that it was *E. purpurata*, and the co-author (M.N.J.) was consulted, and the plants confirmed in 1988 as *E. purpurata*, a species with which he was familiar from sites in Hampshire and the Chilterns. This was, therefore, the first confirmed record of the species in Dorset for 62 years.

There were two main areas of distribution of plants in the coppice. A careful search revealed a total of 37 rootstocks within a broad belt some 45 × 25 m to the north of, and below the central ride through the coppice, stretching across the area of newly-cut hazels, and extending some 5 m into an

area of uncut hazels, where five of the plants were found. A cursory search to the south of, and above the central ride revealed a further five rootstocks in a roughly circular area about 25 m in diameter, and some 25 m away from the main colony. It seems likely that a more detailed search of this second area will reveal more plants. One of these latter plants was growing under bracken, and there is also much Heath Bedstraw (*Galium saxatile*) present: this acid indication was later confirmed by soil tests, which gave pH readings of between 4 and 6.

Of the total of 42 rootstocks found, no fewer than 15 had multiple flowering stems, a feature of this species (Summerhayes 1951), the largest clump having ten inflorescences. A single-stemmed plant can be 30 years old, and it has been said that large many-stemmed plants are probably "hundreds of years of age" (Bateman 1979). It is apparent, therefore, that the species has remained undiscovered beneath the dark hazels for many years, and searches of similar sites elsewhere in the county may well prove rewarding.

An interesting feature of the present colony is that the majority of plants growing in the open flowered in the fourth week of July and the first week of August in 1988 (a generally late season), and had set seed by the third week of August. The five plants growing in the dense shade of the uncut hazels, however, and one or two in shadier locations elsewhere, were in full flower during the second and third weeks of August, a more typical flowering time for the species. Two plants had variegated leaves (i.e. longitudinally striped green and white), and the purplish-grey colouration characteristic of the leaves and stem of this species was very much less marked at this site than at other sites in Hampshire and the Chilterns.

A study of seed capsules was carried out on 22 August 1988 on ten randomly selected inflorescences, with the following results: mean number of flowers = 31·3 (range 24–44); mean percentage of swollen capsules = 88·29% (range 81·8–96%). At this level of pollination efficiency, assuming viable seed, the future of the species at this site seems assured.

Accompanying orchid species found with the helleborines were Common Spotted-orchid (*Dactylorhiza fuchsii*) and Bird's Nest Orchid (*Neottia nidus-avis*), both rather sparse and gone to seed.

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NEW COMBINATIONS IN THE BRITISH AND IRISH FLORA

The following 15 new combinations are needed in order to validate names to be used in forthcoming floristic publications.

1. **Ulmus minor** Miller subsp. **angustifolia** (Weston) Stace, **comb. et stat. nov.**
Basionym: *U. campestris* var. *angustifolia* Weston, *Bot. univ.* **1**: 352 (1770).
2. **Ulmus minor** subsp. **sarniensis** (Loudon) Stace, **comb. et stat. nov.**
Basionym: *U. campestris* var. *sarniensis* Loudon, *Arbor. frutic. brit.* **3**: 1376 (1838).

The view is taken here that *U. glabra* Hudson, *U. procera* Salisb., *U. plotii* Druce and *U. minor*

are four taxa worthy of specific rank. Within this concept of *U. minor* two taxa are distinct entities with well defined, largely allopatric distributions, and seem best recognized as subspecies as above. Other entities within *U. minor*, notably *U. diversifolia* Melville, *U. coritana* Melville and *U. carpinifolia* G. Suckow as well as many unnamed variants, are sympatric and hybridize so frequently that recognition as subspecies is impractical. Whether or not Melville's (1960) idea that *U. minor* subsp. *sarniensis* arose as a quadruple hybrid is correct is immaterial to the above classification.

3. **Euphorbia amygdaloides** L. subsp. **robbiae** (Turrill) Stace, **comb. et stat. nov.**
Basionym: *E. robbiae* Turrill in *Bot. Mag.* **169** (n. s.): t. 208 (1953).

The well-known *E. robbiae* of gardens has recently (Radcliffe-Smith 1976) been reduced to a variety of *E. amygdaloides*. However, it is always distinct, has a different chromosome number, and has a restricted distribution in north-western Turkey; it is an almost ideal subspecies.

4. **Lamiastrum galeobdolon** (L.) Ehrend. & Polatschek subsp. **argentatum** (Smejkal) Stace, **comb. et stat. nov.**
Basionym: *Galeobdolon argentatum* Smejkal in *Preslia (Praha)* **47**: 243 (1975).

The views are taken here that *Lamiastrum* Heister ex Fabr. (1759) is a distinct genus that was validly published and hence predates *Galeobdolon* Adans. (1763) or Hudson (1778), and that the segregates of *L. galeobdolon* are worthy only of subspecific rank.

5. **Coincya wrightii** (O. Schulz) Stace, **comb. nov.**
Basionym: *Brassicella wrightii* O. Schulz in *J. Bot. (Lond.)* **74** (Suppl. 1): 1 (1936). Synonym: *Hutera wrightii* (O. Schulz) Gómez-Campo in *Anal. Inst. Bot. Cavanilles* **34**: 149 (1977).

The current trend (Greuter, Burdet & Long 1986) is to amalgamate the genera *Coincya*, *Hutera* and *Rhynchosinapis* under the first (earliest) name. Combinations already exist for two of the three British species, but not for the Lundy Island endemic above.

6. **Clinopodium menthifolium** (Host) Stace, **comb. nov.**
Basionym: *Calamintha menthifolia* Host, *Fl. Austriaca* **2**: 129 (1831). Synonym: *Calamintha sylvatica* Bromf. (1845).
7. **Clinopodium calamintha** (L.) Stace, **comb. nov.**
Basionym: *Melissa calamintha* L., *Sp. Pl.* 593 (1753).
Synonyms: *Calamintha nepeta* (L.) Savi subsp. *glandulosa* (Req.) P. W. Ball; *C. nepeta* auct. angl., non (L.) Savi sensu stricto.
8. **Clinopodium grandiflorum** (L.) Stace, **comb. nov.**
Basionym: *Melissa grandiflora* L., *Sp. Pl.* 592 (1753).
Synonym: *Calamintha grandiflora* (L.) Moench.

The genera *Clinopodium*, *Acinos* and *Calamintha* differ only by trivial characters and are best united under the first (earliest) name. They are here kept separate from *Satureja*, which differs in its more or less equal-lobed calyx and more or less equal stigmas, despite which it was amalgamated with the other three genera by Greuter, Burdet & Long (1986). The combinations *Clinopodium ascendens* (Jordan) Samp. and *C. acinos* (L.) Kuntze already exist, but two British natives and one alien have not hitherto been covered.

9. **Fallopia japonica** (Houtt.) Ronse Decraene var. **compacta** (Hook. f.) J. Bailey, **comb. nov.**
Basionym: *Polygonum compactum* Hook. f. in *Bot. Mag.* t. 6476 (1880).
10. **Fallopia × bohemica** (Chrtek & Chrtková) J. Bailey, **comb. nov.**
Basionym: *Reynoutria × bohemica* Chrtek & Chrtková in *J. nat. Mus. Praha, Hist. nat.*, **152**: 120 (1983).

L.-P. Ronse Decraene (Ronse Decraene & Akeroyd 1988) at Reading and J. P. Bailey at Leicester have confirmed earlier suggestions that *Reynoutria* and *Fallopia* (*Bilderdykia*) should be amalgamated under *Fallopia*, the earliest name. The combinations *F. japonica* (Houtt.) Ronse Decraene and *F. sachalinensis* (Friedr. Schmidt ex Maxim.) Ronse Decraene already exist; the other two needed for British plants are provided above.

11. **Rumex acetosa** L. subsp. **hibernicus** (Rech. f.) Akeroyd, **comb. et stat. nov.**
Basionym: *Rumex hibernicus* Rech. f. in *Watsonia* **5**: 65 (1961).
Synonym: *Acetosa hibernica* (Rech. f.) Holub in *Folia Geobot. Phytotax.* (*Praha*) **12**: 425 (1977).

A distinctive variant of *Rumex acetosa* occurs in dune-grassland communities in western and parts of southern Ireland, and perhaps elsewhere in the British Isles. It has a dwarf habit, shorter basal leaves, narrower cauline leaves, and a dense, often subsimple inflorescence; the stems, petioles and often the leaves are papillose-puberulent. Intermediate populations occur, but the distinct ecological and geographical distribution of this variant suggests treatment at subspecific rank.

12. **Rumex crispus** L. subsp. **littoreus** (Hardy) Akeroyd, **comb. et stat. nov.**
Basionym: *Rumex crispus* var. *littoreus* Hardy in *Bot. Gaz. (Lond.)* **1**: 133 (1849). Synonym: *R. crispus* var. *trigranulatus* Syme in *Rep. botl Soc. Exch. Club Br. Isl.* **1872–4**: 37 (1875).
13. **Rumex crispus** L. subsp. **uliginosus** (Le Gall) Akeroyd, **comb. et stat. nov.**
Basionym: *Rumex crispus* var. *uliginosus* Le Gall, *Fl. du Morbihan* 500 (1852). Synonyms: *R. crispus* var. *planifolius* auct. brit., non Schur; *R. elongatus* auct. brit., non Guss.

Distinctive variants of the widespread weed *Rumex crispus* occur on seashores, notably shingle beaches, and on estuarine tidal mud (Akeroyd 1988). Both variants are widespread in Britain and Ireland, and are apparently present on Atlantic coasts of Europe. It is therefore appropriate that these 'native' populations of this synanthropic plant be treated as subspecies.

14. **Asperula cynanchica** L. subsp. **occidentalis** (Rouy) Stace, **comb. et stat. nov.**
Basionym: *Asperula occidentalis* Rouy, *Fl. France* **8**: 60 (1903).

The differences between *A. cynanchica* and *A. occidentalis* are slight and quantitative, their chromosome number is the same, and the latter taxon is confined to dunes on the western coasts of Spain, France, Ireland and Wales, where it is approached in several characters by extreme variants of *A. cynanchica*. Subspecific status is wholly appropriate.

15. **Orobanche minor** L. var. **maritima** (Pugsley) Rumsey & Jury, **comb. et stat. nov.**
Basionym: *Orobanche maritima* Pugsley in *J. Bot. (Lond.)* **78**: 110 (1940). Synonym: *O. amethystea* auct. brit., non Thuill.

Webb & Chater (1972) noted that *O. maritima* was probably best regarded as a variety of *O. minor*. Work at Reading by F. J. Rumsey and S. L. Jury supports this and indicates that it should be reduced to one of four varieties of *O. minor* occurring in Britain (Rumsey 1988).

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W. H. PEARSALL'S AQUATIC PLANT RECORDS FROM ESTHWAITE WATER

Recent investigations of the aquatic flora of Esthwaite Water in the Lake District (v.c. 69) have drawn attention to some confusion over the identity of certain taxa recorded by W. H. Pearsall who made extensive studies of the lake (Clapham 1971). Both Pearsall and his father, also W. H. Pearsall, studied the aquatic plants of other Lake District lakes (Pearsall & Pearsall 1921, 1923). Given the fundamental importance of these studies (e.g. Pearsall 1917, 1918, 1920 & 1921) to the understanding of the development of aquatic vegetation (Tansley 1949; Sculthorpe 1967; Macan 1970; Hutchinson 1975), the identity of these early records needs to be explored.

In addition to his scientific papers reference has been made to W. H. Pearsall's vegetation maps of Esthwaite Water housed at the Ferry House, Freshwater Biological Association, Ambleside, and of herbarium specimens which he collected or annotated (**BM**, **K**, **OXF**).

The three species *Ranunculus truncatus*, *Castalia minor* and *Hydrilla verticillata*, and the genus *Potamogeton* need to be considered.

RANUNCULUS TRUNCATUS

Records for *Ranunculus truncatus* Koch refer to *R. peltatus* Schrank. This is clear from Pearsall (1920) and Pearsall (1929) in which they listed the plant as *R. peltatus* var. *truncatus*. There are no known herbarium specimens from Esthwaite Water, though other material identified by Pearsall as *R. peltatus* var. *truncatus* (in **BM**) has been confirmed as *R. peltatus* (S. Webster pers. comm.).

CASTALIA MINOR

The water-lily species referred to by Pearsall (1917) as *Castalia minor* is almost certainly a variant of *Nymphaea alba* L. Tansley (1949) considered *C. minor* to be *Nymphaea occidentalis* though he also included *C. minor* in a plant list reproduced from Pearsall (1917). This "small white water-lily" (Tansley 1949) is distributed "in 'acid' upland tarns" (Pearsall 1917), and conforms to *Nymphaea alba* subsp. *occidentalis* Ostenf. Hutchinson (1975), however, calls the plant *Nymphaea alba* var. *minor* though he considers that most botanists would regard it as "somewhat starved *alba*".

HYDRILLA VERTICILLATA

Esthwaite Water is the only known locality for *Hydrilla verticillata* Casp. in England, a record (Bennett 1914; Pearsall 1914, 1915) which has been the subject of some conjecture. M. J. P. Scannell (pers. comm.), who has studied the plant in Eire, confirms the validity of the material, and numerous specimens at **BM** collected by Pearsall from Esthwaite Water between 1914 and 1920 and labelled by him as *Hydrilla verticillata* or *H. verticillata* var. *pomeranica* Reichb. were confirmed as *H. verticillata* by C. D. K. Cook in 1979. Unfortunately the plant became extinct about 1945 probably as a result of eutrophication (Lund 1979; Cook & Lüönd 1982). Oddly, Pearsall & Pennington (1973) conclude that "the very rare plant which was originally called *Hydrilla verticillata* var. *pomeranica*" is "now called *Elodea nuttallii*", a view originating from Tutin (1962) and Clapham (1971).

POTAMOGETON

Confusion arises over a number of *Potamogeton* species found in Esthwaite Water. The systematics of the genus *Potamogeton* were in a state of flux at the time of Pearsall's work and this has made the records of these species difficult to interpret. This is particularly so for *Potamogeton pusillus* L., *P. panormitanus* Biv. and *P. sturrockii* sensu Pearsall (e.g. Pearsall 1930). Pearsall & Pearsall (1921) believed that distinct variations were exhibited "in relation to the depth of water" and "that light intensity was the chief factor in causing them". Some of these variations were given subspecific and varietal status. Careful examination of herbarium material collected or named by Pearsall (**BM**, **K**, **OXF**), in conjunction with the observations of Dandy & Taylor (1938), lead to the conclusion that *P. pusillus* sensu Pearsall, *P. pusillus* var. *tenuissimus* Mert. & Koch, *P. pusillus* subsp. *lacustris* Pearsall & Pearsall fil., *P. panormitanus* and *P. sturrockii* should all be regarded as *P. berchtoldii* Fieb.; and *P. heterophyllus* Schreber and *P. longipedunculata* should be regarded as *P. gramineus* L. This is further reinforced by Pearsall & Pennington (1973) who described the 'linear-leaved associes' as including the "pondweeds . . . such as *P. pusillus* and what is now known as *P. berchtoldii* (formerly *P. pusillus* subsp. *lacustris*)". Dandy (1958) gave *P. sturrockii* (A. Benn.) A.

Benn. as a synonym for *P. obtusifolius* Mert. & Koch. However, Pearsall did not confuse this latter species with *P. berchtoldii* as is clear from the descriptions he gave of the two species (Pearsall & Pearsall 1921).

Although authors such as Tansley (1949), Sculthorpe (1967), Macan & Worthington (1951) and Macan (1970) have brought some of Pearsall's nomenclature up to date, they have been neither consistent nor thorough. Tansley (1949) uses *P. sturrockii* in his summary of Pearsall's work. Sculthorpe (1967) does not incorporate the *P. pusillus*/*P. berchtoldii* change into his adaptation of Pearsall's deep water succession (Pearsall 1920) and the *P. pusillus* in his schema should read *P. berchtoldii*. Macan & Worthington (1951) repeat this mistake, and Macan (1970) uses names such as *Castalia minor* and *Potamogeton pusillus* subsp. *lacustris* in his text. Hutchinson (1975) plays safe, using the nomenclature *P. berchtoldii* (sens lat.).

As the knowledge of the autecology of species of *Potamogeton* such as *P. berchtoldii* grows it is increasingly important that the correct interpretation should be made of such "classics of British ecology" (Clapham 1971).

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CHENOPODIUM HYBRIDUM L. VAR. *PAESKEI* ASCHERS. & GRAEB. IN BRITAIN

Chenopodium hybridum L. var. *paeskei* Aschers. & Graeb. is the name assigned to populations that can be differentiated from typical *C. hybridum* (var. *hybridum*) in having red or purple colouration and a more compact inflorescence. The red colour, caused by a betacyanin pigment, is primarily in the axils, veins and smaller stems. Var. *paeskei* often has an inflorescence that is leafy towards the apex (like *C. album*, for example). The inflorescence of var. *hybridum* is usually leafless.

The variety *paeskei* was first described by Ascherson & Graebner (1898, 1913) as having a "twisted-together panicle" and a "reddish stem". Rather curiously, they also stated that its overall appearance and smell are similar to *Datura stramonium* L.

In Britain, it was recorded from two sites in Cambridgeshire in the 1950s, at Cambridge and Waterbeach (Perring *et al.* 1964). Scanning electron microscope studies of seed from the latter population revealed differences from var. *hybridum* in testa morphology. *C. hybridum* has a characteristically large seed, 1·75–2 mm in diameter (Brenan 1964), with a coarsely pitted surface. The cells in the areas between the pits have sinuous raised anticlinal walls in var. *hybridum* (Fig. 1a), whereas in var. *paeskei* there are also cells with much straighter, more sharply defined anticlinal walls, which form a prominent reticulum (Fig. 1b). These cells are basically rectangular in shape, and about four times as long as they are broad. The reticulate pattern is especially common around the hilum, but it is found all over the seed surface in varying amounts. It can be seen with a high-powered stereo microscope (at ×60 magnification or greater) using strong unidirectional lighting. It has also been observed on seeds of var. *paeskei* from Oxford and from Kennet in Cambridgeshire in 1987.

Thus there is a case for wider recognition of this variety, on grounds of its distinct morphology and colouration. I am sure that it has often been overlooked in the past. As Snaydon (1984) stated, "variation which is not named tends not to be recognized".

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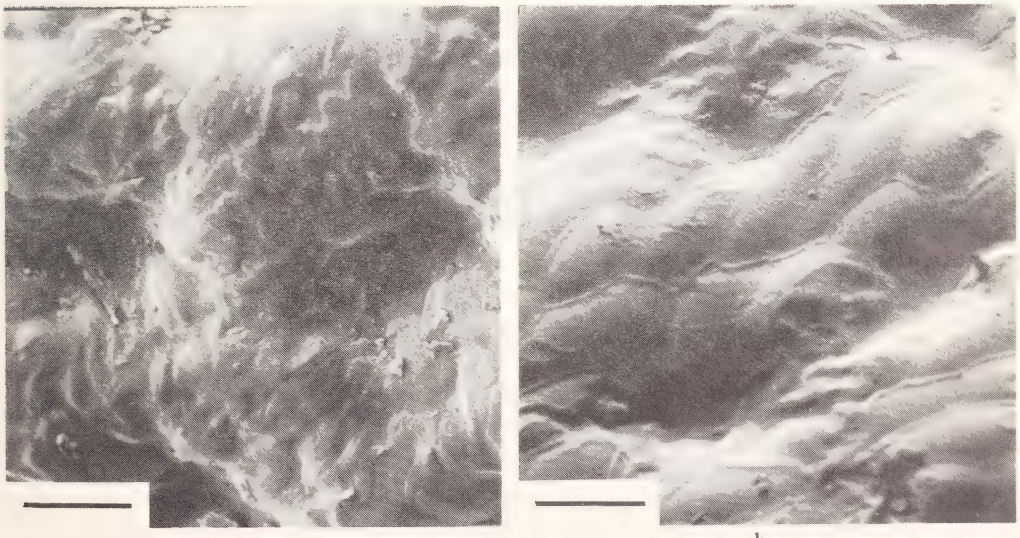

a b

FIGURE 1. Seed-surface of a) *Chenopodium hybridum* var. *hybridum*, and b) var. *paeskei*. Scale bar = 4 μm.

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On Measuring Marsh-orchids

MORPHOMETRIC PROCEDURE, TAXONOMIC OBJECTIVITY AND MARSH-ORCHID SYSTEMATICS

INTRODUCTION

The marsh-orchids *Dactylorhiza traunsteineri* (Sauter) Soó and *D. lapponica* (Laest. ex Hartman) Soó occur predominantly in montane and submontane habitats of northern Europe and the Alps. They are enigmatic taxa whose distinguishing characteristics (and therefore status and distributions) remain controversial. In an earlier paper, we provisionally omitted *D. traunsteineri* from the British and Irish flora pending further investigation (Bateman & Denholm 1983), and referred plants previously regarded as *D. traunsteineri* to a subspecies of *D. majalis* (Reichenbach) P. F. Hunt & Summerhayes.

A recent issue of *Watsonia* contained consecutive papers that re-instated *D. traunsteineri* (Roberts 1988) and added *D. lapponica* (Kenneth *et al.* 1988) to the list of British and Irish marsh-orchids. Roberts' (1988) arguments focused on a single highly heterogeneous dactylorchid colony at Rhos-y-Gad, Pentraeth, Anglesey, which was sampled independently by Roberts (1966, 1988), Bateman & Denholm (1983) and Jenkinson (1986). All these morphometric studies included an assessment of the range of variation and taxonomic status of Pugsley's Marsh-orchid, a taxon referred to *Dactylorhiza traunsteineri* by Roberts and *D. majalis* subsp. *traunsteinerioides* (Pugsley) Bateman & Denholm by Jenkinson and ourselves. Roberts (1988, Table 1) noted statistically significant differences in three characters between his data (together with those of Jenkinson (1986)) and our own and, though unable to explain the discrepancies, argued that they "raise doubts about the reliability of procedures used in Bateman & Denholm's study".

Roberts (1988, Table 2) then compared his mean values for eight characters of the Rhos-y-Gad population with pooled mean values for eight Alpine populations of *D. traunsteineri* extracted from Reinhard's (1985) Table 3. The "remarkable similarity" between Rhos-y-Gad and Alpine plants was regarded as sufficient evidence to indicate general similarity of British and Alpine populations, and allowed Roberts to re-affirm his previously stated opinions that 1) the correct epithet for the British and Irish plants is *traunsteineri* rather than Pugsley's (1936, 1940) *traunsteinerioides*, 2) "introgression" does not occur between this taxon and *D. majalis* subsp. *purpurella* (T. & T. A. Stephenson) D. M. Moore & Soó and 3) hence, by implication, *traunsteineri* should be regarded as a full species distinct from *D. majalis*.

Kenneth *et al.*'s (1988) arguments for the presence of *D. lapponica* in Britain were also based primarily on comparison of mean values for selected morphometric characters of British populations with means for Scandinavian and Alpine populations in Table 3 of Reinhard (1985).

We believe that the conclusions of Roberts and Kenneth *et al.* highlight several widely-held misconceptions concerning the validity of different morphometric procedures and comparability of the resulting data, which are discussed below.

ACQUISITION ON MORPHOMETRIC DATA

CONSTRAINTS ON THE DATABASE

The configuration of any morphometric database is determined by three criteria: number of populations sampled, number of individual plants measured and number of characters recorded. Given a set period of time for a study, they are mutually antagonistic. We believe that the optimal balance should be determined by the primary objective of the investigation. For example, tests for possible adaptive significance of particular structures require few characters but many populations and individuals per population to detect often subtle but biologically significant variation. However, the most rigorous taxonomic studies result from detailed overall description (i.e. many characters)

of plants from a wide geographical and ecological spread (i.e. many populations). Time constraints therefore dictate that the third criterion (i.e. number of plants measured per population) must be the minimum required for meaningful comparison.

Admittedly, smaller samples incur greater sampling error and provide less precise estimates of the distribution of values about the mean. However, since significance tests take account of the numbers of individuals sampled, there is little theoretical support for Roberts' (1988, p. 44) suggestion that the discrepancies in floral dimensions between his multiple samples and our single sample of the Rhos-y-Gad population could reflect the difference in sample size (30–40 and 10 plants respectively).

SELECTING TAXA, COLONIES, POPULATIONS AND INDIVIDUALS

Any morphometric study requires *a priori* selection of the range of variation to be described and, where appropriate, subsequently partitioned into taxa. Within *Dactylorhiza*, non-random selection of populations is necessary if rarer taxa such as *D. traunsteineri* and *D. lapponica* are to be included in the study. Unfortunately, the subjectivity of this procedure allows discrimination against 'awkward' (i.e. morphologically peripheral) populations; if practised, such prejudice often results in false morphological discontinuities and erroneous taxonomic conclusions.

Random sampling of individual plants is also precluded within dactylorchid colonies (sensu Bateman & Denholm 1983, p. 347) that contain more than one species. Unfortunately, in its characteristic habitat (species-rich, *Schoenus*-dominated fens) Pugsley's Marsh-orchid usually forms highly heterogeneous colonies with several other dactylorchid taxa and hybrids. The consequent need for selectivity can be reduced in some colonies by restricting sampling to areas where individuals of the target population predominate, though these must still be distinguished from individuals of co-existing populations of other taxa. In practice, this is achieved primarily by subjective *a priori* delimitation of the morphological range that is considered acceptable within the target taxon. Different operators undoubtedly prescribe different limits of tolerance.

For example, two of our study plants of Pugsley's Marsh-orchid from Rhos-y-Gad possessed unusually broad labella and could have been hybrids with co-existing *D. maculata* (L.) Soó. However, they lacked the most characteristic features contributed by spotted-orchids to hybrids with marsh-orchids: relatively narrow spurs, large numbers of non-sheathing leaves and, most reliable of all, the presence of leaf-markings. After some debate they were included in our sample, though they would probably have been excluded by many other workers. Interestingly, the difference between our mean labellum dimensions for Rhos-y-Gad and those of Roberts (1988) remains statistically significant when these two morphologically extreme plants are excluded. Additional explanations for the discrepancy must therefore be sought.

SELECTING THE TIMING OF MEASUREMENT

Dactylorchids undergo substantial morphological changes during annual growth. For example, inflorescence length can triple during anthesis, and flowers from the base of an inflorescence are appreciably larger than those at the apex. Such ontogenetic variations impair compatibility of samples taken on different dates during the same season. Other factors change the phenotypic composition of populations from year to year. We examined Rhos-y-Gad on four occasions during the last eight years (1980, 1981, 1982, 1987) and noted substantial variations in both the habitat and the population of Pugsley's Marsh-orchid. Some of the variations were non-directional (e.g. selective grazing of larger plants in some years), but others can be directional (e.g. progressive reduction of soil moisture content tends to eliminate less drought-tolerant individuals). Given these factors, the consistency of Roberts' (1988) repeated measurements (1963, 1984, 1986) is perhaps more surprising than their difference from ours.

SELECTING DEFINITIONS OF CHARACTERS

Despite Roberts' (1988) claim for "remarkable similarity" of his population means for *D. traunsteineri* from Rhos-y-Gad to Reinhard's (1985) data from the Alps (mean values for eight pooled populations), there are statistically significant differences ($p<0.05$) in means for two of the eight characters listed (Tables 1 and 2). The most notable, a substantial (by dactylorchid standards) 2 mm difference in mean spur lengths, was ignored by Roberts (1988). However, it highlights

TABLE 1. COMPARISON OF DATA FOR PUGSLEY'S MARSH-ORCHID AT RHOS-Y-GAD (THREE OPERATORS), AND EIGHT COMBINED ALPINE POPULATIONS OF *D. TRAUNSTEINERI*
Includes all eight characters listed by Roberts (1988, Table 2), with three additional vegetative characters susceptible to environmental modification.

Character number and name	Bateman & Denholm (1983) Mean	S.D.	Jenkinson (1986) Mean	S.D.	Roberts (1988) Mean	S.D.	Reinhard (1985) Mean	S.D.
1. Total number of leaves[a]	3·60	0·52	3·20	0·42	3·82	0·53	3·99	0·63
2. Leaf width (cm)[a]	1·36	0·49	1·05	0·17	1·00	0·21	1·03	0·23
3. Inflorescence length (cm)	4·32	1·24	3·35	0·71	4·51	0·84	4·73	1·13
4. Number of flowers	11·50	5·00	10·10	3·98	9·40	3·62	8·43	2·34
5. Labellum max. width (mm)	12·10	1·95	10·15	1·00	10·50	1·29	10·63	1·12
6. Labellum max. length (mm)	8·91	0·78	8·00	1·33	8·20	0·84	7·74	0·76
7. Labellum, length of central lobe (mm)	2·64	0·91	2·20	0·48	2·25	0·62	2·38	0·67
8. Spur length (mm)[a]	9·02	1·39	9·10	0·74	8·92	0·90	10·90[b]	1·24
9. Plant height (cm)	16·7	5·2	10·8	1·7	—	—	24·7	4·6
10. Stem diameter (mm)[a]	3·94	1·19	2·20	0·48	—	—	3·28	1·00
11. Length of longest leaf (cm)[a]	8·54	1·70	6·37	0·99	—	—	9·03[c]	2·07
Year sampled	1981		1986		1986		1984	
Populations studied	Rhos-y-Gad		Rhos-y-Gad		Rhos-y-Gad		8 Alpine populations	
Number of plants measured	10		10		30		75	

[a] Data probably not fully compatible, as character was sometimes ambiguously defined.
[b] Mean = 8·30 with spur diameter subtracted (see text).
[c] Length of second lowest sheathing leaf.

TABLE 2. SIGNIFICANCE OF PAIRWISE COMPARISONS OF MEAN VALUES LISTED IN TABLE 1
Determined by 't' tests with degrees of freedom modified, where appropriate, to account for significant differences between sample variances. ns = not significant, * = P<0·05, ** = P<0·01, *** = P<0·001. Characters numbered as shown in Table 1.

Character no.	Character type[b]	Comparison[a] A × B	A × C	A × D	B × C	B × D	C × D
1	V	ns	ns	ns	**(C)	***(D)	ns
2	V	ns	*(A)	ns	ns	ns	ns
3	V	*(A)	ns	ns	***(C)	***(D)	ns
4	V	ns	ns	ns	ns	ns	ns
5	F	*(A)	*(A)	*(A)	ns	ns	ns
6	F	ns	*(A)	***(A)	ns	ns	**(C)
7	F	ns	ns	ns	ns	ns	ns
8	F	ns	ns	***(D)	ns	***(D)	***(D)
9	V	**(A)	—	***(D)	—	***(D)	—
10	V	**(A)	—	ns	—	***(D)	—
11	V	**(A)	—	ns	—	***(D)	—

[a] A = data from Bateman & Denholm (1983), B = Jenkinson (1986), C = Roberts (1988), D = Reinhard (1985). For statistically significant differences, the letter in parentheses shows the sample having the higher mean value.
[b] V = vegetative character, F = floral character.

another major constraint on the compatibility of data generated by different research groups: inconsistencies or misconceptions in the definition of ostensibly identical characters.

Roberts (1961, 1988) apparently followed the 'British School' (e.g. Heslop-Harrison 1948 *et seq.*) in excising the spur from the labellum prior to measurement (Fig. 1b). Reinhard (1985, Fig. 6) followed the 'Continental School' (e.g. Vermeulen 1947 *et seq.*) in mounting the labellum and spur as an integral unit (Fig. 1a). Thus, spur lengths given by Reinhard (1985) are equivalent to the mean spur lengths given by Roberts (1988) *plus the approximate diameter of the spur*; subtraction of the

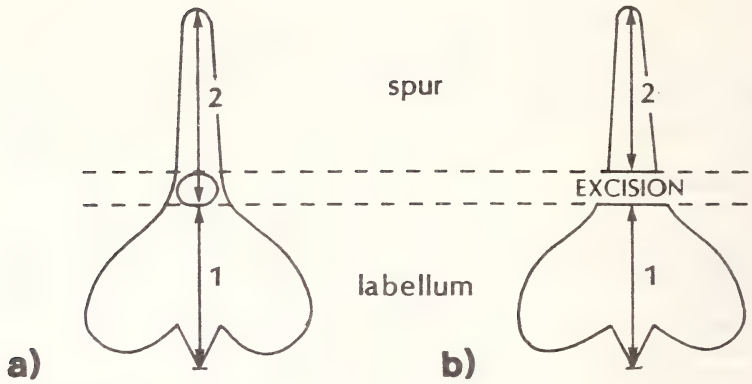

FIGURE 1. Comparison of methods of mounting dactylorchid flowers prior to measurement used by a) the Continental School and b) the British School. The two methods yield identical values for character 1 (labellum length to apex of central lobe) but substantially different values for character 2 (spur length).

mean spur diameter (2·6 mm) brings Reinhard's mean spur length for Alpine *D. traunsteineri* much closer to that of Roberts for the Rhos-y-Gad population. We cannot assess whether this error was also perpetuated by Kenneth *et al.* (1988) because their methods of measurement are not stated. In addition, some readily quantified characters (notably the potentially valuable 'heavy' leaf markings of *D. lapponica*) were only qualitatively described by both Kenneth *et al.* (1988) and Reinhard (1985), thus preventing valid comparison. Such misconceptions emphasize the importance of precisely defining and quantifying every character; several other characters listed in Tables 1–3 are ambiguously defined and potentially incompatible.

SELECTING DATA *A POSTERIORI* FOR PUBLICATION

Some selectivity of characters is inevitable when comparing sets of population means, as full comparison is restricted to characters common to all of the data sets under scrutiny. Thus, Roberts (1988) was obliged to omit from his Table 2 twenty of Reinhard's (1985) 28 characters. Moreover, Roberts' assertion of similarity between his mean values for Rhos-y-Gad and those of Jenkinson (1986) was achieved by further selecting two of these eight characters (labellum length and labellum width) that yielded similar values for the two samples. Comparison of a larger number of characters (Tables 1 and 2) demonstrates highly significant differences in vegetative characters such as total number of leaves and inflorescence length. Furthermore, comparison of mean values obtained by Jenkinson (1986) with our own (including additional vegetative characters not measured by Roberts) demonstrates that Jenkinson's plants had on average shorter stems and shorter leaves. In fact, the diminutive mean stature of Jenkinson's plants reflects sampling within a small, relatively dry area of the meadow at Rhos-y-Gad (M. N. Jenkinson pers. comm. 1988). Consequently, our mean values for vegetative characters are closer to those of Roberts (1988) than to those of Jenkinson (1986), even though Roberts' and Jenkinson's measurements were taken during the same season (1986) and post-dated our published survey by five years.

Thus, we attribute the difference between mean values obtained by ourselves, Roberts (1988) and Jenkinson (1986) from Rhos-y-Gad largely to differences in *a priori* perception of the range of variation encompassed by Pugsley's Marsh-orchid and in the area of the habitat sampled, compounded by inconsistencies between workers in the precise definition of characters. We conclude that internal consistency is likely within any one project but that, in the absence of detailed consultation, the comparison of data collected by different workers is fraught with hazard.

TABLE 3. COMPARISON OF MEAN VALUES FOR ALL COMPATIBLE METRIC CHARACTERS OF SELECTED MARSH-ORCHID POPULATIONS IN WESTERN SCOTLAND AND YORKSHIRE

Character	Western Scotland[a]	Ha Mire Wood, Yorkshire[b]
Plant height (cm)	7·0–21·0	15·4
Number of expanded sheathing leaves	2·3–3·0	3·7
Number of non-sheathing leaves	0·8–1·7	1·0
Length of longest leaf (cm)	5·0–8·9	8·5
Width of longest leaf (cm)	1·1–1·5	1·3
Length of basal bracts (mm)	13–19	17
Length of inflorescence (cm)	3·0–4·6	2·7
Number of flowers	8·9–12·8	9·9
Labellum, length to apex of central lobe (mm)	6·3–7·8	6·3
Labellum, maximum width	(6·4–)7·3–9·4	7·7
Spur length (mm)	7·5–9·2[c]	7·2
Spur, maximum width when flattened (mm)	2·6–3·4	2·9

[a] Data from Kenneth *et al.* (1988, Table 1). Figures given are ranges of mean values for seven populations (4–14 plants/population).
[b] Data from Bateman & Denholm (1983, Table 2). Figures are mean values for ten plants in one population.
[c] Figures are difficult to interpret, as the method of measurement was not described (see Fig. 1).

TAXONOMIC INTERPRETATION OF MORPHOMETRIC DATA

POPULATION MEANS AND INTRA-POPULATION VARIATION

In our studies of the tetraploid and diploid marsh-orchids (Bateman & Denholm 1983, 1985), we applied the same multivariate algorithms to data sets for both 1) individual plants and 2) population means (each of 52 characters). Considerable overlap of individuals of different taxa provided crucial evidence that species could not be delimited within either *D. majalis* or *D. incarnata* (L.) Soó, though assignment of populations to subspecies was based primarily on the multivariate analysis of population means. Once an optimal intraspecific classification was achieved by this method, data for all measured individuals of each taxon were pooled to allow its description using character states selected by univariate analyses. There are therefore three levels in the analytical hierarchy: 1) individual plants, 2) populations and 3) specific or intraspecific taxa.

The data presented by Roberts (1988) are level 2 (population means), whereas those presented by Reinhard (1985) for *D. traunsteineri* are level 3 (taxon means). Data published by Kenneth *et al.* (1988) for *D. lapponica* (ranges of population means) lie uncomfortably between levels 2 and 3. Hence, these data sets are not strictly comparable and although Roberts (1988) and Kenneth *et al.* (1988) stress the similarity of their respective data sets to those of Reinhard (1985), the true concordance of the data cannot be adequately assessed.

The drawbacks of this type of comparative, univariate approach are emphasized by Table 3, which compares Kenneth *et al.*'s (1988, Table 1) range of means for Scottish populations of *D. lapponica* with our means (Bateman & Denholm 1983, Table 2) for a population of *D. majalis* subsp. *purpurella* (corresponding to form 'A' of Stephenson & Stephenson (1920); see also Roberts (1961)) from Ha Mire Wood, Malham, Yorkshire. The Ha Mire Wood population lies within the range for Scottish *D. lapponica* in nine of the twelve characters listed. The three exceptions are spur length (0·3 mm outside, possibly due to differences in method of measurement), inflorescence length (3 mm) and total number of leaves (0·7, again possibly due to differences in the definition of a dactylorchid leaf). This "remarkable similarity" (*sic*) allows only three possible interpretations: 1) the Ha Mire Wood population is *D. lapponica*, 2) at least some of the populations identified as *D. lapponica* by Kenneth *et al.* (1988) are actually *D. majalis* subsp. *purpurella* or 3) the identification of taxa by visual comparison of population means for a small number of characters is irredeemably conceptually flawed and should not be practised. We prefer explanation (3), and regard the case for the presence of both *D. lapponica* and *D. traunsteineri* in the British Isles as unproven (though by no means unlikely).

CLASSIFICATION AND NOMENCLATURE

Roberts (1988) used differences between his populations and ours, together with Reinhard's (1985) recent biometric data on Alpine *D. traunsteineri*, as tools to undermine our broader conclusions concerning the status of Pugsley's Marsh-orchid in the British Isles. Unfortunately, two separate issues have become confused: 1) should populations of Pugsley's Marsh-orchid be treated as a subspecies of *D. majalis* or as a separate, distinct species, and 2) should they bear the epithet *traunsteineri* or *traunsteinerioides*?

In our 1983 paper, we confidently argued that the substantial morphological overlap between populations such as Rhos-y-Gad and populations of other subspecies of *D. majalis* clearly precludes recognition of Pugsley's Marsh-orchid as a distinct species. Much additional morphometric data collected subsequently has increased the extent of the overlap and reinforced this conclusion.

Our use of the epithet *traunsteinerioides* rather than *traunsteineri* was much more tentative, and prompted by the necessity to label a taxon if it is to remain acceptable botanical currency. Roberts (1988) quoted our (admittedly weak) reasons for this nomenclature decision, but omitted our subsequent statement that biometric measurements should be taken from Alpine populations to test this hypothesis (Bateman & Denholm 1983, p. 373). Reinhard's (1985) data are valuable but insufficient to resolve this issue due to 1) constraints on the comparability of data collected by different research groups working in isolation (see above) and 2) the presentation of data as taxon (level 3) and/or population (level 2) means, preventing essential comparison of individual plants (level 1).

Moreover, the possible resolution of the nomenclatural controversy in favour of sinking *traunsteinerioides* into synonymy with *traunsteineri* would not in any way affect the arguments for treating the amalgamated taxon as a subspecies of *D. majalis*. The correct name for Pugsley's Marsh-orchid would then be *D. majalis* subsp. *traunsteineri* (Sauter) Sundermann (1980, p. 40). Similarly, *D. lapponica* may be more appropriately treated as *D. majalis* subsp. *lapponica* (Laest. ex Hartman) Sundermann (1975, p. 45).

CONCLUSIONS

Current evidence is insufficient to determine whether certain problematic marsh-orchid populations in the British Isles should be referred to the predominantly Continental 'species' *Dactylorhiza traunsteineri* (Sauter) Soó and *D. lapponica* (Laest. ex Hartman) Soó. In contrast, there is strong morphological evidence that British and Irish populations referred by some botanists to *D. traunsteineri* are conspecific with *D. majalis* (Reichenbach) P. F. Hunt & Summerhayes. Thus, if future studies demonstrate that some British and Irish dactylorchid populations cannot be distinguished from Continental populations referred to *D. traunsteineri*, they should be included within *D. majalis* subsp. *traunsteineri* (Sauter) Sundermann. If they prove to differ significantly, the British and Irish populations should be maintained separately as *D. majalis* subsp. *traunsteinerioides* (Pugsley) Bateman & Denholm (Pugsley's Marsh-orchid). The controversies surrounding these taxa highlight several commonly encountered methodological and conceptual pitfalls in morphometric studies.

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ERRORS AND MISCONCEPTIONS IN THE STUDY OF MARSH-ORCHIDS

In a former paper (Roberts 1988) I pointed out that the evidence put forward by Bateman & Denholm (1983) was insufficient to warrant the removal of *Dactylorhiza traunsteineri* (Sauter) Soó from the British and Irish flora. Furthermore, some of their data from the British and Irish plants referred to this taxon were unreliable and failed to provide a sufficiently sound basis for the taxonomic changes they proposed. As a result I suggested a return to the *status quo* before the publication of their paper.

Bateman & Denholm (1989) have now gone to great lengths to show that my arguments are not valid: that because of inconsistencies between different workers in their definitions of characters, their data are not compatible; and, moreover, that I have misunderstood the procedures employed by other workers. In some instances they have even attributed to me statements and claims that I have not made.

Below I have dealt with some of the points they have raised in the order in which they occur in their present paper, and, for ease of reference, under the section headings used by them.

CONSTRAINTS ON THE DATABASE

In this section Bateman & Denholm (1989) state that "there is little theoretical support for Roberts' (1988) suggestion that the discrepancies in floral dimensions between his multiple samples and our single sample . . . could reflect the difference in sample size (30–40 and 10 plants respectively)." What I actually said was: "The possibility was considered that the small size of their sample may account for the poor estimates of population means." This sentence contains no reference, either directly or by implication to the significance of the differences between their mean values and mine, but simply states that smaller samples are liable to give less precise estimates of population means, which is a well-known fact of elementary statistical theory. It is another way of saying that "smaller samples incur greater sampling error" as Bateman & Denholm (1989) themselves have put it. It seems that these authors have taken 'discrepancy' to be synonymous with 'significant difference', but these terms are not interchangeable and Bateman & Denholm have attributed to me a statement I have not made. In fact, what I said has full theoretical support.

SELECTING TAXA, COLONIES, POPULATIONS AND INDIVIDUALS

Bateman & Denholm have quite properly underlined the importance of distinguishing individuals of the target population from those of co-existing populations of other taxa. By their own admission, however, two plants which could have been hybrids between *D. traunsteineri* and the co-existing *D. maculata* (L.) Soó were included in their sample. The decision to include them was made on the grounds that such hybrids are characterized by relatively narrow spurs, large numbers of non-sheathing leaves and the presence of leaf-markings. However, they have overlooked the possibility that, in addition to F_1s, the situation is often complicated by the presence of F_2 or backcross plants, or even some of subsequent origin, as was shown by Lord & Richards (1977) in mixed populations of *D. fuchsii* (Druce) Soó and *D. majalis* subsp. *purpurella* (T. & T. A. Steph.) Soó. In such plants the morphological characters of narrow spurs, large numbers of non-sheathing leaves, and the presence of leaf-markings are often not nearly so pronounced, and it is such plants that can pose problems. Their inclusion in a sample is not only the most likely source of the supposed "different limits of tolerance" set by different workers, but will also have a disastrous effect on the conclusions, for the procedures employed by Bateman & Denholm have no in-built mechanism which can identify and reject spurious data.

Observations of pollen fertility, as described by Heslop-Harrison (1954), provide a much more reliable criterion of the status of doubtful plants. The test is readily applied and I have found it to be of the utmost value in the determination of plants whose status on morphology alone would have remained obscure. Bateman & Denholm's failure to use this test must certainly be regarded as a serious weakness in their sampling procedures.

SELECTING THE TIMING OF MEASUREMENT

Bateman & Denholm's statement requires some qualification. Firstly, many characters such as number of leaves, number of flowers per inflorescence, presence or absence of leaf-marking, etc. do not exhibit ontogenetic variation. These authors give two examples of such variation but only one of them, inflorescence length, is correctly cited. The second example they give is that the flowers from the base of an inflorescence are appreciably larger than those at the apex, from which they infer that flowers at the base, having opened some days before those at the apex, have enlarged appreciably in the interval. This assumption is erroneous. Once dactylorchid flowers have opened, floral dimensions remain unchanged throughout anthesis. A simple experiment demonstrates this very clearly.

All the flowers were removed in sequence from the lower two-thirds of the inflorescence of two plants of *D. majalis* subsp. *praetermissa* (Druce) Moresby Moore & Soó, so as to provide two samples at different dates from each of them. The first sample was taken from one side of the inflorescence, leaving the flowers on the other side to be removed a week or so later. These made up the second sample. Labella and spurs from both samples were mounted in the usual way and the data obtained from them are shown in Table 1, a glance at which is sufficient to show that floral dimensions are not subject to ontogenetic variation. This was the basis on which I compared Jenkinson's data for labellum dimensions from Rhos-y-gad with mine.

The difference in size between flowers at the base of an inflorescence and those at the apex is a

TABLE 1. DATA FOR FLORAL DIMENSIONS FROM TWO SAMPLES TAKEN FROM OPPOSITE SIDES OF THE INFLORESCENCE AT DIFFERENT TIMES IN THE SAME SEASON FROM TWO PLANTS OF *D. MAJALIS* SUBSP. *PRAETERMISSA*

	Plant A				Plant B			
Date of sample	26.5.87		6.6.87		29.5.87		6.6.87	
Number in sample	15		8		10		10	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Labellum width (mm)	14·2	0·06	14·1	0·09	13·2	0·07	13·1	0·13
Labellum length (mm)	9·2	0·06	9·2	0·09	8·4	0·08	8·4	0·15
Spur width (mm)	3·7	0·07	3·8	0·09	3·9	0·09	3·5	0·08
Spur length (mm)	9·3	0·08	9·1	0·07	9·2	0·17	8·9	0·21

well-known phenomenon in dactylorchids, but it is not the result of ontogenetic variation: those at the apex are innately smaller.

Bateman & Denholm further claim that environmental factors have brought about visible changes in the phenotypic composition of the Rhos-y-gad population in the course of a few years; and that it has undergone substantial directional variation as a result of the gradual drying-out of the habitat.

This shows a complete lack of understanding of conditions at this locality, where the habitat is a calcareous mire irrigated by calcium-rich ground water derived from springs and seepages. The main part of the population of *D. traunsteineri* occurs on the spring line and is not affected to any great extent by drought or drainage, and there is no support for the view that the Rhos-y-gad mire is gradually drying out. Neither is there any evidence for the supposition that this population of *D. traunsteineri* is gradually changing in its phenotypic composition. On the contrary the consistency of my sample data repeated after an interval of over 20 years (Roberts 1988) lends considerable support for this view.

Moreover, if Bateman & Denholm's observations were correct, the changes in the Rhos-y-gad population would be an outstanding example of rapid evolutionary adaptation, and it would be reasonable to expect *D. traunsteineri* to have become adapted to drier, grassland habitats in some parts at least of its distributional area. However, as such a phenomenon has not been observed, there is no support for this hypothesis.

SELECTING DEFINITIONS OF CHARACTERS

According to Bateman & Denholm (1989) a major cause of incompatibility between sample data produced by different workers is inconsistency in the definition of morphological characters, or misconceptions of how such characters are defined by others. As an example they cite the different methods of mounting labella and spurs, prior to measurement, by Reinhard (1985) and myself.

Reinhard mounts the labellum and spur in one piece, as shown in Fig. 1a. My method is to separate the labellum from the spur by making a cut, as shown at C in Fig. 1b, the flower being inverted to facilitate the operation. The ovary and column are then separated from the spur and the latter mounted on card, as shown in Fig. 1c. There is no excision as suggested by Bateman & Denholm (1989) in their Fig. 1b.

Reinhard's measurement of spur length is made as shown at A in Fig. 1a; mine as shown at D in Fig. 1c, not as shown at B in Fig. 1a, as Bateman & Denholm have assumed. Consequently the values given by Reinhard and myself are reasonably compatible. Bateman & Denholm's assertion that mean spur lengths given by Reinhard (1985) are equivalent to those given by me (Roberts 1988) "plus the approximate diameter of the spur" is erroneous: it is not necessary to subtract mean spur diameter (2·6 mm) from Reinhard's value to make it equivalent to that from the Rhos-y-gad population. The misconception in this instance is thus shown to be on the part of Bateman & Denholm, and in fact the spur length of the Alpine plants *is* considerably greater than in the Anglesey ones, as was clearly shown in Table 2 of my paper (Roberts 1988).

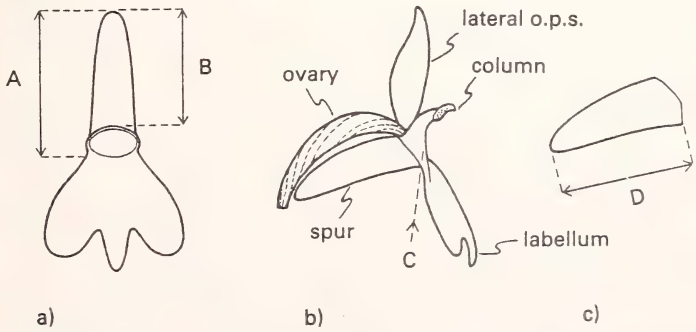

FIGURE 1. Comparison of methods of mounting floral parts prior to measurement: (a) labella and spurs mounted together by Reinhard; (c) spurs mounted separately by Kenneth *et al.* and Roberts. The two methods give identical values for spur length. o.p.s. = outer perianth segment. (Not to scale).

It will be recalled that one of the discrepancies cited by Bateman & Denholm (1983) to justify the removal of *D. traunsteineri* from the British and Irish flora was that the Alpine plants had *smaller spurs*. Yet Reinhard's data show that the opposite is the case. No adjustment of these figures, e.g. by subtracting 2·6 mm from the spur length given by Reinhard, can alter the fact that most of the discrepancies quoted by Bateman & Denholm (1983, p. 373) have no basis in reality.

SELECTING DATA *A POSTERIORI* FOR PUBLICATION

Bateman & Denholm are once again mistaken when they assert that I have claimed a general similarity between my mean values from the Rhos-y-gad population and those of Jenkinson (1986) and that this was achieved "by further selecting two . . . characters (labellum length and labellum width) that yielded similar values for the two samples." A glance at their Table 2 (Bateman & Denholm 1989) will show that, in fact, six of the eight characters show similar values for the two samples, i.e. Bateman & Denholm have contradicted the facts shown in their own Table. Moreover, my only reference to Jenkinson's (1986) paper was made when discussing labellum dimensions. These authors have thus distorted the facts to further their own argument.

Jenkinson's data for these two characters were quoted to show that although a small sample (10) gives less precise estimates of population means, his values do not differ from mine to the same extent as those of Bateman & Denholm (1983, Table 2). Consequently it seemed unlikely that their large mean values for these characters were attributable to sample size alone.

Although my data were taken six days after Jenkinson's, his mean value for length of labellum mid-lobe (2·2 mm) also compares well with mine (2·25 mm), as do his means for spur length (9·10 mm and 8·92 mm) and number of flowers per inflorescence (10·10 and 9·40 respectively). All of these are characters which are not subject to ontogenetic variation. On the other hand, the highly significant difference in inflorescence length is only to be expected, given the difference in the dates of sampling. Jenkinson's mean value of 3·2 for the total number of leaves can be ascribed to the small and unrepresentative sample measured by him, for it now appears that he confined his sampling to a small, comparatively dry part of the meadow at Rhos-y-gad (Bateman & Denholm 1989).

There is thus no need to invoke "differences in *a priori* perception of the range of variation encompassed by Pugsley's Marsh-orchid" as Bateman & Denholm have done to explain some of the differences between the mean values obtained by them (Bateman & Denholm 1983), Jenkinson (1986) and myself (Roberts 1988) from this population. As I have shown, simpler and more rational explanations are available.

POPULATION MEANS AND INTRA-POPULATION VARIATION

One of the most important taxonomic changes made by Bateman & Denholm (1983) was based on a comparison of data comprising population means (their 'level 2') with data taken from descriptions of *D. traunsteineri* by Vermeulen (1949) and Nelson (1976) based on individual plants (their 'level 1'). It is therefore difficult to accept their suggestion that my data (and likewise those of Kenneth *et al.* 1988) cannot strictly be compared with those of Reinhard on the grounds that mine are population means (their 'level 2'), Kenneth *et al.*'s are ranges of population means (between their 'levels 2 and 3'), while Reinhard's, based on 75 plants taken from eight populations and aggregated, are taxon means (their 'level 3').

The populations sampled by Reinhard cover only a fraction of the total distribution of *D. traunsteineri* and it is debatable whether his data can be called taxon means, for there is no clear distinction between taxon means and population means.

In the Introduction to their paper Bateman & Denholm (1989) have already suggested that "Kenneth *et al.*'s (1988) arguments for the presence of *D. lapponica* in Britain were . . . based primarily on comparison of mean values of selected morphometric characters . . .". This is an assumption on their part and is incorrect. By assuming that no comparisons are valid unless the data are quantified, they feel justified in ignoring all qualitative data, however important these may be.

The primary steps in the identification of the Scottish plants are clearly described in Kenneth *et al.*'s (1988) paper, where they state that the initial positive determination was made by H. R. Reinhard after examining numerous photographs and some biometric data sent to him. The comparisons made in Table 1 of Kenneth *et al.*'s paper consist of a mixture of quantitative data, in

the form of ranges of population means, and qualitative data, making a total of 15 pairs of characters. However, a number of additional characters such as the presence of stem anthocyanin, the distribution of markings on the leaf surface, the presence of markings on the bracts, the secund inflorescence and several additional characters of the labellum and spur are given in the description on p. 39 of Kenneth *et al.*'s (1988) paper. Altogether, well over 20 pairs of characters were involved in the comparison of these Scottish plants with the Scandinavian and Alpine ones studied by Reinhard (1985).

In an attempt to show that Kenneth *et al.*'s data could equally well apply to *D. majalis* subsp. *purpurella*, Bateman & Denholm (1989, Table 3) have selected twelve characters of the Scottish plants to compare with those from a population of this taxon studied by them (Bateman & Denholm 1983). On finding that three of these pairs do not agree, they attempt to minimise (a) the difference in spur length by attributing it to the different methods of measurement employed by them and Kenneth *et al.*; and (b) the difference in the number of expanded sheathing leaves as being possibly due to differences in the definition of a dactylorchid leaf.

Kenneth *et al.* measure the spur in the same way as I do (D. J. Tennant pers. comm.) and it has already been shown (above) that Bateman & Denholm's description of how I measure spur length is incorrect. There are no grounds, therefore, for assuming that the difference in mean values shown in Bateman & Denholm's Table 3 (1989) is not, in fact, a real one.

In (b), however, the differences in the definition of a dactylorchid leaf are important and require some clarification. In a former paper Bateman & Denholm (1983) divided dactylorchid leaves into three categories which are treated as separate characters: no. 34, defined as the "number of sheathing leaves (excluding basal leaf if present)"; no. 35, number of non-sheathing leaves; no. 36, "presence or absence of a basal leaf", which is defined as "ranging from a chlorophyllose sheath above ground level to a leaf up to half the length of the sheathing leaf immediately above."

Kenneth *et al.* (1988, Table 1) also list three categories of leaves: (a) the number of expanded sheathing leaves, (b) the number of non-sheathing leaves, and (c) the total number of leaves.

These two groups of workers differ in their definitions of some of these categories. For example, character no. 34 in Bateman & Denholm's (1983) paper, Table 2, comprises leaves nos. 3, 4 and 5 in Fig. 2. Kenneth *et al.*'s 'number of expanded sheathing leaves', on the other hand, includes leaf no. 2 in addition to nos. 3, 4 and 5 (D. J. Tennant, pers. comm.). These two characters are therefore not compatible at all, as Bateman & Denholm (1989, Table 3) have assumed. This misunderstanding has led them to adopt the term 'Number of expanded sheathing leaves' for Table 3 in their present paper and, by doing so, they have committed a serious error. While Kenneth *et al.*'s means of 2·3–3·0 are correctly placed in this category, the mean of 3·7 is not, for this value has been taken from Table 2 of Bateman & Denholm's (1983) former paper, where it can be seen under character no. 34. As shown above, this character and Kenneth *et al.*'s 'number of expanded sheathing leaves' are not identical and it is meaningless to compare the means 2·3–3·0 with 3·7 as Bateman & Denholm (1989) have now done in their Table 3.

In their count of 'Number of expanded sheathing leaves' Kenneth *et al.* (1988, Table 1) include leaf no. 2 (Fig. 2) but omit no. 1. In their separate count of 'Total number of leaves', however, no. 1 is included, along with nos. 2–6.

The total number of leaves from the Ha Mire Wood population can be found by adding the means for characters nos. 34, 35 and 36 in Bateman & Denholm's (1983) Table 2, i.e. 3·7 plus 1·0 plus 1·0 making 5·7. This value falls within the range of means, 5·1–9·2, for this character in *D. majalis* subsp. *purpurella* in North Wales (Roberts 1961), but is well outside the ranges in Continental and Scottish *D. lapponica*, 3·04–3·52 and 3·3–4·3 respectively (Kenneth *et al.* 1988, Table 1).

Total leaf number is one of the key characters which separates *D. lapponica* (and *D. traunsteineri*) from *D. majalis* subsp. *purpurella*. The difference between the means from the Scottish plants, 3·3–4·3 (Kenneth *et al.* 1988, Table 1), and the mean from the Yorkshire population, 5·7, is therefore sufficient on its own to preclude any possibility of identifying the Ha Mire Wood population as *D. lapponica*, or any of the Scottish populations as *D. majalis* subsp. *purpurella*. Moreover, the rest of Bateman & Denholm's arguments and conclusions in this section become completely untenable.

The presence of *D. lapponica* in Britain is thus seen to be established on reliable and convincing evidence. Kenneth *et al.* (1988), however, have not expressed an opinion on the taxonomic status of these plants, but have accepted Reinhard's arguments for the treatment of *D. lapponica* at species level, which are fully detailed in his paper (Reinhard 1985).

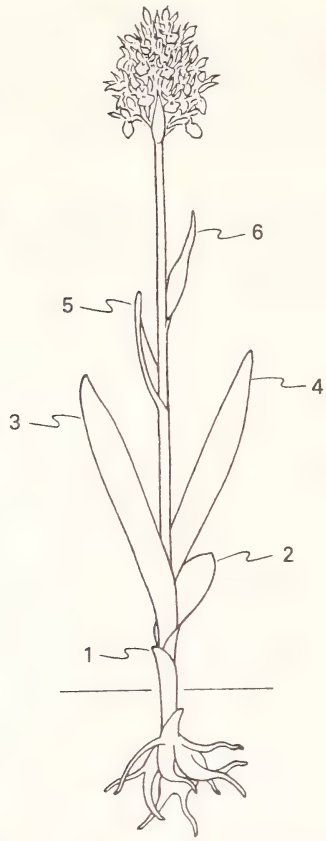

FIGURE 2. Diagram of a dactylorchid plant to explain the different definitions of the leaves. (This diagram only applies to a proportion of the plants in a population.)

CLASSIFICATION AND NOMENCLATURE

In an earlier paper Bateman & Denholm (1983) stated their belief that "gene flow between subspecies is at most only partially restricted". This implies that at Rhos-y-gad, where *D. traunsteineri* co-exists with *D. majalis* subsp. *purpurella*, hybridization between the two should be common and presumably result in a hybrid swarm. However, over the last 30 years I have had ample opportunity to examine the marsh-orchids at this locality and have searched for possible hybrids between these two taxa without success. Furthermore, there is no difficulty in identifying plants as one or the other in the field.

The evidence for introgression of *D. traunsteineri* from *D. majalis* subsp. *purpurella* would be an extension of the range of variability within the population of the former. A useful measure of variability in the characters for which morphometric data are available is the Coefficient of Variation. When this coefficient is calculated for the eight pairs of data in Table 2 of my paper (Roberts 1988), most of them agree closely. For example, for the characters 'total number of leaves' and 'leaf width' from the Rhos-y-gad plants it is 13·9% and 21·0% respectively, and for the Alpine plants 15·7% and 22·3%. The means of this coefficient for the two sets of data are 19·0% and 18·8% respectively and the small difference of 0·2% between them is not significant.

These observations do not support Bateman & Denholm's belief, nor do they provide evidence for the introgression of *D. traunsteineri*. It is also worth noting that (1) where they state that "The supposed British and Irish *D. traunsteineri* show morphological overlap with *D. majalis* subsp. *praetermissa* and subsp. *occidentalis*" (Bateman & Denholm 1983, p. 373) they do not mention *D.*

majalis subsp. *purpurella*. Yet it is this subspecies which occurs with *D. traunsteineri* at all of the three sites where Bateman & Denholm sampled it; (2) they do not record any hybrids between *D. traunsteineri* and *D. majalis* subsp. *purpurella* at any of them; (3) they did not study the co-existing population of subsp. *purpurella* at any of these places, when it seems logical that they should have done so.

In their earlier paper Bateman & Denholm (1983) recommended that biometric data should be taken from Alpine populations of *D. traunsteineri* "to quantify their differences from *D. majalis* subsp. *traunsteinerioides*", that is, not to show whether they differ or not, but by how much they do so. They now appear to have shifted their argument and say that the purpose of taking biometric data from Alpine plants was "to test this hypothesis", the hypothesis being, presumably, whether the British and Irish plants differ at all from the Alpine ones. Their claim that Reinhard's data, which were cited in my Table 2 (Roberts 1988), cannot be used to resolve this issue because of the inconsistencies or misconceptions in the definition of characters, has already been shown to be without foundation because it was based on a misconception on their part (see 'Selecting definitions of characters' above).

CONCLUSIONS

Bateman & Denholm (1989) are quite correct when they state that the controversies over *D. traunsteineri* and *D. lapponica* draw attention to some of the pitfalls encountered in morphometric studies. A fruitful source of error is the complication introduced when a seemingly simple character such as the 'Total number of leaves' is subdivided into three separate characters, as we have seen above. One example of such an error has already been seen in Bateman & Denholm's (1989) Table 3. A second and equally important one occurs in their Table 1, where their mean (3·60) for the 'Total number of leaves' from Rhos-y-gad has been obtained by extracting the means of characters no. 34 (2·6) and no. 35 (1·0) from Table 2 of their 1983 paper, and adding them. Unfortunately, they have omitted character no. 36, which consists of leaves nos. 1 and 2 in my Fig. 2. This is a serious omission, for the value 3·60 is thus equivalent only to leaves nos. 3–6 in Fig. 2 and does not give the true mean for the total number of leaves from this population, as it purports to do. Moreover, this is not the only mistake they have made in compiling the data in Table 1. Such errors are not only an unwitting misuse of morphometric data, but yet further examples of the pitfalls which these authors have been at such pains to warn us against and into which they themselves have fallen.

ACKNOWLEDGMENT

Thanks are due to Mr D. J. Tennant for his considerable help with parts of this note.

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(*This matter is now closed—Eds.*)

Plant Records

Records for publication must be submitted to the appropriate Vice-county Recorder (see *Vice-county Recorders* (1988)), and *not* the Editors. The records must normally be of species, hybrids or subspecies of native or naturalized alien plants belonging to one or more of the following categories: 1st or 2nd v.c. record; 1st post-1930 v.c. record; only extant v.c. locality, or 2nd such locality; a record of an extension of range by more than 100 km. Such records will also be accepted for the major islands in v.cc. 102–104 and 110. Only 1st records can be accepted for *Rubus*, *Hieracium* and hybrids. Records for subdivisions of vice-counties will not be treated separately; they must therefore be records for the vice-county as a whole. Records of *Taraxacum* are now being dealt with separately, by Dr A. J. Richards, and will be published at a later date.

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)). All records are field records unless otherwise stated. With the exception of collectors' initials, herbarium abbreviations are those used in *British and Irish herbaria* by D. H. Kent & D. E. Allen (1984).

Records from the following vice-counties are included in the text below: 2, 4–7, 11–14, 17, 25–27, 33–35, 38–51, 59–62, 64, 65, 67–73, 75, 77–81, 83, 88, 93, 96, 98, 99, 101, 103, 104, 111, H5, H8, H21, H33, H39.

The following signs are used:

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

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

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

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

1/1. Huperzia selago (L.) Bernh. ex Schrank & C.F.P. Mart. **83**, Midlothian: Jeffrey's Course, Hawkster Gill Burn, GR 36/29.49. Streamside. N. F. Stewart, 1983. Only extant locality.

1/5. Diphasiastrum alpinum (L.) Holub **80**, Roxburghs.: Black Needle, Kielderhead, GR 36/64.02. Amongst broken rocks at 440 m. C. O. Badenoch & A. Panter, 1988. Only extant locality.

2/1. Selaginella selaginoides (L.) Link **46**, Cards.: Soar y Mynydd, GR 22/78.53. Flushed slope. A. O. Chater & D. Davies, 1988. 2nd record. **83**, Midlothian: Moorfoot Hills south-east of Trousley, GR 36/38.45. Wet flush. D. Adamson, 1988. Glentress Burn, Mount Main, GR 36/37.48. Stony flush. D. R. McKean, 1988, **E**. Only extant localities.

3/2. Isoetes echinospora Durieu **2**, E. Cornwall: Glynn Valley Works north of Maidenwell, GR 20/14.71. Edge of pool. T. J. Dingle, R. Lees & R. J. Murphy, 1988. 2nd record. ***47**, Monts.: Glaslyn, GR 22/82.94. A. J. Morton, 1982, det. A. M. Paul. Llyn Penrhaeadr, GR 22/75.93. A. J. Morton, 1985. 1st and 2nd records.

4/1 × 4. Equisetum hyemale L. × E. variegatum Schleicher ex Weber & Mohr ***103**, Mid Ebudes: West of Carpach, Coll, GR 17/14.53. Steep slope of sand dune. H. J. Noltie, 1987, **E**, det. C. N. Page. 1st confirmed record.

†4/3. Equisetum ramosissimum Desf. ***6**, N. Somerset: Weston-super-Mare, GR 31/31.60. Sandy bank. P. R. & I. P. Green, 1986, **BM**, det. A. C. Jermy.

4/4. Equisetum variegatum Schleicher ex Weber & Mohr **104**, N. Ebudes: Bearreraig River, GR 18/51.52. Damp gravel and scree. C. W. Murray, 1984, **herb. C.W.M.**, det. C. N. Page. 2nd record.

4/7 × 8. Equisetum sylvaticum L. × E. pratense Ehrh. ***88**, Mid Perth: Ben Lawers, GR 27/60.40. Grassy, damp scree. D. Marden *et al.*, 1985, **E**, det. C. N. Page. 1st British record.

4/8. Equisetum pratense Ehrh. ***93**, N. Aberdeen: Cabrach, GR 38/38.26. Heathery open woodland by river. D. Welch, 1987, **herb. D. W.**, det. C. N. Page.

7/1. Hymenophyllum tunbrigense (L.) Sm. **104**, N. Ebudes: Raasay Forest north of Screapadal, GR 18/58.45. Shaded stream-banks in conifer forest. A. Currie & F. Rose, 1988. 2nd Raasay record and northernmost British locality.

7/2. HYMENOPHYLLUM WILSONII Hooker **104**, N. Ebudes: Allt na Criche Tuatha, Canna, GR 18/22.05. Shaded gorge. H. J. B. & H. H. Birks, 1984. 1st Canna record.

9/1. CRYPTOGRAMMA CRISPA (L.) R.Br. ex Hooker *__43__, Rads.: South of Glog-fawr near Garreg Ddu Reservoir, GR 22/91.66. Shale quarry waste. R. G. Woods, 1988. Rhayader, GR 22/9.7. Rock outcrop. I. D. Soane & D. Hargreaves, 1988. 1st and 2nd records, both of single plants.

11/1. ADIANTUM CAPILLUS-VENERIS L. †*__34__, W. Gloucs.: Coleford, GR 32/57.10. Mortar of disused railway bridge. E. W. Jones, 1988. Present for over 25 years.

15/5. ASPLENIUM TRICHOMANES L. subsp. TRICHOMANES **73**, Kirkcudbrights.: Holy Linn, Barscobe, GR 25/6.8. Rocks by river. O. M. Stewart, 1986, **E**. 2nd record.

16/1. CETERACH OFFICINARUM DC. *__77__, Lanarks.: Stonehouse, GR 26/7.4. Wall. S. W. Birnage, 1956, **herb. S.W.B.** Biggar, GR 36/03.36. Wall. M. M. Allan, 1983, eradicated in 1986. 1st and 2nd records.

21/2 aff. DRYOPTERIS AFFINIS (Lowe) Fraser-Jenkins subsp. AFFINIS *__75__, Ayrs.: Craigie, GR 26/42.32. T. Wise, n.d. but c. 1900, **GL**, det. C. R. Fraser-Jenkins. *__99__, Dunbarton: Tarbet, GR 27/3.0. T. Moore, 1855, **K**, det. C. R. Fraser-Jenkins. *__101__, Kintyre: Dearg Allt, GR 16/82.78. A. G. Kenneth, 1987, det. A. C. Jermy.

21/2 bor. DRYOPTERIS AFFINIS (Lowe) Fraser-Jenkins subsp. BORRERI (Newman) Fraser-Jenkins *__75__, Ayrs.: Near Barr, GR 25/27.94. Woods. J. R. Lee, 1936, **GL**, det. C. R. Fraser-Jenkins. *__99__, Dunbarton: Kilpatrick Hills, GR 26/4.7. L. Watt, 1889, **GL**, det. C. R. Fraser-Jenkins. *__101__, Kintyre: South of Artilligan Bridge, GR 16/85.77. Roadside woodland. A. G. Kenneth, 1987, det. A. C. Jermy.

21/2 cam. DRYOPTERIS AFFINIS (Lowe) Fraser-Jenkins subsp. CAMBRENSIS Fraser-Jenkins *__75__, Ayrs.: Hindog Glen, Dalry, GR 26/28.50. R. Kidston, 1877, **GL**, det. C. R. Fraser-Jenkins. *__99__, Dunbarton: Glen Fruin, Helensburgh, GR 26/3.8. Unknown collector, 1939, **GL**, det. C. R. Fraser-Jenkins. *__101__, Kintyre: Near Artilligan Cottage, GR 16/85.76. Scrub. A. G. Kenneth, 1987, det. A. C. Jermy.

21/2 × 1. DRYOPTERIS AFFINIS (Lowe) Fraser-Jenkins × D. FILIX-MAS (L.) Schott *__44__, Carms.: Near Gwyddgrug, GR 22/4.3. Roadside bank. A. M. Pell & T. S. Crosby, 1986, **NMW**. 1st confirmed record.

[21/3. DRYOPTERIS OREADES Fomin **101**, Kintyre: Delete record, material collected by M. Cunningham on which it is based is *D. filix-mas* (L.) Schott.]

21/8. DRYOPTERIS AEMULA (Aiton) O. Kuntze *__60__, W. Lancs.: Thorn Crag, Over Wyersdale, GR 34/59.47. Gritstone rocks. E. F. Greenwood & N. A. Robinson, 1985, **LIV**. R. Brock, Myerscough, GR 34/50.40. Streamside. C. J. Bruxner, 1986, det. B. S. Parris. 1st and 2nd records.

21/9. DRYOPTERIS EXPANSA (C. Presl) Fraser-Jenkins & Jermy *__67__, S. Northumb.: Deadwater Fell, GR 35/62.97. Amongst boulders. G. A. & M. Swan, 1988, **herb. G.A.S.**, det. A. C. Jermy. **73**, Kirkcudbrights.: Black Gairy, GR 25/41.85. Rocky cliff. H. Lang, 1988. 2nd record.

22/2 × 1. POLYSTICHUM ACULEATUM (L.) Roth × P. SETIFERUM (Forskål) Woynar *__69__, Westmorland: R. Lyvenet west of King's Meaburn, GR 35/61.21. R. W. M. Corner, 1988, **LANC**, det. A. C. Jermy. *__70__, Cumberland: R. Caldew above Sebergham, GR 35/34.40. Gorge. R. W. M. Corner, 1988, **BM**, det. A. C. Jermy.

24/4. GYMNOCARPIUM DRYOPTERIS (L.) Newman **34**, W. Gloucs.: Newent Woods, GR 32/70.21. Old woodland. J. M. Fleming, 1988. 2nd extant locality.

24/5. GYMNOCARPIUM ROBERTIANUM (Hoffm.) Newman †*__96__, Easterness: Inshriach, GR 28/87.07. Roadside wall. G. & G. Wheldon & E. L. S. Lindsay, 1988, **herb. P. Macpherson**, det. P. M. Grown at nearby nursery.

25/1. POLYPODIUM VULGARE L. sens. str. ***H8**, Co. Limerick: North of Hebertstown, GR 11/68.43. Overgrown quarry. Black Rock, Ballyhoura Mountains, GR 11/63.19. Both S. Reynolds, 1987, **DBN**, det. D. M. Synnott. 1st and 2nd records.

29/1a. OPHIOGLOSSUM VULGATUM L. subsp. VULGATUM **81**, Berwicks.: Millknowe Burn, GR 36/67.51. Damp grassland. M. E. Braithwaite, 1988. Only extant locality. **104**, N. Ebudes: Below Beinn na Leac, Raasay, GR 18/59.37. E. Charter, 1984, **herb. C.W. Murray**. 1st Raasay record.

†43/2. ANEMONE RANUNCULOIDES L. ***6**, N. Somerset: Alford, GR 31/60.32. Riverside woodland. R. G. B. & I. G. Roe, 1988. ***69**, Westmorland: East of Mabbin Hall, GR 34/50.84. Wood. C. E. Wild, 1987.

46/15. RANUNCULUS SCELERATUS L. ***98**, Main Argyll: Lochgoilhead rubbish dump, GR 27/19.03. Wet ground. B. H. Thompson, 1988.

46/17. RANUNCULUS OMIOPHYLLUS Ten. ***H8**, Co. Limerick: South-east of Broadford, GR 11/32.19. Roadside ditch. S. Reynolds, 1987, **DBN**.

46/23. RANUNCULUS BAUDOTII Godr. ***47**, Monts.: Dovey Junction, GR 22/69.98. Saltmarsh pools. M. Wainwright, 1987, **NMW**.

58/3. PAPAVER LECOQII Lamotte **42**, Brecs.: Brecon, GR 32/03.28. River-bank. M. Porter, 1987. 2nd record, 1st since 1930.

†65/1. CORYDALIS SOLIDA (L.) Swartz **73**, Kirkcudbrights.: R. Cluden near Newbridge, GR 25/94.79. Woodland bank. O. M. Stewart, 1988. 2nd record.

†65/2. CORYDALIS BULBOSA (L.) DC. ***68**, Cheviot: Dunstan, GR 46/24.19. Woodland. M. E. Craster, 1987, **herb. G.A. Swan.**

66/7. FUMARIA DENSIFLORA DC. ***13**, W. Sussex: Brighton, GR 51/31.05. Waste ground. A. Spiers, 1987.

†68/1. ERUCASTRUM GALLICUM (Willd.) O. E. Schulz **44**, Carms.: A48 south of Cross Hands, GR 22/56.11. Roadside verge. A. M. Pell, 1985, **NMW**, det. R. G. Ellis. 2nd record.

†71/1. HIRSCHFELDIA INCANA (L.) Lagrèze-Fossat ***38**, Warks.: Coventry, GR 42/33.79. Waste ground. D. Porter, 1988, **WAR**, det. T. C. G. Rich. ***46**, Cards.: Eglwys-fach, GR 22/67.96. Railway embankment. W. M. & P. Condry, 1988, **NMW**, det. A. O. Chater & E. J. Clement. Present for at least 20 years.

†72/1. DIPLOTAXIS MURALIS (L.) DC. **83**, Midlothian: Leith Docks, GR 36/27.76. Waste ground. D. R. McKean, 1988. 2nd confirmed record.

80/1. CORONOPUS SQUAMATUS (Forskål) Ascherson **93**, N. Aberdeen: Pitullie, GR 38/95.67. Trampled bare ground. M. Innes, 1988. 1st post-1930 record.

†80/2. CORONOPUS DIDYMUS (L.) Sm. **50**, Denbs.: Penley, GR 33/41.42. Farm lane. J. A. Green, 1988. 2nd record.

84/1. THLASPI ARVENSE L. **42**, Brecs.: Brecon, GR 32/03.28. River-bank. M. Porter, 1987. 2nd record, 1st since 1930.

†86/2. CAPSELLA RUBELLA Reuter ***14**, E. Sussex: Preston Park, Brighton, GR 51/30.06. Base of wall. P. Harmes, 1987, det. A. C. Leslie.

88/4. COCHLEARIA SCOTICA Druce **93**, N. Aberdeen: Perthudden, GR 48/03.28. Dry coastal grassland. D. Welch, 1986, **herb. D.W.**, det. D. H. Dalby. 1st post-1930 record.

†92/1. LOBULARIA MARITIMA (L.) Desv. ***42**, Brecs.: Brecon, GR 32/03.28. River shingle. M. Porter, 1987.

94/4. DRABA MURALIS L. †**12**, N. Hants.: Ashford Chase, GR 41/74.26. Old wall. J. Fryer, 1988, **herb. Lady A. Brewis**. 2nd record. †**33**, E. Gloucs.: Withington, GR 32/03.15. Drive built on disused railway. R. J. Cooper, 1987. 2nd record.

97/2. CARDAMINE AMARA L. **43**, Rads.: Church House Farm, GR 32/24.50. Wet flush. D. E. Grey, 1987. 2nd record.

97/3. CARDAMINE IMPATIENS L. †***44**, Carms.: Gellideg, GR 22/42.10. Garden. T. S. Crosby, 1987.

†97/7. CARDAMINE RAPHANIFOLIA Pourret ***2**, E. Cornwall: Valley of R. Allen near Penvose Farm, GR 20/05.77. River-bank. B. Mollard, 1988. ***73**, Kirkcudbrights.: Forest Walk, Fleet Forest, GR 25/60.55. Streamsides in wood. R. W. M. Corner, 1988. ***79**, Selkirks.: R. Ettrick, Howden, GR 36/44.27. Riverside. A. J. Smith, 1988, **herb. R.W.M. Corner.** ***80**, Roxburghs.: R. Ettrick, Lindean, GR 36/47.31. Backwater of river. R. W. M. Corner, 1988, **herb. R.W.M.C.**

98/2. BARBAREA STRICTA Andrz. †***77**, Lanarks.: Yorkhill, GR 26/55.66. Waste ground by river. P. Macpherson, 1986, **herb. P.M.**, det. T. C. G. Rich. 1st established locality.

†98/3. BARBAREA INTERMEDIA Boreau **2**, E. Cornwall: Tideford, GR 20/34.58. Hedgebank. S. C. Madge, 1988. 2nd record. ***67**, S. Northumb.: Near Netherton Park, GR 45/21.80. Roadside verge. G. A. Swan, 1988, **herb. G.A.S.**, det. T. C. G. Rich. 1st localized record. **98**, Main Argyll: Inverliever Nursery, GR 17/89.05. Side of path. B. H. Thompson, 1988, **herb. B.H.T.**, det. T. C. G. Rich. 2nd record. ***H8**, Co. Limerick: South-east of Bradford, GR 11/33.18. S. Reynolds, 1987, **DBN**, det. T. C. G. Rich.

†98/4. BARBAREA VERNA (Miller) Ascherson **33**, E. Gloucs.: St James's Station, Cheltenham, GR 32/94.22. Waste ground. H. J. Butcher, 1988, det. T. C. G. Rich. 2nd record. **47**, Monts.: Llanfair Caereinion, GR 33/10.06. Disturbed roadside bank. M. Wainwright, 1988, det. T. C. G. Rich.

†100/3. ARABIS CAUCASICA Schlecht. **50**, Denbs.: Froncysyllte, GR 33/26.40. Old quarry face. G. Emery, 1988. 2nd record.

102/5 × 3. RORIPPA AMPHIBIA (L.) Besser × R. SYLVESTRIS (L.) Besser ***38**, Warks.: Leamington Spa, GR 42/32.65. Damp field-side. J. C. Bowra, 1988, **WAR**, det. T. C. G. Rich.

†102/6. RORIPPA AUSTRIACA (Crantz) Besser ***11**, S. Hants.: Fleetend, GR 41/50.05. Disused gravel pit. R. P. Bowman, 1988, **herb. R.P.B.**, det. T. C. G. Rich. Chilling, GR 41/50.04. Disused gravel pit. R. P. Bowman, 1988, **herb. R.P.B.** 1st and 2nd records.

†105/1. ERYSIMUM CHEIRANTHOIDES L. **H39**, Co. Antrim: Near Lough Neagh, GR 33/10.80. Waste ground. S. Beesley, 1987. 1st post-1930 record.

†112/3. RESEDA ALBA L. ***50**, Denbs.: Cefn y bedd, GR 33/31.55. Open-cast mine waste. B. Formstone, 1987.

113/4 × 6. VIOLA RIVINIANA Reichenb. × V. CANINA L. ***69**, Westmorland: Firbank, GR 34/63.93. Riverside rocks. R. W. M. Corner, 1988, **LANC**, det. D. M. Moore.

113/7. VIOLA LACTEA Sm. **46**, Cards.: Pennant, GR 22/49.63. *Molinia* pasture. A. O. Chater & A. P. Fowles, 1988, **NMW**. Only extant locality.

113/9b. VIOLA PALUSTRIS L. subsp. JURESSI (Link ex K. Wein) Coutinho ***47**, Monts.: Troed-yr-esgair, GR 23/7.1. *Salix* carr. P. M. Benoit, 1988, **NMW**.

†115/2. HYPERICUM × INODORUM Miller ***99**, Dunbarton: St Bernard's Weir, Helensburgh, GR 26/30.83. Woodland. A. Rutherford, 1977. Abundantly naturalized.

115/9. HYPERICUM HUMIFUSUM L. **104**, N. Ebudes: Armadale Castle, GR 18/63.04. D. MacInnes, 1984, **herb. C.W. Murray**. 1st localized Skye record.

†115/for. HYPERICUM × FORRESTII (Chittenden) N. K. B. Robson ***69**, Westmorland: Whitbarrow, GR 34/85.45. Limestone debris. G. Halliday, 1988, **LANC**, det. N. K. B. Robson.

122/1. ELATINE HEXANDRA (Lapierre) DC. *47, Monts.: Llyn Du, GR 32/00.96. I. C. Trueman *et al.*, 1984.

123/3. SILENE GALLICA L. †40, Salop: Oswestry, GR 33/30.28. Roadside verge. M. Wainwright, 1987, det. C. A. Sinker. 2nd confirmed record.

†124/cor. LYCHNIS CORONARIA (L.) Desr. *70, Cumberland: Rockcliffe, GR 35/35.61. Scrub on riverside cliff. R. E. Groom, 1979, still present in 1987, **LANC**.

†130/2. PETRORHAGIA SAXIFRAGA (L.) Link *6, N. Somerset: Huish Episcopi, GR 31/42.27. Railway bank. D. Maxwell, 1988.

131/2. CERASTIUM ARVENSE L. *99, Dunbarton: A82 between Duntocher and Drumchapel, GR 26/50.71. Roadside verge. A. McG. Stirling, 1988, **GL**.

†131/3. CERASTIUM TOMENTOSUM L. *35, Mons.: Sudbrook, GR 31/4.9. Riverside cliff-top. T. G. Evans, 1972, still present in 1985.

133/3. STELLARIA PALLIDA (Dumort.) Piré *80, Roxburghs.: Troney Hill, GR 36/57.23. Grassland over shallow soil. R. W. M. Corner, 1988, **herb. R.W.M.C.**

136/3. SAGINA MARITIMA L. *47, Monts.: Mouth of Afon Llyfnant, GR 22/69.97. Upper saltmarsh. P. M. Benoit, 1987, **NMW**.

†141/6. ARENARIA BALEARICA L. *50, Denbs.: Glan Conway, GR 23/80.76. Rock by laneside. E. Chicken, 1988.

143/1. SPERGULARIA RUBRA Lebel ex Le Jolis 103, Mid Ebudes: North of Shiaba, GR 17/4.2. Forestry road. I. C. Christie, 1988, det. A.McG. Stirling. 1st confirmed Mull record.

149/1a. MONTIA FONTANA L. subsp. FONTANA *4, N. Devon: Twitchen, GR 21/79.32. Bog. W. H. Tucker, 1987, det. S. M. Walters.

149/1b. MONTIA FONTANA L. subsp. CHONDROSPERMA (Fenzl) Walters *81, Berwicks.: Hume Craigs, GR 36/69.41. Basaltic crag. M. E. & P. F. Braithwaite, 1988, **herb. M.E.B.**, det. R. W. M. Corner.

149/1d. MONTIA FONTANA L. subsp. VARIABILIS Walters 81, Berwicks.: Blackadder Water near Halliburton, GR 36/68.47. Damp sandy track. M. E. Braithwaite, 1988, **herb. M.E.B.** 2nd record.

154/14. CHENOPODIUM RUBRUM L. 73, Kirkcudbrights.: Kirkmabreck quarry quay, GR 25/47.56. Shore. O. M. Stewart, 1988. 2nd record.

156/1. ATRIPLEX LITTORALIS L. 2, E. Cornwall: Lower Anderton, Millbrook, GR 20/44.52. Beach. R. Gould, 1988. 2nd extant locality.

156/lon. ATRIPLEX LONGIPES Drejer *5, S. Somerset: Wall Common, GR 31/26.45. Saltmarsh. Lady R. FitzGerald, 1988, **NCCH**, det. J. R. Akeroyd.

162/2. TILIA CORDATA Miller *12, N. Hants.: Little Hanger, Bradshott, GR 41/76.30. Coppiced stand in woodland. W. A. Sanderson, 1985.

†166/2. LINUM USITATISSIMUM L. 50, Denbs.: Ruabon, GR 33/30.43. Roadside verge. T. M. Bell & M. Rogers, 1988. Ruabon, GR 33/29.43. Roadside verge. G. A. Spencer, 1988. 1st and 2nd post-1930 records.

†168/8. GERANIUM MACRORRHIZUM L. *6, N. Somerset: Trudoxhill, GR 31/75.42. Roadside. R. G. B. & I. G. Roe, 1976, still present in 1988.

†168/ibi. × pla. GERANIUM IBIRICUM Cav. × G. PLATYPETALUM Fischer & C. A. Meyer *69, Westmorland: Ashfell, GR 35/75.04. Edge of quarry. J. Frankland, 1987, **herb. J.F.** *70, Cumberland: Halfwaywell, GR 35/53.35. Roadside verge. R. W. M. Corner, 1987, **LANC**, det. P. F. Yeo.

169/3. ERODIUM CICUTARIUM (L.) L'Hér. *104, N. Ebudes: Dunscaith, GR 18/59.12. Short turf. G. Yoxon, 1985. 1st localized record.

†170/exi. OXALIS EXILIS A. Cunn. *70, Cumberland: Ralliss, GR 34/15.84. Farmyard. F. & J. Steeden, 1984. Netherhall, GR 35/04.36. Gravel drive. M. Milne, 1986, **LANC**, det. M. F. Watson. 1st and 2nd records.

171/1. IMPATIENS NOLI-TANGERE L. †**38**, Warks.: Berkswell, GR 42/22.79. Marshy area in woodland. M. J. Senior, 1987, **herb. M.J.S.**, det. J. C. Bowra. 1st record since 1888.

185/3. GENISTA PILOSA L. *42, Brecs.: Penwyllt, GR 22/86.16. Heath at edge of limestone pavement. R. G. Woods, 1984.

187/3. ULEX MINOR Roth *51, Flints.: Twt Hill, GR 33/02.77. Sandy heath. D. J. Tinston, 1988, det. P. M. Benoit.

†191/3. MELILOTUS ALBA Medicus *93, N. Aberdeen: Newburgh, GR 38/99.26. Disused gravel pit. D. Welch, 1987, **ABD**.

192/1. TRIFOLIUM ORNITHOPODIOIDES L. *26, W. Suffolk: replace entry in *Watsonia* **17**: 187 (1988) by: Red Lodge, Freckenham, GR 52/69.70. Sandy waste ground. D. Dupree, 1953, **CGE**, det. D. E. Coombe.

†192/7. TRIFOLIUM INCARNATUM L. subsp. INCARNATUM *46, Cards.: Llanaeron, GR 22/48.59. Weedy turnip field. A. O. Chater, 1987.

†193/1car. ANTHYLLIS VULNERARIA L. subsp. CARPATICA (Pant.) Nyman var. PSEUDOVULNERARIA (Sag.) Cullen *39, Staffs.: Weston Coyney, GR 33/93.44. Roadside verge. I. W. Brown, 1987, det. J. R. Akeroyd.

†198/1. ROBINIA PSEUDACACIA L. *70, Cumberland: Nunnery, Kirkoswald, GR 35/52.42. R. W. M. Corner, 1987, **LANC**.

200/3. ASTRAGALUS GLYCYPHYLLOS L. †**83**, Midlothian: Lochend, Edinburgh, GR 36/27.74. Old railway track. D. R. McKean & M. Staples, 1988, **E**. Only extant locality.

202/1. ORNITHOPUS PERPUSILLUS L. *79, Selkirks.: Above Shaws Under Loch, GR [illegible]6/39.18. Edge of forestry track. R. W. M. Corner, 1988, **herb. R.W.M.C.**

†203/1. CORONILLA VARIA L. *26, W. Suffolk: Broomhouse Covert, Wangford, GR 52/[illegible]5.82. Conifer plantation. M. G. Rutterford & P. J. O. Trist, 1988. **49**, Caerns.: Tyn-y-groes, GR 23/77.70. Edge of woodland. R. Lewis, 1987. 2nd record.

206/2. VICIA TETRASPERMA (L.) Schreber †*77, Lanarks.: Laigh Mains, GR 26/63.56. Rocky, wet area. P. Macpherson, 1987, **herb. P.M.** 1st established locality.

207/2. LATHYRUS NISSOLIA L. †*77, Lanarks.: Laigh Mains, GR 26/63.56. Grassy banks. P. Macpherson, 1988, **herb. P.M.** 1st established locality.

207/6. LATHYRUS SYLVESTRIS L. **50**, Denbs.: Brynhovah Farm, GR 33/38.43. Bank of R. Dee. J. A. Green, 1987, **NMW**. 2nd post-1930 record.

207/9. LATHYRUS PALUSTRIS L. **49**, Caerns.: Tyn-y-groes, GR 23/77.70. Amongst *Phragmites* on bank of drainage channel. R. Lewis, 1987, **NMW**, det. R. G. Ellis. 2nd record, 1st this century.

†207/gra. LATHYRUS GRANDIFLORUS Sibth. & Sm. **39**, Staffs.: Fenton, GR 33/90.44. Waste ground. I. J. Hopkins, 1987. 2nd record. *77, Lanarks.: Ibrox, GR 26/55.64. Wood near old railway line. P. Macpherson, 1985, **herb. P.M.** 1st established locality. *99, Dunbarton: Colgrain Farm, GR 26/32.79. Roadside hedge. R. R. Mill, 1967, still present in 1986. Huge colony.

†ARUNCUS DIOICUS (Walter) Fernald *73, Kirkcudbrights.: North of Minigaff, GR 25/41.67. Riverside. O. M. Stewart, 1984.

211/2. RUBUS SAXATILIS L. **43**, Rads.: Dol-berthog, Llandrindod Wells, GR 32/16.39. Cliff by R. Ithon. R. G. Woods, 1987. 2nd record.

†211/8. RUBUS SPECTABILIS Pursh *50, Denbs.: Llangollen, GR 33/19.43. Edge of canal. G. Spencer, 1988, det. A. Newton. 2nd Welsh record.

†211/10. RUBUS LOGANOBACCUS L. H. Bailey *44, Carms.: The Esplanade, Carmarthen, GR 22/41.20. Derelict ground. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton. 1st Welsh record.

211/11/2. RUBUS SCISSUS W. C. R. Watson *75, Ayrs.: Between Sorn and Muirkirk, GR 26/57.26. Rough pasture. A. McG. Stirling & A. Newton, 1987.

211/11/7. RUBUS FISSUS Lindley *75, Ayrs.: Sornhill, GR 26/51.34. Roadside. A.McG. Stirling & A. Newton, 1987.

211/11/77. RUBUS AMPLIFICATUS Lees *42, Brecs.: Llangoed, GR 32/11.40. Bank at edge of wood. M. Porter, 1982, **herb. M.P.**, det. A. Newton. *44, Carms.: Devanah Farm, Llangadog, GR 22/68.26. Laneside hedge. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

211/11/123. RUBUS CARDIOPHYLLUS P. J. Mueller & Lefèvre *44, Carms.: Marros Mountain, GR 22/20.08. Heath. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

211/11/133. RUBUS ROSSENSIS A. Newton *44, Carms.: Yet Wen, Whitland, GR 22/19.13. Roadside hedgerow. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

†211/11/139. RUBUS PROCERUS P. J. Mueller 'Himalayan Giant' *44, Carms.: Glanaman, GR 22/69.13. Wall. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

211/11/183. RUBUS DREJERI Jensen *77, Lanarks.: Forth & Clyde Canal north-east of Cadder, GR 26/61.72. Canal bank. G. H. Ballantyne *et al.*, 1982, **herb. P. Macpherson**, det. A. Newton.

211/11/212. RUBUS ECHINATUS Lindley *42, Brecs.: Priory Groves, Brecon, GR 32/04.29. Woodland glade. M. Porter, 1978, **herb. M.P.**, det. A. Newton.

211/11/221. RUBUS MICANS Gren. & Godron *44, Carms.: Pantcae Melyn, Gorslas, GR 22/57.14. Hedgerows. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

211/11/253. RUBUS INSECTIFOLIUS P. J. Mueller & Lefèvre *44, Carms.: Marros Mountain, GR 22/20.08. Dry heath. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

211/11/263. RUBUS SCABER Weihe & Nees *44, Carms.: Trevaughan Wood, GR 22/39.20. Woodland margin. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

211/11/284. RUBUS RUFESCENS P. J. Mueller & Lefèvre *44, Carms.: Llandingat Without, GR 22/77.32. Forestry track. A. D. Marshall & G. Hutchinson, 1986, **NMW**, det. A. Newton.

211/11/fle. RUBUS FLEXUOSUS P. J. Mueller & Lefèvre *44, Carms.: Glyn yr Henllan, GR 22/59.15. Wet roadside. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

221/11/moy. RUBUS MOYLEI Barton & Riddelsd. *44, Carms.: Dolaucothi, GR 22/66.40. Rocky roadside. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton.

211/11/vil. RUBUS VILLICAULIFORMIS A. Newton *42, Brecs.: Llangammarch Wells, GR 22/88.44. Lane-bank. M. Porter, 1978, **herb. M.P.**, det. A. Newton. *44, Carms.: Marros Mountain, GR 22/20.08. Dry heath. B.S.B.I. meeting, 1987, **NMW**, det. A. Newton. 1st and 2nd Welsh records.

†212/7. POTENTILLA RECTA L. 35, Mons.: Cwmsyfiog, GR 32/1.0. Landscaped coal tip. T. G. & U. T. Evans, 1988. 2nd record.

†212/9. POTENTILLA INTERMEDIA L. *93, N. Aberdeen: Turriff, GR 38/71.50. Disused railway yard. D. Welch, 1988, **ABD**.

212/13 str. POTENTILLA ERECTA (L.) Räuschel subsp. STRICTISSIMA (Zimm.) A. J. Richards *99, Dunbarton: Cove, Gare Loch, GR 26/2.8. Rocky shore. A.McG. Stirling, 1979. Faslane, Gare Loch, GR 26/2.8. Shingle shore. A.McG. Stirling & A. Rutherford, 1982. Both **E**, det. T. C. G. Rich. 1st and 2nd records.

220/3/2. ALCHEMILLA FILICAULIS Buser subsp. VESTITA (Buser) M. E. Bradshaw *45, Pembs.: Cwm Rhigian, west of Newport, GR 22/03.39. Flushed grassland. S. B. Evans & E. Gwynn, 1987.

220/3/9. ALCHEMILLA GLOMERULANS Buser **79**, Selkirks.: South side of R. Ettrick near Tushielaw, GR 36/30.16. Hayfield. R. W. M. Corner, 1988, **CGE**, det. S. M. Walters. 2nd record.

†220/3/12. ALCHEMILLA MOLLIS (Buser) Rothm. ***42**, Brecs.: Brecon, GR 32/05.27. Mud dredged from canal. M. Porter, 1987.

†224/ova. ACAENA OVALIFOLIA Ruiz & Pavón ***5**, S. Somerset: West Porlock, GR 21/86.47. Woodland. K. Jessup, 1981, det. A. C. Leslie.

225/1 × 10. ROSA ARVENSIS Hudson × R. OBTUSIFOLIA Desv. ***42**, Brecs.: Cwm Llwch, GR 32/01.26. Hedge. M. Porter, 1987, **herb. M.P.**, det. G. G. Graham. 1st Welsh record.

†225/3. ROSA MULTIFLORA Thunb. ***73**, Kirkcudbrights.: Calgow, GR 25/42.65. Hedge. O. M. Stewart, 1987. Between Kirkbride and Hollanbank, GR 25/48.55. Hedge. O. M. Stewart, 1988, **E**. 1st and 2nd records.

†225/5. ROSA RUGOSA Thunb. ***51**, Flints.: Gronant, GR 33/0.8. Well naturalized behind sand dunes. G. Wynne, 1983.

225/8 × 7. ROSA CANINA L. × R. STYLOSA Desv. ***7**, N. Wilts.: Ravensroost Wood, GR 41/02.88. Woodland edge. D. Green, 1987, **herb. D.G.**, det. G. G. Graham.

225/8 × 11. ROSA CANINA L. × R. TOMENTOSA Sm. ***7**, N. Wilts.: Hartham Park, GR 31/85.71. Downland. D. Green, 1987, **herb. D.G.**, det. G. G. Graham.

225/8 × cae. ROSA CANINA L. × R. CAESIA Sm. ***99**, Dunbarton: Ardmore Point, Helensburgh, GR 26/3.7. Hedge. A.McG. Stirling, 1978, det. G. G. Graham.

225/12. ROSA SHERARDII Davies ***99**, Dunbarton: Ardmore Point, Helensburgh, GR 26/3.7. Scrub. A. McG. Stirling, 1978, det. G. G. Graham as var. *woodsiana* (Groves & J. Groves) Wolley-Dod.

225/12 × afz. ROSA SHERARDII Davies × R. AFZELIANA Fries ***99**, Dunbarton: Kilpatrick Braes, GR 26/4.7. Hedge. A.McG. Stirling, 1978, det. G. G. Graham.

225/15 × afz. ROSA MICRANTHA Borrer ex Sm. × R. AFZELIANA Fries ***42**, Brecs.: Cwm Clydach, GR 32/21.12. Scrub on limestone. M. Porter, 1987, **herb. M.P.**, det. G. G. Graham. 1st Welsh record.

225/afz. ROSA AFZELIANA Fries ***99**, Dunbarton: Ardmore Point, Helensburgh, GR 26/3.7. Scrub. A.McG. Stirling, 1978, det. G. G. Graham as var. *glaucophylla* (Winch) Wolley-Dod.

225/cae. ROSA CAESIA Sm. ***99**, Dunbarton: Old Kilpatrick, GR 26/4.7. Scrub. A.McG. Stirling, 1978, det. G. G. Graham.

225/dum. ROSA DUMETORUM Thuill. ***99**, Dunbarton: Clyde-side near Old Kilpatrick, GR 26/4.7. Scrub. A.McG. Stirling, 1978, det. G. G. Graham as forma *semiglabra* (Rip. ex Déségl.) Wolley-Dod.

226/1 × †2. PRUNUS SPINOSA L. × P. DOMESTICA L. ***64**, Mid-W. Yorks.: Threshfield, GR 34/98.64. Woodland on limestone pavement. P. P. Abbott, 1988, det. A. C. Leslie.

†226/2b. PRUNUS DOMESTICA L. subsp. INSITITIA (L.) C. K. Schneider ***99**, Dunbarton: Duntocher, GR 26/51.72. Trackside. A.McG. Stirling, 1979.

†226/5. PRUNUS CERASUS L. **39**, Staffs.: Kinver Edge, GR 32/83.83. Rough grassland. W. A. Thompson, 1974. 1st post-1930 record.

†226/7. PRUNUS LAUROCERASUS L. ***77**, Lanarks.: Blackwood, GR 26/79.43. Waste ground. P. Macpherson & E. L. S. Lindsay, 1988.

†227/3. COTONEASTER HORIZONTALIS Decne ***42**, Brecs.: Brecon, GR 32/05.27. Bank of disused railway. M. Porter, 1987.

†227/4. COTONEASTER MICROPHYLLUS Wallich ex Lindley *11, S. Hants.: Butts Lawn, Brockenhurst, GR 41/29.03. Bank of drainage ditch on heath. P. V. J. Barker & R. P. Bowman, 1988, **herb. R.P.B.**, det. J. Fryer.

†227/5 × sal. COTONEASTER FRIGIDUS Wallich ex Lindley × C. SALICIFOLIUS Franch. *69, Westmorland: Grubbins Wood, Arnside, GR 34/44.78. M. Baecker, 1977, det. J. Fryer.

†227/acu. COTONEASTER ACUTIFOLIUS Turcz. *69, Westmorland: Red Hills Wood, Arnside, GR 34/45.78. M. Baecker, 1983, det. J. Fryer.

†227/aff. COTONEASTER AFFINIS Lindley *11, S. Hants.: Hurn Forest, GR 41/10.01. Edge of ride in conifer plantation. R. P. Bowman & R. M. Walls, 1985, **herb. R.P.B.**, det. A. L. Grenfell.

†227/bul. COTONEASTER BULLATUS Boiss. *69, Westmorland: Grubbins Wood, Arnside, GR 34/44.78. M. Baecker, 1977, det. J. Fryer.

†227/cong. COTONEASTER CONGESTUS Baker *11, S. Hants.: Mogshade Hill, GR 41/23.09. Roadside bank. R. P. Bowman, 1988, **herb. R.P.B.**, det. J. Fryer.

†227/cons. COTONEASTER CONSPICUUS Marquand *17, Surrey: Chertsey, GR 41/9.6. Roadside verge. J. F. Leslie, K. Page & J. E. Smith, 1988.

†227/fra. COTONEASTER FRANCHETII Boiss. *69, Westmorland: Arnside, GR 34/45.79. Railway embankment. M. Baecker, 1977. South-east of Dalton-in-Furness, GR 34/23.74. Limestone wall. P. Burton, 1987, **LANC**. 1st and 2nd records, both det. J. Fryer. *99, Dunbarton: Helensburgh, GR 26/29.82. Rough ground. A. Rutherford, 1978, det. C. D. Brickell.

†227/ste. COTONEASTER STERNIANUS (Turrill) Boom *69, Westmorland: Grubbins Wood, Arnside, GR 34/44.78. M. Baecker, 1977, det. J. Fryer.

229/1. CRATAEGUS LAEVIGATA (Poiret) DC. *46, Cards.: Allt Pantybeudy, Llangeitho, GR 22/63.61. Oakwood. G. Saunders, 1988. *47, Monts.: Afon Garno Bridge near Caersws, GR 32/02.91. Roadside hedge. M. Wainwright, 1988, det. I. C. Trueman. B4393 road near Pont Ysgadan, GR 33/08.17. Wooded roadside. M. Wainwright, 1988, det. P. M. Benoit. 1st and 2nd records.

229/1 × 2. CRATAEGUS LAEVIGATA (Poiret) DC. × C. MONOGYNA Jacq. *6, N. Somerset: Weston-super-Mare, GR 31/34.61. Hedge. R. S. Cropper, 1987.

232/5/7. SORBUS RUPICOLA (Syme) Hedl. *67, S. Northumb.: R. South Tyne, south of Williamston Bridge, GR 35/68.51. River-bank. A. J. Richards, 1988, **herb. G.A. Swan**, det. P. J. M. Nethercott.

235/1. SEDUM ROSEA (L.) Scop. *78, Peebless.: Talla Craig, GR 36/15.18. Rocky cliffs. E.H. & D.J. McCosh, 1988.

†235/3. SEDUM SPURIUM Bieb. *80, Roxburghs.: North of Bedrule, GR 36/60.19. Edge of roadside woodland. R. W. M. Corner, 1988, **herb. R.W.M.C.**

†237/hel. CRASSULA HELMSII (T. Kirk) Cockayne *27, E. Norfolk: Whitlingham, GR 63/26.08. Ditch. E. T. Daniels, 1988. 34, W. Gloucs.: Jugshole Pool, east of Coleford, GR 32/58.10. Edge of acidic pool. S. C. Holland, 1988. 2nd record. *42, Brecs.: Talgarth, GR 32/15.33. Garden pond. R. G. Woods, 1986. *44, Carms.: Wern Fendigaid, GR 22/63.45. Pond. I. K. Morgan, 1987. 59, S. Lancs.: Near Pinfold Cottages, Ainsdale, GR 34/30.11. Large pond. V. Gordon, 1988. 2nd record. *69, Westmorland: Dawres House, Bampton Grange, GR 35/5.1. Pond. D. M. McClintock, 1986. *70, Cumberland: Silecroft, GR 34/12.80. Small pond. R. Jerrams, 1988. *H38, Co. Down: Glastry Clay Pits, GR 33/63.63. R. Weyl, 1985.

239/14. SAXIFRAGA ROSACEA Moench †*6, N. Somerset: Windsor Hill, GR 31/61.45. Disused railway track. N. Vaughan-Davies, 1983, det. D. A. Webb.

†240/1. TELLIMA GRANDIFLORA (Pursh) Douglas ex Lindley *80, Roxburghs.: Overhall, GR 36/48.14. Roadside woodland. R. W. M. Corner, 1986, **herb. R.W.M.C.**

†241/1. TOLMIEA MENZIESII (Pursh) Torrey & A. Gray *46, Cards.: Afon Mydyr N.N.E. of Felin Rhiwbren, GR 22/47.57. Stream-bank in wood. A. O. & M. Chater, 1988, **NMW**.

†ASTILBE RIVULARIS Buch.-Ham. ex D. Don *101, Kintyre: Near Meall Mhor house, GR 16/86.74. Ravine and sides of forest road. A. G. Kenneth, 1987, det. J. M. Mullin.

†DARMERA PELTATA (Torrey) Voss *70, Cumberland: R. Eden, Nunnery Walks, Staffield, GR 35/52.43. Riverside. R. W. M. Corner, 1987, **LANC.**

246/3. RIBES NIGRUM L. †*99, Dunbarton: Kilmardinny Loch, Bearsden, GR 26/54.73. Damp shore of loch. A.McG. Stirling, 1979.

247/1 × 2. DROSERA ANGLICA Hudson × D. ROTUNDIFOLIA L. *73, Kirkcudbrights.: Silver Flowe, GR 25/47.83. Bog. O. M. Stewart, 1988, **E**.

247/3. DROSERA INTERMEDIA Hayne *42, Brecs.: Onllwyn, GR 22/82.11. Blanket bog. R. G. Woods, 1984. Site destroyed, 1985. Gorsllwyn near Coelbren, GR 22/85.11. Bog. R. G. Woods, 1987. 1st and 2nd records.

251/2. DAPHNE LAUREOLA L. *42, Brecs.: Cantref, GR 32/05.25. Deciduous wood. M. Porter, 1987. †73, Kirkcudbrights.: Near New Bridge, GR 25/94.79. Wood. O. M. Stewart, 1988. Only extant locality.

254/†6 × 9. EPILOBIUM CILIATUM Raf. × E. OBSCURUM Schreber *73, Kirkcudbrights.: Burnfoot, GR 25/74.44. Waste ground. O. M. Stewart, 1986.

†256/nov. OENOTHERA NOVAE-SCOTIAE Gates *70, Cumberland: Silloth, GR 35/10.53. Docks. A. Cannell, 1986, **LANC**, det. J. C. Bowra.

†259/aqu. MYRIOPHYLLUM AQUATICUM (Velloso) Verdcourt *45, Pembs.: Porthiddy, Abereiddy, GR 12/80.30. Irrigation reservoir. J. W. Donovan, 1983. Still present in 1986.

262/2. CALLITRICHE PLATYCARPA Kütz. 73, Kirkcudbrights.: R. Tarff, High Bridge of Tarff, GR 25/68.56. N. F. Stewart, 1988. 2nd record.

262/4. CALLITRICHE HAMULATA Kütz. ex Koch 83, Midlothian: Threipmuir Reservoir, GR 36/16.63. S. Hendry, 1988, **E**, det. D. R. McKean. 2nd extant locality.

†271/1. ASTRANTIA MAJOR L. 79, Selkirks.: R. Ettrick below Annelshope, GR 36/30.16. Riverbank. R. W. M. Corner, 1988, **herb. R.W.M.C.** 1st post-1930 record.

†280/1. SMYRNIUM OLUSATRUM L. 7, N. Wilts.: Lockeridge, GR 41/15.67. J. Oliver, 1987. 1st record since 1896.

285/4. APIUM INUNDATUM (L.) Reichenb. fil. *104, N. Ebudes: An t-Oban, Sanday, GR 18/28.04. Mud at edge of artificial lochan. H. J. B. Birks & C. W. Murray, 1984, **herb. C.W.M.**

291/1. CARUM VERTICILLATUM (L.) Koch *104, N. Ebudes: West of Sligachan Hotel, GR 18/48.29. Gravel at edge of burn. G. D. Field, 1984, **herb. C.W. Murray**.

294/1. PIMPINELLA SAXIFRAGA L. 103, Mid Ebudes: Cornaigbeg, Coll, GR 17/23.62. Roadside grassland. B. Brookes, 1988. 1st Coll record.

300/2. OENANTHE PIMPINELLOIDES L. *35, Mons.: Tynewydd, GR 31/2.9. Grassy verge. T. G. Evans, 1985, **NMW**.

300/5. OENANTHE CROCATA L. *111, Orkney: Swanbister Bay, GR 57/36.05. Amongst *Phalaris arundinacea*. C. Turner, 1988.

301/1. AETHUSA CYNAPIUM L. **H39**, Co. Antrim: Carnlough, GR 34/27.18. Hedgerow, S. Beesley, 1987. Joymount, Carrickfergus, GR 33/41.87. S. Beesley, 1987. Only extant localities.

319/10. EUPHORBIA PEPLUS L. *98, Main Argyll: Dunbeg Housing Estate, Oban, GR 17/88.33. Side of footpath. B. H. Thompson, 1988, **herb. B.H.T.**, conf. H. J. Noltie. 1st localized record.

†319/15. EUPHORBIA ESULA L. sens. lat. **5**, S. Somerset: Hinkley Point, GR 31/19.45. Arable land. R. E. Daniels, 1985. 2nd record.

319/16. EUPHORBIA CYPARISSIAS L. †***35**, Mons.: Beaufort, GR 32/1.1. Bank of R. Sirhowy. R. Fraser, 1987, **herb. T. G. Evans.** †**70**, Cumberland: Wheyrigg, GR 35/18.48. Old lane. M. Porter, 1987, **LANC**. 1st post-1930 record.

320/1/3. POLYGONUM RURIVAGUM Jordan ex Boreau **26**, W. Suffolk: Session Heath, Brandon, GR 52/79.84. Forest ride. M. G. Rutterford & P. J. O. Trist, 1988, det. J. R. Akeroyd. 1st confirmed post-1930 record.

320/1/are. POLYGONUM ARENASTRUM Boreau ***H8**, Co. Limerick: Cahir Guillamore, GR 11/60.40. Farm track. South-east of Broadford, GR 11/32.18. Both S. Reynolds, 1987, **DBN**. 1st and 2nd records.

320/6. POLYGONUM BISTORTA L. †**103**, Mid Ebudes: Farm, Ulva, GR 17/44.39. Roadside waste ground. J. W. Clark, 1988. 1st record since 1879.

†320/7. POLYGONUM AMPLEXICAULE D. Don ***60**, W. Lancs.: St Annes, GR 34/32.29. Sandy waste ground. J. Maudsley, 1962, **LTR**, det. A. P. Conolly & C. A. Stace.

320/12 × 9. POLYGONUM HYDROPIPER L. × P. PERSICARIA L. ***48**, Merioneth: Cynwyd, GR 33/0.4. Marshy edge of pool. P. M. Benoit, 1987, **NMW**. One plant. 1st Welsh record.

†320/19 × 20. REYNOUTRIA JAPONICA Houtt. × R. SACHALINENSIS (Friedrich Schmidt Petrop.) Nakai ***6**, N. Somerset: Rownham, Long Ashton, GR 31/56.72. Sides of towpath. A. C. Leslie, 1987, det. J. Bailey.

†320/22. POLYGONUM CAMPANULATUM Hooker fil. **49**, Caerns.: Rowen, GR 23/75.71. Rocks in Afon Roe. R. Lewis, 1987, **NMW**, det. R. G. Ellis. 2nd record.

†320/pen. POLYGONUM PENSYLVANICUM L. ***46**, Cards.: Mwnt, GR 22/19.52. Arable field. A. O. Chater, 1988, **NMW**, det. J. R. Akeroyd & D. H. Kent.

325/4. RUMEX HYDROLAPATHUM Hudson **73**, Kirkcudbrights: Near Dalbeattie, GR 25/82.61. Damp area in field. O. M. Stewart, 1988. 2nd record.

325/8. RUMEX LONGIFOLIUS DC. ***103**, Mid Ebudes: Road between Pennyghael and Carsaig, GR 17/53.23. Roadside verge. A.McG. Stirling & J. W. Clark, 1984, **E.**

325/8 × 12. RUMEX LONGIFOLIUS DC. × R. OBTUSIFOLIUS L. ***77**, Lanarks.: Newbigging, GR 36/02.44. Gravel pit. O. M. Stewart, 1987, **herb. P. Macpherson**, det. D. H. Kent.

325/18. RUMEX MARITIMUS L. ***35**, Mons.: Tredegar Park, Newport, GR 31/2.8. Disturbed bank of drainage ditch. G. Hutchinson, 1988, **NMW.**

†325/rug. RUMEX RUGOSUS Campd. ***25**, E. Suffolk: Landguard Common, GR 62/28.32. Roadside shingle. F. W. Simpson, 1988, det. J. R. Akeroyd.

†327/1. SOLEIROLIA SOLEIROLII (Req.) Dandy **103**, Mid Ebudes: Gometra House, Gometra, GR 17/35.40. Steps of unoccupied house. M. Jones, 1988, **E**. 1st Mull record.

342/4. POPULUS NIGRA L. ***49**, Caerns.: Tyn-y-Groes, GR 23/77.71. Hedgerow. Between Pontwgan and Llanbedr-y-Cennin, GR 23/76.70. Hedgerow. Both R. Lewis, 1987. 1st and 2nd records.

†342/6. POPULUS GILEADENSIS Rouleau ***77**, Lanarks.: Dalton, GR 26/67.58. Old coal bing. P. Macpherson, 1987, **E**, det. D. R. McKean.

343/6 × 9. SALIX PURPUREA L. × S. VIMINALIS L. ***42**, Brecs.: Llanhamlach, GR 32/09.26. River-bank. M. Porter, 1987, det. R. D. Meikle.

343/12a. SALIX CINEREA L. subsp. CINEREA ***42**, Brecs.: Near Llandeilo'r-Fan, GR 22/88.39. Margin of upland fen. M. Porter, 1987, det. R. D. Meikle. 1st Welsh record.

343/12b × 15. SALIX CINEREA L. subsp. OLEIFOLIA Macreight × S. PHYLICIFOLIA L. ***77**, Lanarks.: Glespin Burn, Douglas, GR 26/81.27. Bank of burn. R. C. L. Howitt, 1979, **herb. P. Macpherson**, det. R. D. Meikle.

343/13 × 15. SALIX AURITA L. × S. PHYLICIFOLIA L. ***75**, Ayrs.: R. Doon, Dalmellington, GR 26/4.0. Damp ground. O. M. Stewart, 1976, **E**, det. R. C. L. Howitt.

343/14. SALIX MYRSINIFOLIA Salisb. **73**, Kirkcudbrights.: Torrs Moss, GR 25/78.62. Mixed sedge fen. N. F. Stewart, 1988. 2nd record. ***93**, N. Aberdeen: Cabrach, GR 38/38.26. Rocky river-bank. D. Welch, 1988, **ABD**, det. R. D. Meikle.

343/15. SALIX PHYLICIFOLIA L. **81**, Berwicks.: Longmuir Moss, GR 36/47.50. Fen. M. E. & P. F. Braithwaite & D. R. McKean, 1988, **herb. M.E.B.** Only extant locality.

343/16b. SALIX REPENS L. subsp. ARGENTEA (Sm.) G. & A. Camus ***42**, Brecs.: Cwmgeidd, GR 22/77.11. Moorland. M. Porter, 1973, det. R. D. Meikle.

†345/2. RHODODENDRON LUTEUM Sweet ***50**, Denbs.: Coed Cerrig y Wyallt near Talycafn, GR 23/78.70. Wet ground in wood. R. Lewis, 1988. ***99**, Dunbarton: Finnart, Loch Long, GR 26/23.93. Roadside verges. M. Mackay, 1971, still present in 1984 as very extensive colonies.

350/1. ANDROMEDA POLIFOLIA L. **43**, Rads.: North of Drysgol, St. Harmon, GR 22/94.75. Blanket bog. I. D. Soane, 1987. 2nd record.

†351/1. GAULTHERIA SHALLON Pursch ***41**, Glam.: Gnoll House, Neath, GR 21/76.97. Moorland cleared of *Rhododendron*. J. C. Watkins, 1988, **NMW**, det. R. G. Ellis.

357/8. ERICA VAGANS L. †**50**, Denbs.: Rhyd y Foel near Llandulas, GR 23/91.77. Edge of limestone cliff. P. Day, 1988. 2nd record.

358/3. VACCINIUM ULIGINOSUM L. ***78**, Peebless.: Talla Craig, GR 36/15.18. Rock ledge. D. J. & E. H. McCosh, 1988, **herb. D.J. McC.**

358/4. VACCINIUM OXYCOCCOS L. **104**, N. Ebudes: Lochan Doiragat, GR 18/65.11. On *Sphagnum* at edge of lochan. A. Currie & D. Gilbert, 1988, **herb. C.W. Murray**. 2nd record for Skye.

†367/flo. PRIMULA FLORINDAE Ward ***81**, Berwicks.: Littlecleugh Burn, Redheugh, GR 36/82.70. Burnside flush. M. E. Braithwaite, 1981, det. A. C. Leslie. Still present in 1988.

†370/5. LYSIMACHIA PUNCTATA L. **47**, Monts.: B4393 near Pont Ysgadan, GR 33/08.17. Wooded roadside. M. Wainwright, 1988, det. P. M. Benoit. 2nd record.

372/4. ANAGALLIS MINIMA (L.) E. H. L. Krause **26**, W. Suffolk: Roper's Heath, Tuddenham, GR 52/75.72. Hollow. D. E. Coombe, 1988, **CGE**. Only extant locality.

379/1. VINCA MINOR L. †***99**, Dunbarton: Helenburgh, GR 26/30.83. Steep embankment. R. R. Mill, 1971. Still present in 1983.

†379/2. VINCA MAJOR L. **99**, Dunbarton: Kilcreggan, GR 26/24.80. Bank above sea. C. Luckwell & M. Thornton, c. 1972. 2nd record.

382/4. CENTAURIUM ERYTHRAEA Rafn ***96**, Easterness: Lower Foyers, GR 28/49.21. Grassland. M. Barron, 1988. 1st localized record.

382/6. CENTAURIUM LITTORALE (D. Turner) Gilmour **98**, Main Argyll: Island Add Bridge, Bellanoch, GR 16/80.92. Saltmarsh grazings. A. G. Kenneth, 1986, **herb. B.H. Thompson.** 1st post-1930 record.

387/1. NYMPHOIDES PELTATA (S. G. Gmelin) Kuntze †***70**, Cumberland: Silecroft, GR 34/12.80. Pond. R. Jerrams, 1987. Broughton Moor, GR 35/04.32. Roadside ditch. A. Dudman & C. C. Haworth, 1988, **LANC**. 1st and 2nd records.

388/1. POLEMONIUM CAERULEUM L. †**73**, Kirkcudbrights.: Near Ballochanamour Wood, GR 25/48.58. Roadside verge. O. M. Stewart, 1988. 1st post-1930 record.

†394/1. TRACHYSTEMON ORIENTALIS (L.) G. Don *80, Roxburghs.: A68 south of Jedburgh, GR 36/65.19. Roadside. R. W. M. Corner, 1988, **E**, det. D. R. McKean.

400/4 × 1. MYOSOTIS CAESPITOSA K. F. Schultz × M. SCORPIOIDES L. *70, Cumberland: Frizington, GR 35/02.15. Marshy field. C. C. Haworth, 1986, **LANC**, det. P. M. Benoit.

400/7. MYOSOTIS SYLVATICA Hoffm. †49, Caerns.: Hafoty Gwyn, GR 23/74.70. Waste ground. R. Lewis, 1987, **NMW**. 2nd record, 1st since 1876.

400/10. MYOSOTIS RAMOSISSIMA Rochel 99, Dunbarton: Between Milton and Dumbuck, GR 26/42.74. Dry bank. A.McG. Stirling & A. Rutherford, 1988, **GL**. 2nd record.

†AMSINCKIA MICRANTHA Sudsk. *13, W. Sussex: West of Coates Common, GR 41/99.17. Maize field. A. G. Knapp, 1988, **BM**, det. J. M. Mullin.

402/1. MERTENSIA MARITIMA (L.) S. F. Gray 103, Mid Ebudes: Aird Mor Bay, GR 17/99.47. Grassy shore. B. Rae, 1988, confirmed from photograph by J. W. Clark. 1st record from Tiree this century.

†406/2. CALYSTEGIA PULCHRA Brummitt & Heywood 103, Mid Ebudes: Gallanach, GR 17/21.60. Garden wall. J. W. Clark, 1988. 1st Coll record.

406/4. CALYSTEGIA SOLDANELLA (L.) R.Br. 67, S. Northumb.: North of mouth of Chevington Burn, GR 45/27.98. Sand dune. C. C. E. Douglas, 1988, conf. G. A. Swan. 2nd record.

†413/3 sch. SOLANUM NIGRUM L. subsp. SCHULTESII (Opiz) Wessely *26, W. Suffolk: Lakenheath, GR 52/71.81. J. Partridge, 1988.

†413/4. SOLANUM SARRACHOIDES Sendtner *64, Mid-W. Yorks.: Thorpe Willoughby, GR 44/58.30. Arable field. P. P. Abbott & M. Bradbrook, 1988.

†416/3. VERBASCUM PHLOMOIDES L. *77, Lanarks.: Bellahouston, GR 26/55.63. P. Macpherson, 1987, **herb. P.M.**, det. A. C. Leslie.

420/3 × 4. LINARIA REPENS (L.) Miller × L. VULGARIS Miller *83, Midlothian: Granton Gas Works, Edinburgh, GR 36/22.76. Railway track. D. R. McKean & S. Hendry, 1988, **E**.

422/1. KICKXIA SPURIA (L.) Dumort. †*43, Rads.: South of Penylan Wood, Clyro, GR 32/20.44. Lay-by. R. G. Woods, 1988.

†424/5. SCROPHULARIA VERNALIS L. *38, Warks.: Walton, GR 42/30.53. Woodland. R. Langdon, 1988, **WAR**, det. P. J. Copson. Walton, GR 42/28.52. Trackside. H. A. Roberts & J. M. Turner, 1988. 1st and 2nd records.

†425/3. MIMULUS MOSCHATUS Douglas ex Lindley 50, Denbs.: Whitewell, GR 33/48.41. Edge of permanent pasture. N.C.C. pond survey, 1979. 2nd localized record.

†425/1 × cup. MIMULUS CUPREUS Regel × M. GUTTATUS DC. *64, Mid-W. Yorks.: Conistone, GR 34/98.65. River-bank. P. P. Abbott & T. G. Evans, 1988.

426/1. LIMOSELLA AQUATICA L. *43, Rads.: Common north of Pen-y-graig Farm, GR 32/10.45. Ephemeral pool. R. G. Woods, 1988. *73, Kirkcudbrights.: Tongland Loch by R. Dee, GR 25/71.57. Mud on draw-down zone. O. M. & N. F. Stewart, 1988, **E**. R. Dee north-east of Tongland, GR 25/70.54. Dried mud by river. O. M. & N. F. Stewart, 1988. 1st and 2nd records.

427/1. SIBTHORPIA EUROPAEA L. †*103, Mid Ebudes: Gruline Estate, Mull, GR 17/54.39. Pathside in policy wood. A. Walker, 1988, **GL**.

430/2 × 3. VERONICA ANAGALLIS-AQUATICA L. × V. CATENATA Pennell *25, E. Suffolk: R. Alde, Langham Bridge, GR 62/37.58. Damp riverside. J. M. Croft & C. D. Preston, 1988, **CGE**, det. S. M. Walters.

†430/9. VERONICA LONGIFOLIA L. *77, Lanarks.: Ruchill, GR 26/58.68. Grassy area. P. Macpherson, 1988, **herb. P.M.**

†430/14. VERONICA PEREGRINA L. *80, Roxburghs.: Appletreehall House, GR 36/51.17. Driveway. M. E. Braithwaite, 1988, **herb. R.W.M. Corner**.

430/20 hed. VERONICA HEDERIFOLIA L. subsp. HEDERIFOLIA *80, Roxburghs.: Bairnkine, GR 36/65.15. Arable field. M. E. Braithwaite, 1988, **herb. R.W.M. Corner**.

435/1/1 × 13. EUPHRASIA MICRANTHA Reichenb. × E. NEMOROSA (Pers.) Wallr. *42, Brecs.: Pont-ar-hydfer, GR 22/84.26. Damp heathy pasture. M. Porter, 1981, **herb. M.P.**, det. A. J. Silverside.

435/1/13 × 16. EUPHRASIA NEMOROSA (Pers.) Wallr. × E. PSEUDOKERNERI Pugsley *7, N. Wilts.: Knap Hill, GR 41/12.63. Chalk downland. K. Payne, 1986, det. A. J. Silverside.

435/1/14. EUPHRASIA HESLOP-HARRISONI Pugsley *103, Mid Ebudes: East of Breachacha Castle, Coll, GR 17/16.54. Upper saltmarsh, on banks of drainage channels. H. J. Noltie, 1987, **E**, det. A. J. Silverside.

435/1/15 × 1. EUPHRASIA CONFUSA Pugsley × E. MICRANTHA Reichenb. *5, S. Somerset: Corner's Gate, Withypoole, GR 21/86.35. Moorland roadside bank. A. J. Silverside, 1982.

435/1/16. EUPHRASIA PSEUDOKERNERI Pugsley *46, Cards.: Mwldan valley, Penparc, GR 22/20.48. Calcareous flush. A. O. Chater, 1986, **NMW**, det. P. F. Yeo as f. *elongata* Pugsley.

435/1/17. EUPHRASIA ARCTICA Lange ex Rostrup subsp. BOREALIS (Townsend) Yeo *12, N. Hants.: Winnall Moors N. R., Winchester, GR 41/48.30. Path by stream. R. P. Bowman, 1985, **herb. R.P.B.**, det. A. J. Silverside.

435/1/17 × 1. EUPHRASIA ARCTICA Lange ex Rostrup × E. MICRANTHA Reichenb. *42, Brecs.: Llanafan-fawr, GR 22/94.55. Hay meadow. M. Porter, 1978, **herb. M.P.**, det. A. J. Silverside.

435/1/17 × 15. EUPHRASIA ARCTICA Lange ex Rostrup × E. CONFUSA Pugsley *42, Brecs.: Llangammarch Wells, GR 22/90.44. Hay meadow. M. Porter, 1981, **herb. M.P.**, det. A. J. Silverside. 1st Welsh record.

435/1/17 × 19. EUPHRASIA ARCTICA Lange ex Rostrup × E. ROSTKOVIANA Hayne *42, Brecs.: Coelbren, GR 22/86.12. Heathy field. M. Porter, 1980, **herb. M.P.**, det. A. J. Silverside. 1st confirmed Welsh record.

†439/2. LATHRAEA CLANDESTINA L. **2**, E. Cornwall: Wareham Woods, Trecombe, GR 20/38.78. Bank of R. Tamar. M. & Tony Atkinson, 1988. 2nd record.

[440/4. OROBANCHE ALBA Stephan ex Willd. **6**, N. Somerset: Delete record published in *Watsonia* **16**: 191 (1986), now believed to be an error for *O. minor* Sm.]

440/8. OROBANCHE MINOR Sm. *39, Staffs.: Kinver, GR 32/83.83. Sandy grassland. W. A. Thompson, 1976. Lower Penn, GR 32/86.96. Disused railway cutting. P. Hodgson, 1980. 1st and 2nd records. **42**, Brecs.: Llangynidr, GR 32/16.19. On *Trifolium repens* M. Porter, 1986. 2nd record, 1st since 1800.

440/9. OROBANCHE LORICATA Reichenb. *13, W. Sussex: Bank of R. Adur by Coombes Farm, GR 51/19.08. V. Johnstone, 1984, det. from photograph in **RNG** by F. J. Rumsey.

440/10. OROBANCHE HEDERAE Duby †11, S. Hants.: Winchester, GR 41/48.29. *Hedera* at foot of garden wall. Lady Anne Brewis, 1988, **herb. R.P. Bowman**, det. D. J. Hambler. Only extant locality. †*59, S. Lancs.: Calderstones Park, Liverpool, GR 33/40.87. Foot of *Hedera*-covered wall. E. Hardy, 1984.

442/1. UTRICULARIA VULGARIS L. *44, Carms.: Pendine, GR 22/30.07. Drainage ditch in sand dunes. R. G. Ellis, 1988, **NMW**.

442/och. UTRICULARIA OCHROLEUCA R. Hartman *101, Kintyre: Near An Creachan, GR 16/80.77. Swamp. A. G. Kenneth, 1987, **K**, det. P. Taylor.

†445/5 × 6. MENTHA SPICATA L. × M. LONGIFOLIA (L.) Hudson *70, Cumberland: Orton Rigg, GR 35/3.5. Wet roadside. R. E. Groom, 1982, **LANC**, det. R. M. Harley.

†461/arg. GALEOBDOLON ARGENTATUM Smejkal *43, Rads.: Gellicadwgan, GR 32/06.51. Bank of Cnithio Brook. R. G. Woods, 1987. 1st Welsh record. *49, Caerns.: Disused railway track near Caernarfon, GR 23/48.63. Coarse ballast. R. H. Roberts, 1987, det. A. McG. Stirling & A. Rutherford. *69, Westmorland: Scroggs Wood, Kendal, GR 34/51.90. Sedburgh Road, Kendal, GR 34/54.91. Both C. E. Wild, 1986, det. A. Rutherford. 1st and 2nd records. *70, Cumberland: Millbeck, GR 35/25.26. Roadside hedge. E. E. Marper, 1986. South-west of Dunbar, GR 35/39.50. Roadside copse. R. E. Groom, 1987, **LANC.** 1st and 2nd records, both det. A. Rutherford. *73, Kirkcudbrights.: Bar of Barlay, GR 25/60.58. O. M. Stewart, 1985.

462/2. LAMIUM MOLLUCELLIFOLIUM Fries *104, N. Ebudes: Kilmarie, GR 18/55.17. Shingle above shore. M. Gregory, 1985, **herb. C.W. Murray**, det. D. R. McKean. 1st definite Skye record.

462/3. LAMIUM HYBRIDUM Vill. *47, Monts.: Llanymynech Golf Course, GR 33/26.21. Dumped soil. P. M. Benoit & M. Wainwright, 1988, **NMW**.

†462/6. LAMIUM MACULATUM L. 99, Dunbarton: Ardenconnel Woods, Rhu, GR 26/26.84. Waste ground. A.McG. Stirling & A. Rutherford, 1972. 1st post-1930 record.

465/1. GALEOPSIS ANGUSTIFOLIA Ehrh. ex Hoffm. 40, Salop: Jones's Rough N.R., Nant Mawr, GR 33/24.24. Foot of limestone scree. C. Johnson, 1987, det. P. M. Benoit. 1st post-1930 record.

469/1. SCUTELLARIA GALERICULATA L. 103, Mid Ebudes: Between W. Hynish and Hynish, GR 07/97.38. *Iris pseudacorus* bed near shore. L. Farrell & R. Scott, 1988. 1st record from Tiree.

472/2. PLANTAGO MEDIA L. 46, Cards.: Ciliau Aeron chapel graveyard, GR 22/49.58. Mown grass. A. O. Chater, 1988. Only extant locality.

472/5. PLANTAGO CORONOPUS L. 7, N. Wilts.: Spye Park, GR 31/96.67. Track. D. Green, 1987. Only extant locality. *47, Monts.: Mouth of Afon Llyfnant, GR 22/69.97. Gravelly bank of tidal river. P. M. Benoit, 1987, **NMW**.

475/2. CAMPANULA TRACHELIUM L. †77, Lanarks.: Craigton, GR 26/54.64. Waste ground. P. Macpherson, 1988. 2nd record.

†475/4. CAMPANULA LACTIFLORA Bieb. *69, Westmorland: Goody Bridge, Grasmere, GR 35/33.08. Frequent on lanesides. G. Halliday, 1987, **LANC**, det. D. H. Kent & J. M. Mullin.

†475/5. CAMPANULA PERSICIFOLIA L. 83, Midlothian: Warriston cemetery, GR 36/25.75. Dense grass by railway. S. Hendry, 1988, det. D. R. McKean. 2nd record.

†475/por. CAMPANULA PORTENSCHLAGIANA Schultes *99, Dunbarton: Ardoch Farm, Cardross, GR 26/36.76. Verge. A.McG. Stirling & A. Rutherford, 1983.

485/3 × 4. GALIUM MOLLUGO L. × G. VERUM L. *83, Midlothian: Fountainhall, GR 36/42.49. Road cutting. M. Little, 1981, **E**, det. D. R. McKean.

494/2. VALERIANELLA CARINATA Loisel. †*78, Peebless.: Walkerburn, GR 36/35.37. Bank above car park. M. E. Braithwaite, 1988, **herb. D.J. McCosh**, det. D. J. McCosh. †*H8, Co. Limerick: South of Coolcappagh, GR 11/30.40. S. Reynolds, 1987, **DBN**.

494/5. VALERIANELLA DENTATA (L.) Pollich 2, E. Cornwall: Near Polzeath, GR 10/95.79. Barley field. T. J. Dingle, 1988. Only extant locality.

502/1. BIDENS CERNUA L. *96, Easterness: Near Aviemore, GR 28/8.0. Margin of loch. E. Charter *et al.*, 1988.

502/2. BIDENS TRIPARTITA L. 67, S. Northumb.: Holywell Pond, GR 45/32.75. Marsh at edge of pond. O. L. Gilbert, 1968. 1st record this century.

†HELIANTHUS RIGIDUS (Cass.) Desf. *70, Cumberland: Silloth, GR 35/10.52. Well naturalized by sand-dunes. M. Armstrong, 1986, **LANC**.

†503/1. GALINSOGA PARVIFLORA Cav. *26, W. Suffolk: Broomhouse Farm, Wangford, GR 52/75.83. Dump of waste soil. M. G. Rutterford & P. J. O. Trist, 1988. *68, Cheviot: Holy Island village, GR 46/12.42. Roadside. G. A. & M. Swan, 1988, **herb. G.A.S.**

506/2 × 1. SENECIO AQUATICUS Hill × S. JACOBAEA L. *47, Monts.: R.Dyfi S.S.E. of Pennal, GR 22/70.99. Marsh by river. P. M. Benoit, 1987, **NMW**.

506/3. SENECIO ERUCIFOLIUS L. †77, Lanarks.: Meadowside, Partick, GR 26/54.66. Waste ground by disused railway. A. McG. Stirling, 1988, **GL**. 2nd record, 1st this century.

506/5. SENECIO CAMBRENSIS Rosser *83, Midlothian: Leith Docks, GR 36/27.76. Waste ground. O. M. Stewart, 1974, **E**, det. H. J. Noltie. Carron Place, Leith, GR 36/27.76. Waste ground. H. J. Noltie, 1986, **E**.

†506/13. SENECIO FLUVIATILIS Wallr. **73**, Kirkcudbrights.: Gribdae, GR 25/73.50. Field edge. O. M. Stewart, 1988. 1st post-1930 record.

†509/2. PETASITES ALBUS (L.) Gaertner **44**, Carms.: Dryslwyn Uchaf, GR 22/55.20. Lane bank. D. Smith, 1988, det. R. D. Pryce. 2nd record.

†509/3. PETASITES JAPONICUS (Siebold & Zucc.) Maxim. *2, E. Cornwall: Innyfoot, GR 20/37.77. Woodland. S. C. & P. S. Madge, 1988. *59, S. Lancs.: Near Bardsley Bridge, GR 34/93.01. M. Newton, 1987. *77, Lanarks.: Shieldhill, GR 36/00.40. Streamside. M. M. Allan, 1959, **herb. P. Macpherson**, still present in 1988.

†509/4. PETASITES FRAGRANS (Vill.) C. Presl *77, Lanarks.: Cathkin, GR 26/62.58. Roadside. P. Macpherson, 1988, **herb. P.M.** 1st localized record.

†512/1. INULA HELENIUM L. **93**, N. Aberdeen: Craig, GR 38/47.24. Streamside in gorge. D. Welch, 1987, **ABD**. 2nd record and only extant locality.

514/5. FILAGO MINIMA (Sm.) Pers. **51**, Flints.: Near Flint Castle, GR 33/24.73. Waste ground. P. Day, 1988. 1st post-1930 record.

†519/9. ASTER LANCEOLATUS Willd. × A. NOVI-BELGII L. *5, S. Somerset: Ford Gate, North Petherton, GR 31/32.32. Roadside. I. P. Green, 1987, det. A. C. Leslie. *77, Lanarks.: Shieldhall, GR 26/53.65. Waste ground. P. Macpherson, 1985, **herb. P.M.**, det. P. F. Yeo.

520/1. ASTER LINOSYRIS (L.) Bernh. **45**, Pembs.: Linney Head, GR 11/89.95. Exposed limestone sea-cliff. C. Gillham, 1986, **NMW**, det. S. B. Evans. 2nd record.

†522/1. CONYZA CANADENSIS (L.) Cronq. *47, Monts.: Trefeglwys, GR 22/96.90. Waste ground. M. Wainwright, 1986. **70**, Cumberland: Denton Holme Industrial Estate, GR 35/39.55. Old railway sidings. R. E. Groom, 1987, **LANC**. 2nd record.

527/1. CHAMAEMELUM NOBILE (L.) All. *71, Man: Andreas airport, GR 25/42.00. Dumped soil. M. Devereau & L. S. Garrad, 1987. 1st definite record.

532/1. MATRICARIA RECUTITA L. **80**, Roxburghs.: Old Orchard, Hawick, GR 36/52.14. Arable land. M. E. Braithwaite, 1974. 1st record since 1873.

†536/1. ECHINOPS SPHAEROCEPHALUS L. *46, Cards.: Plas Gogerddan, GR 22/63.83. Conifer plantation. A. P. Fowles, 1987, det. A. O. Chater. **69**, Westmorland: Near Leece, GR 34/25.69. P. Burton, 1988, **LANC**. 2nd record.

539/3. CARDUUS NUTANS L. **H5**, E. Cork: Ballybutler Lake, GR 10/92.73. Limestone pasture. P. Smiddy, 1986. 1st record since 1898.

540/3 × 2. CIRSIUM PALUSTRE (L.) Scop. × C. VULGARE (Savi) Ten. *48, Merioneth: Arthog, GR 23/6.1. Roadside. P. M. Benoit, 1986, **NMW**. 1st Welsh record.

540/4 × 3. CIRSIUM ARVENSE (L.) Scop. × C. PALUSTRE (L.) Scop. *47, Monts.: Cwm Einion, Pontrobert, GR 33/09.13. Meadow. P. M. Benoit, 1987, **NMW**.

†540/5. CIRSIUM OLERACEUM (L.) Scop. *59, S. Lancs.: Clitheroe, GR 34/73.40. Bank of small stream. S. Wynn, 1988. Colony has persisted for 10 years. 1st record of established population.

†544/2. CENTAUREA MONTANA L. **25**, E. Suffolk: Between Aldeburgh and Thorpeness, GR 62/47.59. Long grass on roadside. J. G. Murrell & P. D. Sell, 1988, **CGE**. 2nd record. *__51__, Flints.: Graig, Tremeirchion, GR 33/08.72. Road verge. B.S.B.I. Field Meeting, 1988.

544/3. CENTAUREA CYANUS L. **44**, Carms.: Near Foelgastell, GR 22/54.15. New motorway cutting. R. D. Pryce, 1987. 1st localized record since 1912.

547/1. LAPSANA COMMUNIS L. **103**, Mid Ebudes: Arnabost Farm, GR 17/21.59. Neglected farmyard. J. W. Clark, 1988. 2nd Coll record.

549/2. HYPOCHAERIS GLABRA L. *__69__, Westmorland: South Walney, GR 34/22.62. Sand dunes. G. Halliday, 1987, **LANC**.

550/3. LEONTODON TARAXACOIDES (Vill.) Mérat †*__111__, Orkney: Trumland House, Rousay, GR 57/43.27. Grassland by drive. R. W. M. Corner, 1987, **E**.

551/1. PICRIS ECHIOIDES L. **69**, Westmorland: A590 between Meathop and Lindale, GR 34/43.81. Roundabout. C. E. Wild, 1988, **LANC**. 2nd post-1930 record. [**99**, Dunbarton: Delete record published in *Watsonia* **15**: 402 (1985), specimen is *Crepis setosa* Haller fil.]

555/1. MYCELIS MURALIS (L.) Dumort. †*__H8__, Co. Limerick: South-east of Foynes, GR 11/28.48. Limestone crag. S. Reynolds, 1987.

†557/3. CICERBITA MACROPHYLLA (Willd.) Wallr. subsp. URALENSIS (Rouy) P. D. Sell *__42__, Brecs.: Cwm Clydach, GR 32/20.12. Roadside verge. M. Porter, 1988, **NMW**.

†557/plu. CICERBITA PLUMIERI (L.) Kirschleger *__77__, Lanarks.: Bothwell, GR 26/69.58. Wood. J. Lyth, 1957, **GL**. Still present in 1986, J. H. Dickson, **GL**, det. P. D. Sell.

†558/1/1. HIERACIUM AMPLEXICAULE L. *__72__, Dumfriess.: 'Dumfriesshire'. Dr Dewar, 1857, **HAMU**, det. P. D. Sell & C. West.

558/1/4. HIERACIUM ALPINUM L. *__104__, N. Ebudes: Beinne na Greine, GR 18/74.22. Rock outcrops. A. A. P. Slack & C. W. Murray, 1986, det. J. Bevan.

558/1/59. HIERACIUM ORIMELES F. J. Hanb. ex W. R. Linton *__47__, Monts.: Dulas valley, Aberhosan, GR 22/80.96. Shaded bank. A. J. Morton, 1986, det. P. D. Sell.

558/1/83. HIERACIUM PSEUDOSARCOPHYLLUM Pugsley *__101__, Kintyre: Near Forest, GR 16/80.71. Ravines. A. G. Kenneth, 1987, **CGE**, det. P. D. Sell.

558/1/94. HIERACIUM DURICEPS F. J. Hanb. *__77__, Lanarks.: Hillshie Burn, Camps Reservoir, GR 36/03.21. Rocks by waterfall. D. J. McCosh, 1987, **E**.

558/1/117. HIERACIUM DIPTEROIDES Dahlst. *__99__, Dunbarton: Lang Craigs, GR 26/43.76. Cliffs. J. Bevan *et al.*, 1987, **MNE**.

558/1/118. HIERACIUM OISTOPHYLLUM Pugsley *__81__, Berwicks.: Greenlaw Dean, GR 36/6.4. Scaur. A. G. Long, 1969, **HAMU**, det. D. J. McCosh.

558/1/131. HIERACIUM RHOMBOIDES (Stenström) K. Joh. *__101__, Kintyre: South-west of Lochan Dobhrain, GR 16/79.78. Base-poor rock outcrop. A. G. Kenneth, 1987, det. P. D. Sell.

558/1/139. HIERACIUM RUBIGINOSUM F. J. Hanb. *__77__, Lanarks.: Tillietudlem, GR 26/81.46. Unknown collector, 1936, **GL**, det. P. D. Sell.

558/1/143. HIERACIUM CALEDONICUM F. J. Hanb. *__93__, N. Aberdeen: Eden, GR 38/70.60. Dyke top by deciduous woodland. D. Welch, 1985, **herb. D. W.**, det. P. D. Sell.

558/1/152. HIERACIUM LEPIDULUM (Stenström) Omang *__35__, Mons.: Bettws near Newport, GR 31/2.9. Grassy roadside bank. T. G. Evans, 1985, **NMW**, det. J. Bevan.

558/1/163. HIERACIUM STRUMOSUM (W. R. Linton) A. Ley *__77__, Lanarks.: Necropolis, Glasgow, GR 26/60.65. Grassy slope. J. H. Dickson, 1984, **GL**, det. P. D. Sell.

558/1/188. HIERACIUM UIGINSKYENSE Pugsley ***77**, Lanarks.: Near Crawford, GR 26/9.2. J. T. Johnstone, 1892, **GL**, det. P. D. Sell.

558/1/205. HIERACIUM LISSOLEPIUM (Zahn) Roffey ***77**, Lanarks.: Linthouse, GR 26/54.66. Old dock. P. Macpherson, 1985, **herb. P.M.**, det. D. J. McCosh. ***83**, Midlothian: George Street, Leith, GR 36/2.7. Railway bank. J. Fraser, 1910, **GL**, det. P. D. Sell.

558/1/gla. HIERACIUM GLANDULIDENS P. D. Sell & C. West ***93**, N. Aberdeen: Blairfowl, GR 38/80.38. Sandstone rock ledge in deciduous woodland. D. Welch, 1984, **ABD**, det. P. D. Sell.

†558/1/gou. HIERACIUM GOUGETANUM Gren. & Godron ***77**, Lanarks.: Hallside, GR 26/66.59. Pit bing. K. Watson, 1986, **GL**, det. P. D. Sell.

558/1/sub. HIERACIUM SUBCRASSUM (Almq. ex Dahlst.) K. Joh. **†*99**, Dunbarton: Overtoun House, Milton, GR 26/42.76. Grassy slope under trees. B.S.B.I. Hieracium Group Meeting, 1987, **herb. O. M. Stewart**, det. D. J. McCosh & P. D. Sell. 1st Scottish record.

558/2/7. PILOSELLA AURANTIACA (L.) F. W. Schultz & Schultz Bip. subsp. AURANTIACA ***46**, Cards.: Ponterwyd, GR 22/74.80. Rough grass in chapel graveyard. A. O. Chater, 1987, **NMW**, det. P. D. Sell.

†559/3. CREPIS SETOSA Haller fil. **69**, Westmorland: Greenodd, GR 34/31.82. Industrial site. P. Burton, 1988, **LANC**. 2nd record. ***77**, Lanarks.: Millburn, Glasgow, GR 26/61.60. Streamside. P. Macpherson & R. Hunter, 1988, **GL**. Govan, GR 26/55.65. Waste ground. P. Macpherson, 1988, **herb. P.M.** 1st and 2nd records. ***99**, Dunbarton: Duntocher, GR 26/49.72. Grass in landscaped area. A.McG. Stirling, 1984, **GL**, det. J. H. Dickson.

559/4. CREPIS MOLLIS (Jacq.) Ascherson **80**, Roxburghs.: Fulton Burn, Bedrule, GR 36/60.16. Woodland bank. M. E. Braithwaite, 1988. 1st record this century.

559/5. CREPIS BIENNIS L. **40**, Salop: Porth-y-Waen, GR 33/25.23. Roadside verge and derelict railway track. M. Wainwright, 1987. 2nd record.

559/8. CREPIS PALUDOSA (L.) Moench **46**, Cards.: Cwm Llyfnant, GR 22/73.97. Streamside in wood. R. Bamford, 1988. 2nd record.

561/1. BALDELLIA RANUNCULOIDES (L.) Parl. **50**, Denbs.: Wrexham Industrial Estate, GR 33/39.49. Pond. N.C.C. Pond Survey, 1979. 1st post-1930 record.

563/2. ALISMA LANCEOLATUM With. ***H33**, Fermanagh: South-east of Belleisle House, Upper Lough Erne, GR 23/29.35. Swamp. S. J. Leach *et al.*, 1986.

†LIMNANTHES DOUGLASII R.Br. ***42**, Brecs.: Pencelli, GR 32/0.2. Ox-bow of R. Usk. M. Porter, 1987.

†570/3. ELODEA NUTTALLII (Planchon) St John **34**, W. Gloucs.: Wildfowl Trust grounds, Slimbridge, GR 32/72.04. Rhine. B. Stewart, 1986. 2nd record. ***88**, Mid Perth: R. Earn south-west of Forteviot Bridge, GR 37/03.17. Still backwater. J. R. Akeroyd, C. D. Preston and N. F. Stewart, 1988, **PTH**, det. D. A. Simpson.

†571/1. LAGAROSIPHON MAJOR (Ridley) Moss ***42**, Brecs.: Glyntawe, GR 22/85.16. New pond. M. Porter, 1981, det. D. A. Simpson.

[577/3. POTAMOGETON COLORATUS Hornem. **41**, Glam.: Delete record published in *Watsonia* **14**: 430 (1983), specimen at **NMW** is *P. gramineus* L., det. C. D. Preston.]

577/6 × 5 POTAMOGETON GRAMINEUS L. × P. LUCENS L. ***79**, Selkirks.: Crooked Loch, GR 36/35.14. C. O. Badenoch, 1980, **CGE**, det. C. D. Preston.

577/7. POTAMOGETON ALPINUS Balbis ***78**, Peebless.: Eshiels, GR 36/28.40. Ponds. R. Robertson, 1988, **herb. D.J. McCosh**, det. C. D. Preston.

577/9. POTAMOGETON PERFOLIATUS L. **45**, Pembs.: Eastern Cleddau above Canaston Bridge, GR 22/0.1. Tranquil bays of river. J. W. Donovan, 1985.

[577/11. POTAMOGETON FRIESII Rupr. **73**, Kirkcudbrights.: Delete record published in *Watsonia* **12**: 177 (1978), specimens at **CGE** and **E** are *P. obtusifolius* Mert. & Koch, det. C. D. Preston.]

[577/13. POTAMOGETON PUSILLUS L. **98**, Main Argyll: Delete record published in *Watsonia* **16**: 448 (1987), specimen in **herb. B. H. Thompson** is *P. berchtoldii* Fieb., det. C. D. Preston.]

577/14. POTAMOGETON OBTUSIFOLIUS Mert. & Koch **45**, Pembs.: Maerdy Farm, GR 12/84.25. Irrigation reservoir. J. W. Donovan, 1986. 2nd record. ***78**, Peebless.: North Esk Reservoir, GR 36/15.58. D. J. McCosh, 1979, **herb. D.J.McC.**, det. A. C. Jermy & C. D. Preston.

[577/20 × 21. POTAMOGETON FILIFORMIS Pers. × P. PECTINATUS L. **83**, Midlothian: Delete record published in *Watsonia* **15**: 138 (1984), specimen at **E** is indistinguishable from *P. pectinatus* L., det. C. D. Preston and N. F. Stewart.]

578/1. GROENLANDIA DENSA (L.) Fourr. ***50**, Denbs.: Gresford, GR 33/37.55. Field pond. N.C.C. Pond Survey, 1979. **H21**, Co. Dublin: Walkinstown, Dublin, GR 32/10.31. Slow-flowing stream. P. S. Wyse Jackson, 1987, **TCD**. 2nd extant locality.

†589/3 × 2. POLYGONATUM MULTIFLORUM (L.) All. × P. ODORATUM (Miller) Druce ***99**, Dunbarton: Torwood, Rhu, GR 26/27.83. Rough ground. A.McG. Stirling & A. Rutherford, 1984.

†593/2. LILIUM PYRENAICUM Gouan ***77**, Lanarks.: Ibrox, GR 26/55.64. Wood. P. Macpherson, 1987, **herb. P.M.**

†599/lil. SCILLA LILIO-HYACINTHUS L. ***80**, Roxburghs.: Abbotsford/Faldonside Woods, GR 36/50.33. Woodland. M. E. Braithwaite, 1987. Black Burn, Jedburgh, GR 36/64.17. Woodland. M. E. Braithwaite, 1988, **E**, det. D. R. McKean. 1st and 2nd records. ***81**, Berwicks.: Longformacus House, GR 36/69.57. Policy woodland. M. E. & P. F. Braithwaite, 1988, det. D. R. McKean.

†CHIONODOXA LUCILIAE Boiss. ***99**, Dunbarton: Cardross Park, GR 26/34.77. Wood. A.McG. Stirling & A. Rutherford, 1985.

†601/arm. MUSCARI ARMENIACUM Leichtlin ex Baker ***99**, Dunbarton: Kilcreggan Pier, GR 26/29.83. Bank. A. McG. Stirling & A. Rutherford, 1982.

†605/2. JUNCUS TENUIS Willd. ***26**, W. Suffolk: Wangford, GR 52/78.82. Open forest ride. M. G. Rutterford & P. J. O. Trist, 1988. Ten Wood, Ringshall, GR 62/03.52. Disturbed wet woodland. J. Harris & E. M. Hyde, 1988. 1st and 2nd records. **50**, Denbs.: Maeshafn, GR 33/20.61. Track. J. A. Green, 1987, **NMW**. 2nd record.

605/9 × 8. JUNCUS EFFUSUS L. × J. INFLEXUS L. ***79**, Selkirks.: The Haining, Selkirk, GR 36/47.27. Damp grassland. ***80**, Roxburghs.: Ale Water below Stotshaw Craigs, GR 36/42.17. Damp grassland. Both R. W. M. Corner, 1982, **herb. R.W.M.C.**, det. C. A. Stace.

605/15. JUNCUS ACUTUS L. ***6**, N. Somerset: Berrow, GR 31/28.52. Saltmarsh. M. J. Galliott, 1988. 1st confirmed record.

605/18 × 19. JUNCUS ACUTIFLORUS Ehrh. ex Hoffm. × J. ARTICULATUS L. ***42**, Brecs.: Ystradfellte, GR 22/92.15. Fen. M. Porter, 1978. ***H8**, Co. Limerick: South of Coolcappagh, GR 11/31.40. Wet pasture. S. Reynolds, 1987, **DBN**.

605/amb. JUNCUS AMBIGUUS Guss. ***44**, Carms.: Morfa Uchaf, GR 22/37.11. Tidal mud flat by R. Tywi. G. Hutchinson, 1986, **NMW**, det. C. A. Stace.

605/fol. JUNCUS FOLIOSUS Desf. **4**, N. Devon: Lowman valley near Beer Down, GR 31/00.18. Wet field. L. J. Margetts, 1988. 2nd record. **46**, Cards.: Pantycetris, Talgarreg, GR 22/40.51. Ditch. A. O. Chater, 1988. 2nd record. ***98**, Main Argyll: Ardtur, GR 17/91.46. Muddy pond margin. A. McG. Stirling, 1987. ***H8**, Co. Limerick: Foynes Island, GR 11/24.52. Muddy seepage area. S. Reynolds, 1987, **DBN**. ***H33**, Fermanagh: Ardunshin, GR 23/3.4. S. A. Brenan, undated but probably c. 1860, **BEL**. ***H39**, Co. Antrim: Portrush, GR 24/8.3. S. Wear, 1910, **BEL**.

†606/4. LUZULA LUZULOIDES (Lam.) Dandy & Wilmott **47**, Monts.: Great Wood, Gregynog Hall, GR 32/08.97. T. Kohler, 1987. 2nd record.

611/2. LEUCOJUM AESTIVUM L. †**73**, Kirkcudbrights.: Carlingwark Loch, GR 25/76.60. Marshy area under *Salix*. A. Carstairs, 1975. 2nd record.

†614/6. NARCISSUS POETICUS L. subsp. POETICUS ***99**, Dunbarton: Aikenshaw, GR 26/23.87. Wood and waste ground above shore. A. McG. Stirling & A. Rutherford, 1985.

†620/pan. CROCOSMIA PANICULATA (Klatt) Goldblatt ***99**, Dunbarton: Ardencaple, GR 26/28.83. Waste ground. A. Rutherford, 1975.

625/3. EPIPACTIS PURPURATA Sm. **40**, Salop: St Martins, GR 33/33.40. In deep shade on steep wooded slope. D. Hampson, 1987, det. J. J. Wood. Northernmost confirmed British locality.

625/5. EPIPACTIS DUNENSIS (T. & T. A. Stephenson) Godfery ***61**, S. E. Yorks.: Skipwith Common, GR 44/65.37. Under trees by stream. T. F. Medd, 1985, det. F. Horsman & A. J. Richards.

631/1. HAMMARBYA PALUDOSA (L.) O. Kuntze ***43**, Rads.: Elan valley north of Pont ar Elan, GR 22/90.71. Wet peaty flush. R. G. Woods, 1988. **65**, N. W. Yorks.: Near Sedbergh, GR 34/68.90. Marsh. F. Horsman & A. Stoddard, 1983. Cronkley, GR 35/80.20. Marsh. F. Horsman, 1985. Only extant localities.

635/1. COELOGLOSSUM VIRIDE (L.) Hartman **44**, Carms.: Pantycerrig, GR 22/56.30. Thin soil near sandstone rock outcrop. J. J. Hopkins *et al.*, 1987. 2nd extant locality. **46**, Cards.: Rhos Glynrhelyg, Gorsgoch, GR 22/49.51. Pingo rampart. A. O. Chater, 1988. 1st record since 1926.

636/1a. GYMNADENIA CONOPSEA (L.) R.Br. subsp. CONOPSEA **4**, N. Devon: Braunton Burrows, GR 21/45.33. Damp dune-slack. J. Breeds, 1988. 1st record since 1912.

640/1. OPHRYS APIFERA Hudson ***67**, S. Northumb.: Wallsend Dene, GR 45/31.67. Grassland. J. Willey, 1988.

640/4. OPHRYS INSECTIFERA L. **38**, Warks.: Snitterfield Bushes N.R., GR 42/20.60. Scrub. S. J. & J. B. Matthews, 1988, det. J. A. Hardman. 1st record since 1880.

643/1 × 3. DACTYLORHIZA FUCHSII (Druce) Soó × D. INCARNATA (L.) Soó ***62**, N.E. Yorks.: Ashberry Pasture, GR 44/56.84. Marsh. F. Horsman, 1987, det. J. J. Wood & D. M. Turner-Ettlinger.

643/2b × 6 cam. DACTYLORHIZA MACULATA (L.) Soó subsp. ERICETORUM (E. F. Linton) P. F. Hunt & Summerhayes × D. MAJALIS (Reichenb.) P. F. Hunt & Summerhayes subsp. CAMBRENSIS (R. H. Roberts) R. H. Roberts ***46**, Cards.: Ynyslas, GR 22/61.91. Marsh. F. Horsman, 1987, det. R. H. Roberts.

643/3c. DACTYLORHIZA INCARNATA (L.) Soó subsp. COCCINEA (Pugsley) Soó **103**, Mid Ebudes: Langamull, GR 17/3.5. Machair. R. Coomber, 1984. 1st Mull record.

643/3 × 2. DACTYLORHIZA INCARNATA (L.) Soó × D. MACULATA (L.) Soó ***62**, N. E. Yorks.: Dalby Forest near Thornton Dale. GR 44/85.84. Marsh. F. Horsman, 1988, det. R. H. Roberts. ***64**, Mid-W. Yorks.: Austwick, GR 34/7.6. Marsh. F. Horsman, 1988, det. R. H. Roberts.

643/2 × 636/1. DACTYLORHIZA MACULATA (L.) Soó × GYMNADENIA CONOPSEA (L.) R.Br. ***42**, Brecs.: Abergwesyn, GR 22/84.52. Hay meadow. M. Porter, 1987.

645/1. ANACAMPTIS PYRAMIDALIS (L.) L. C. M. Richards **73**, Kirkcudbrights.: Brighouse Bay, GR 25/63.45. Sandy grassland. D. Hawker, 1988. 2nd extant locality.

†647/1. CALLA PALUSTRIS L. ***83**, Midlothian: Bawsinch, Duddingston, GR 36/28.72. Marsh. J. Muscott, 1984.

†648/1. LYSICHITON AMERICANUS Hultén & St John ***47**, Monts.: Llandinam, GR 32/02.88. Shady ditch west of R. Severn. K. Jones, 1972. Llandinam, GR 32/02.88. Shaded swampy ground

east of R. Severn. V. Evans & J. Packwood, 1986. 1st and 2nd records. ***99**, Dunbarton: R. Allander, Craighton, GR 26/54.76. Marshy ground. G. Rodway, 1984. ***103**, Mid Ebudes: Fishnish, GR 17/65.42. Amongst *Iris* near stream on shore. B. Rae, 1988.

649/2 × 1. ARUM ITALICUM Miller × A. MACULATUM L. ***5**, S. Somerset: Staplegrove, GR 31/21.26. Roadside copse. P. R. & I. P. Green, 1987.

650/1. LEMNA POLYRHIZA L. **83**, Midlothian: Bawsinch, Duddingston, GR 36/28.72. Artificially created ponds. J. Muscott, 1984. 1st record since 1894.

650/2. LEMNA TRISULCA L. ***73**, Kirkcudbrights.: Loch Milton, GR 25/83.71. O. M. & N. F. Stewart, 1988.

†650/min. LEMNA MINUSCULA Herter ***6**, N. Somerset: Burrington Combe, GR 31/47.58. Nursery pool. I. P. Green, 1987, det. A. C. Leslie. ***7**, N. Wilts.: Near Chippenham, GR 31/94.74. Old carp ponds near R. Avon. D. Green, 1987, det. A. C. Leslie. Inwood near Lacock, GR 31/91.67. Gravel pit. D. Green, 1987. 1st and 2nd records. **12**, N. Hants.: R. Blackwater, GR 41/85.59. Pool. J. E. Smith, 1987. 2nd record. ***27**, E. Norfolk: Barton Broad, GR 63/35.21. Shallow water amongst *Phragmites*. F. J. Rumsey, 1988, **CGE**. Woodbastwick Fen, GR 63/33.16. Ditch. T. C. G. Rich, 1988. 1st and 2nd records.

653/2 × 1. TYPHA ANGUSTIFOLIA L. × T. LATIFOLIA L. ***39**, Staffs.: Rugeley, GR 43/0.1. By R. Trent. H. P. Reader, 1919, **NMW**, det. S. G. Smith. ***59**, S. Lancs.: Rufford, GR 34/46.15. Canal. J. A. Wheldon, 1907, **NMW**, det. S. G. Smith. ***61**, S.E. Yorks.: Holme upon Spalding Moor, GR 44/82.38. Pond. T. Mundell, 1988, **herb. F.E. Crackles**, det. A. C. Leslie. ***67**, S. Northumb.: Holywell Pond, GR 45/31.75. G. A. & M. Swan, 1988, **herb. G.A.S.**, det. A. C. Leslie.

663/4 × 8. CAREX HOSTIANA DC. × C. VIRIDULA Michx subsp. OEDOCARPA (N. J. Andersson) B. Schmid ***43**, Rads.: Pentrosfa Bog, Llandrindod Wells, GR 32/05.59. Calcareous fen. R. G. Woods, 1987.

663/7. CAREX VIRIDULA Michx subsp. BRACHYRRYNCHA (Čelak.) B. Schmid **34**, W. Gloucs.: Cherington, GR 31/90.98. Flush. S. H. Bishop, 1987. Only extant locality.

663/11. CAREX EXTENSA Good. ***5**, S. Somerset: Wall Common, GR 31/26.45. Brackish ditch behind sea wall. M. J. Galliott, 1988.

663/33. CAREX LASIOCARPA Ehrh. **45**, Pembs.: Cors Penally, GR 21/11.98. *Molinia*-dominated calcareous mire. F. Rose, 1987. 2nd record.

663/48. CAREX AQUATILIS Wahlenb. ***104**, N. Ebudes: Skeabost River south of Skeabost Bridge, GR 18/42.48. River-bank. C. W. Murray and H. J. B. & H. H. Birks, 1984, **herb. C.W.M.**, det. R. W. David.

663/56. CAREX DIANDRA Schrank **81**, Berwicks.: Longmuir Rig, GR 36/47.50. Base-rich fen. M. E. & P. F. Braithwaite and D. R. McKean, 1988, **herb. M.E.B.** Only extant locality. **83**, Midlothian: Longmuir Rig, GR 36/47.50. Base-rich fen. M. E. & P. F. Braithwaite and D. R. McKean, 1988. Only extant locality.

663/54 × 71. CAREX PANICULATA L. × C. REMOTA L. ***42**, Brecs.: Talybont-on-Usk, GR 32/08.17. Margin of reservoir. M. Porter, 1987, **herb. M.P.**, det. A. O. Chater & A. C. Jermy. ***77**, Lanarks.: Port Dundas, GR 26/58.66. Canal wall. K. Watson, 1987, **GL**.

663/57 × 71. CAREX OTRUBAE Podp. × C. REMOTA L. ***42**, Brecs.: Talybont-on-Usk, GR 32/08.17. Margin of reservoir. M. Porter, 1980, **herb. M.P.**, det. A. C. Jermy.

663/60. CAREX DISTICHA Hudson ***43**, Rads.: Pentrosfa Bog, Llandrindod Wells, GR 32/05.59. Calcareous fen. R. G. Woods, 1987.

663/66. CAREX DIVULSA Stokes subsp. LEERSII (Kneucker) Walo Koch ***69**, Westmorland: Near Millwood House, GR 34/21.73. Hedgerow. P. Burton, 1988, **LANC**, det. A. O. Chater & R. W. David.

663/68 mur. CAREX MURICATA L. subsp. MURICATA *65, N. W. Yorks.: Red Scar, Downholme, GR 45/11.00. Limestone scree. D. J. Millward, 1987, det. R. W. David.

†SASA PALMATA (Burbidge) E. G. Camus *99, Dunbarton: Shandon, GR 26/25.87. Burnside. A.McG. Stirling & A. Rutherford, 1982, det. D. McClintock. Vast colony.

667/1 alt. MOLINIA CAERULEA (L.) Moench subsp. ALTISSIMA (Link) Domin *67, S. Northumb.: Near Druridge Bay, GR 45/27.99. Fen behind sand dunes. Broomlee Lough, GR 35/78.69. Wet ground by lake. Both G. A. Swan, 1988, **herb. G.A.S.**, det. P. J. O. Trist. 1st and 2nd records. *68, Cheviot: Embleton's Bog, GR 46/16.29. Base-rich fen. G. A. Swan, 1988, **herb. G.A.S.**, det. P. J. O. Trist. *81, Berwicks.: Gordon Moss, GR 36/63.42. Fen. M. E. Braithwaite, 1988, **herb. P.J.O. Trist**, det. P.J.O.T.

669/1 × 2. GLYCERIA FLUITANS (L.) R.Br. × G. PLICATA (Fries) Fries *44, Carms.: Eastern Cleddau west of Clynderwen, GR 22/08.19. Marshy ground. G. Hutchinson, 1986, **NMW**, *83, Midlothian: North-east of Stow, GR 36/47.45. Marsh. R. Learmouth, 1986, **E**, det. D. R. McKean. *H8, Co. Limerick: Cahir Guillamore, GR 11/60.40. S. Reynolds, 1987, **DBN**.

669/2. GLYCERIA PLICATA (Fries) Fries *79, Selkirks.: Pot Loch, Selkirk, GR 36/47.28. Pond margin. R. W. M. Corner, 1978. Hartwoodburn Pond, Selkirk, GR 36/46.26. Pond margin. R. W. M. Corner, 1982. 1st and 2nd records, both **herb. R.W.M.C.** 80, Roxburghs.: R. Liddel below Kershopefoot, GR 35/46.82. Burnside. R. W. M. Corner, 1981, **herb. R.W.M.C.** 2nd extant locality. 83, Midlothian: North-east of Stow, GR 36/47.45. Marshy ground. R. Learmouth, 1988, **herb. R.L.**, det. D. R. McKean. 1st record since 1927.

670/4. FESTUCA ALTISSIMA All. *43, Rads.: Bach Howey Gorge, GR 32/11.43. Rocks and decaying wood. R. G. Woods & M. Porter, 1987. *50, Denbs.: Erbistock, GR 33/35.41. Sandstone rocks in wood by R. Dee. J. A. Green, 1987, **NMW**. Llansannan, GR 23/92.61. Mossy rocks by stream in wood. J. A. Green, 1988. 1st and 2nd records.

†670/5. FESTUCA HETEROPHYLLA Lam. *60, W. Lancs.: Myerscough, GR 34/49.39. Gravel path. C. J. Bruxner, 1987, det. P. J. O. Trist.

670/8 oph. FESTUCA OVINA L. subsp. OPHIOLITICOLA (Kerguélen) M. J. Wilkinson [illegible] Monts.: Afon Hengwm, Carn Hyddgen, GR 22/79.89. Marsh dominated by *Juncus effusus*. A. C[illegible] [illegible]hater, 1988, **NMW**, det. M. J. Wilkinson.

670/9. FESTUCA TENUIFOLIA Sibth. *47, Monts.: Llanfihangel-yng-Ngwynfa, GR 33/0.1. Dry hummocks in bog. P. M. Benoit, 1988, **NMW**. 1st localized record.

670/11. FESTUCA TRACHYPHYLLA (Hackel) Krajina 4, N. Devon: Between Uplowman and Sampford Peverell, GR 31/02.14. Steep roadside bank. L. J. Margetts, 1988, **herb. L.J.M.**, det. C. A. Stace. 2nd record.

670/1 × 671/1. FESTUCA PRATENSIS Hudson × LOLIUM PERENNE L. *50, Denbs.: Overton, GR 33/39.42. Wet meadows. D. Tinston, 1987, **NMW**, det. P. M. Benoit *73, Kirkcudbrights.: Tongland Loch, GR 25/71.56. Muddy edge of ditch. O. M. & N. F. Stewart, 1988, **E**, det. P. J. O. Trist.

670/6 × 672/3. FESTUCA RUBRA L. sens. lat. × VULPIA MYUROS (L.) C. C. Gmelin *35, Mons.: Newport, GR 31/32.87. Waste ground. T. G. Evans, 1988, **herb. T.G.E.**, det. C. A. Stace.

672/1. VULPIA FASCICULATA (Forskål) Samp. 5, S. Somerset: Dunster, GR 21/99.45. Sand dunes. I. P. Green, 1987. 1st record since 1849. *51, Flints.: Talacre Warren, GR 33/0.8. Mobile dune. P. Day, 1982. Point of Ayr, GR 33/1.8. Sand dunes. J. A. Green & G.Wynne, 1985. 1st and 2nd records.

672/5. VULPIA CILIATA Dumort. subsp. AMBIGUA (Le Gall) Stace & Auquier *5, S. Somerset: Dunster, GR 21/99.46. Fixed dunes. C. J. Giddens & M. Tulloh, 1972.

676/12. POA SUBCAERULEA Sm. *H8, Co. Limerick: Foynes Island, GR 11/24.52. Short turf above shore. Ballyneety, GR 11/62.48. Wall top. Both S. Reynolds, 1987, **DBN**. 1st and 2nd records.

†676/14. Poa palustris L. **48**, Merioneth: Llyn Tegid, GR 23/9.3. Wet marshy ground. P. M. Benoit, 1982. 2nd record.

†676/15. Poa chaixii Vill. **43**, Rads.: Cemetery, Knighton, GR 32/28.72. R. G. Woods, 1987. 2nd record.

677/1. Catabrosa aquatica (L.) Beauv. ***47**, Monts.: Wern Clay Pits, Arddleen, GR 33/25.14. Margin of recently dug pool. I. Gunn & K. Edwards, 1987. **104**, N. Ebudes: Suileabhaig, Canna, GR 18/27.04. Wet sandy ground. H. J. B. & H. H. Birks and C. W. Murray, 1984. 1st Canna record.

681/2. Melica nutans L. **33**, E. Gloucs.: Lineover Wood, GR 32/98.18. Steep north-facing slope in ancient wood. S. Porter & I. Ralphs, 1988. Only extant locality.

683/1. Bromus erectus Hudson ***47**, Monts.: Llanymynech Hill, GR 33/2.2 Limestone grassland. P. M. Benoit, 1988, **NMW.** ***H8**, Co. Limerick: South-west of Askeaton, GR 11/33.49. S. Reynolds, 1987, **DBN**, det. C. A. Stace.

683/3. Bromus benekenii (Lange) Trimen ***47**, Monts.: Near Llanfihangel-yng-Ngwynfa, GR 33/0.1. Wooded dingle. Abermule Dingle, GR 32/1.9. Base-rich woodland. Both P. M. Benoit, 1988, **NMW**. 1st and 2nd records.

†683/4. Bromus inermis Leysser ***33**, E. Gloucs.: Icomb, GR 42/20.23. Grassy roadside verge. H. J. Gardner, 1988.

†683/8. Bromus rigidus Roth ***11**, S. Hants.: Gunner Point, GR 40/69.99. Sand dune. R. P. Bowman, 1988, det. P. J. O. Trist. South Hayling, GR 40/70.98. Sand dune. R. P. Bowman, 1988. Both **herb. R.P.B.** 1st and 2nd records of established populations.

†683/9. Bromus tectorum L. ***5**, S. Somerset: Scott's Nurseries, Merriott, GR 31/44.12. Fallow nursery gardens. R. G. B. Roe, 1987.

683/14. Bromus racemosus L. **47**, Monts.: Powis Castle Park, GR 33/21.06. Parkland. P. M. Benoit, 1985, **NMW**. 2nd record.

683/15. Bromus commutatus Schrader ***42**, Brecs.: Talgarth, GR 32/16.35. Roadside verge. M. Porter, 1981, **NMW**, det. T. A. Cope. 1st confirmed record.

†683/19. Bromus carinatus Hooker & Arnott ***H21**, Co. Dublin: Pigeon House Road, Dublin, GR 32/18.34. Grassy verge. S. Reynolds, 1987, **DBN**, det. T. C. G. Rich & C. A. Stace. 1st Irish record.

683/20. Bromus catharticus Vahl ***46**, Cards.: Lampeter, GR 22/57.48. Roadside verge. A. Orange, 1981, **NMW**, det. P. J. O. Trist.

683/wil. Bromus willdenowii Kunth **25**, E. Suffolk: Levington, GR 62/23.39. Garden. I. J. Killeen, 1987, det. M. N. Sanford & P. J. O. Trist. 2nd record.

684/2. Brachypodium pinnatum (L.) Beauv. ***50**, Denbs.: Bryn Euryn, GR 23/83.79. Limestone grassland. P. Day and A. M. Burn, 1987, **NMW**.

685/4. Elymus pycnanthus (Godron) Melderis ***68**, Cheviot: Near Alnmouth, GR 46/24.09. Saltmarsh. G. A. Swan, 1988, **herb. G.A.S.**, det. P. J. O. Trist. 1st confirmed record.

687/3. Hordeum marinum Hudson ***51**, Flints.: R. Clwyd, Rhuddlan, GR 33/01.78. Grazed saltings. P. Day, 1986, det. R. H. Roberts.

689/1. Koeleria macrantha (Ledeb.) Schultes ***42**, Brecs.: Ystradfellte, GR 22/90.14. Limestone pavement. R. G. Woods, 1986. 1st localized record.

691/1. Trisetum flavescens (L.) Beauv. ***93**, N. Aberdeen: Slains, GR 48/03.30. Steep grassland. D. Welch, 1988, **ABD**.

695/1 × 2. Holcus lanatus L. × H. mollis L. ***62**, N. E. Yorks.: Wykeham Forest, GR 44/92.87. Sandy soil in Forestry Commission nursery. E. Chicken, 1986, **herb. E.C.**, det. T. A. Cope.

†697/3. AIRA CARYOPHYLLEA L. subsp. MULTICULMIS (Dumort.) Bonnier & Layens *4, N. Devon: Lower Yelland, GR 21/48.32. Old railway track. W. H. Tucker, 1988.

701/2b. AGROSTIS VINEALIS Schreber *46, Cards.: Llynnoedd Ievan, GR 22/79.81. Upland heath. Gorsgoch, GR 22/47.51. Roadside cliff. Both A. O. Chater, 1988, **NMW**. 1st and 2nd records. *47, Monts.: Coedleos, GR 33/08.14. Forestry track. P. M. Benoit, 1987. **NMW**.

701/4. AGROSTIS GIGANTEA Roth **43**, Rads.: Presteigne, GR 32/31.64. Waste ground. R. G. Woods, 1988. 2nd record.

†701/cas. AGROSTIS CASTELLANA Boiss. & Reuter *42, Brecs.: Llangynidr, GR 32/15.19. Garden weed. M. Porter, 1981, **NMW**, det. T. A. Cope. 1st Welsh record.

701/5 × 703/1. AGROSTIS STOLONIFERA L. × POLYPOGON MONSPELIENSIS (L.) Desf. *25, E. Suffolk: Beccles, GR 62/42.91. Field entrance. J. Muddeman & T. Abrehart, 1987.

702/1. APERA SPICA-VENTI (L.) Beauv. *7, N. Wilts.: Netherstreet Farm, Bromham, GR 31/98.65. Barley field. D. Green, 1987, **herb. D.G.**

708/1. ALOPECURUS MYOSUROIDES Hudson **50**, Denbs.: Llanfihangel Glyn Myfyr, GR 33/00.48. Farmyard. J. A. Green, 1988. 2nd post-1930 record.

708/4 × 3. ALOPECURUS AEQUALIS Sobol. × A. GENICULATUS L. *42, Brecs.: Talybont Reservoir, GR 32/09.17. Margin of reservoir. M. Porter, 1987, **NMW**, det. T. A. Cope. 2nd Welsh record.

708/5 × 3. ALOPECURUS BULBOSUS Gouan × A. GENICULATUS L. *25, E. Suffolk: Church Farm, Burgh Castle, GR 63/47.05. R. P. Libbey, 1980, **LTR**.

711/1. HIEROCHLOE ODORATA (L.) Beauv. **79**, Selkirks.: Clearburn Loch, 36/33.15. Damp grassy area. R. W. M. Corner, 1988. 2nd record.

Book Reviews

Biological survey need & network. Report of a Working Party set up by the Linnean Society of London. Chairman R. J. Berry. Pp. 48. PNL Press. 1988. Price £2 (ISBN 1–85377–006–X).

This report discusses the problems facing biological recording in the British Isles, particularly the lack of co-ordination amongst the various bodies: local and national, statutary and voluntary who undertake biological surveys. In brief chapters it covers the nature and aims of biological surveys; their history, including an international perspective; the users of biological records; technical problems; the current situation; conclusions and recommendations.

Members of the B.S.B.I. currently contributing to the update of the *Atlas* may be most interested in the historical review. The past successes, most notably the original B.S.B.I. *Atlas of the British flora* and Supplement, and the British Trust for Ornithology atlases, stem from clear goals (the publications) and a dedicated and dynamic group of individuals driving towards those goals. By contrast, the failures seem characterized by conferences, seminars and reports making important sounding resolutions, mostly requiring large inputs of money, which are rarely carried through. Unfortunately, this report appears to fall within this latter class, although events in the next few years should be the real judge.

The central weakness of the report seems, to me, to be the failure to clearly spell out exactly how (and why) the proposed multi-tiered, fully co-ordinated system of records centres will address the central issue, that is, how to give an effective service to users (especially Local Authorities). Until this is done I fear any calls for cash will fall on deaf ears.

A. S. Gunn

Poisonous plants and fungi: an illustrated guide. M. R. Cooper & A. W. Johnson. Pp. 134 with 101 colour plates. H.M.S.O., London. 1988. Price £8.95 (ISBN 0–11–242718–9).

Over the years the Ministry of Agriculture and Fisheries (and now including Food) have published a number of books and Bulletins dealing with plants that have caused symptoms of poisoning – and often death – in animals. The present reviewer recalls reviewing *British Poisonous Plants*, (Bulletin No. 161 of the M. A. F.) in 1955. The present book also includes fungi. All the publications have referred not only to the effects of toxic plants on animals but also their possible effect on people and this book is no exception.

In a sense all plants are poisonous to all animals and to all people; it depends upon the quantity consumed. It should not be assumed that whenever side-effects appear to any person that the particular plant responsible should be described as a poisonous one. This is only mentioned because the common onion *Allium cepa* is listed among the more important poisonous plants. There is no doubt that feeding large quantities of onion waste to farm animals can cause poisoning, although different animals respond in different ways to similar quantities of any plant.

People generally consider plants or plant parts as poisonous when the consumption of only a very small amount can prove deleterious and the book names these (but includes the onion) in a different list from those which are considered to be less poisonous. Thus there are the well-known poisonous plants such as Black Bryony, Deadly Nightshade, Dog's Mercury, Hemlock Water Dropwort, Mezereon, Ragwort and Yew to mention only a few in the main list. Altogether the authors list 100, describe the plants, and discuss the symptoms to which they give rise as well as indicating the best way of treating the animal or person involved.

Then there is an annotated list of 166 plants which are considered to be less poisonous. The book also contains descriptions of 22 fungi which can produce symptoms of poisoning; like some of the higher plants these can easily lead to death if large quantities are consumed, although with certain plants and fungi the amount can be quite small. There is an annotated list of another 15 fungi which can be harmful.

The book includes a number of good colour photographs of the plants and fungi most likely to be

mistaken for others and it is only possible to criticize one of them – that of Hemlock, because it cannot be distinguished from any other Umbellifer. A closeup showing the purple patches on the stems would have been a better guide for purposes of identification.

It is a very useful book for all those likely to encounter problems of poisoning by plants and fungi to have at their finger tips.

E. J. Shellard

The Irish Red Data Book: 1. Vascular plants. T. G. F. Curtis & H. N. McGough. Pp. 168 with 4 colour plates. Published by Stationery Office, Dublin, for Wildlife Service, Ireland. 1988. Price IR£7 (ISBN 0–7076–0032–4).

In recent years Red Data Books have become a familiar weapon in the armoury of conservationists. The inclusion in a Red Data Book of the rarest and most vulnerable species confers upon them a cachet which can usefully be invoked when the species themselves, or the sites where they grow, are threatened. The vascular plants of Great Britain were treated in the Red Data Book compiled by F. H. Perring and L. Farrell (1977, 1983); this volume is a complementary publication covering Ireland.

Native and naturalized species are placed on the Irish 'Red List' if they have been recorded since 1970 in ten or fewer 10-km squares in Ireland or if they are considered by the Council of Europe (1983) as threatened in Europe as a whole. Species which have disappeared from 66% or more of their known 10-km squares are also said to have been considered for inclusion, but none of the plants listed qualifies on this criterion alone. The authors appear to have been thorough in their research into known records, although *Parapholis incurva* and *Trifolium occidentale*, recently added to the Irish flora, are unaccountably omitted. However they have clearly been handicapped by the absence of recent records of montane plants, and of species such as *Erigeron acer* and *Hypericum hirsutum* which grow in relatively uninteresting localities. There is still plenty of scope for fieldwork to establish the current distribution of such species.

The individual species are listed in habitat groups. Species accounts are closely modelled on those in the *British Red Data Book*, usually containing a descriptive phrase and a brief summary of habitat and past and present distribution. In addition to the Red List species, species which are or were formerly legally protected in Northern Ireland or the Republic are included. Where the reasons for the apparent decline of a species are mysterious the authors have wisely confessed their ignorance. Distribution maps of 28 selected species are presented at the back of the book. These show old records as white crosses on a black background, a symbol which is both amusing and effective, but are marred by a horribly fuzzy coastline. The appearance of the *Irish Red Data Book* is more attractive than that of its British counterpart and it certainly benefits from the inclusion of four colour plates.

Curtis and McGough conclude that conservation of the Irish flora is still in its infancy, handicapped by a lack of environmental awareness, little interest in the conservation of rare and threatened species and little available funding – remarkably outspoken sentiments for a government publication! They could, however, have pointed to some encouraging public attitudes upon which conservationists might be able to build. Almost everyone in Ireland seems to know about the Burren, and one hopes that the current campaign to save the remaining Irish bogs might bring about a similar appreciation of their importance. The popularity of angling has led to a concern about water quality which must be as great in Ireland as anywhere in Europe. Education is needed to expand these areas of public concern, and pressure must be exerted to persuade politicians to translate existing concern into effective action. The *Irish Red Data Book* should play an important role in bringing home to legislators their responsibility for plant conservation.

C. D. Preston

The evolution and classification of flowering plants. A. Cronquist. Second edition. Pp. x + 556. New York Botanical Garden, New York. 1988. Price $46.80 (ISBN 0–89327–332–5).

A second edition of Cronquist's book is a major event in botanical publication as it updates the 1968 edition incorporating the scheme of his monumental *An integrated system of classification of flowering plants* (1981) and deals with modern schools of taxonomic thought in the context of all angiosperms ('flowering plants'). Compared with the first edition the text is 150 pages longer and is more closely printed; the first chapter on taxonomic principles is replaced by three – 'nature of taxonomy', 'species and infraspecific taxa' and 'speciation', tripling the number of pages devoted to this part, while the chapters on the origin of the angiosperms and the evolution of characters are doubled in size.

"The book presents taxonomy as seen by Cronquist" (p. vii), "I make no pretense of equal time for opposing views. For other points of view, read other authors". The book, then, is inevitably very American, with Bessey as the prophet and a number of 'principles' attributed to Americans: Ownbey's Principle (the presence of a structure of substance is more likely to be important than its absence) and McVaugh's Principle ("any segregate genus should be sharply delimited; that is, any species which is intermediate in one or more respects toward a more inclusive genus should be relegated to the latter . . ."). The American bias in the book must be invoked to explain the failure to cite S. M. Walters' masterly 'The shaping of angiosperm taxonomy' (*New Phytologist* **60**: 74–84, 1961) when discussing folk taxonomies, or Clayton & Renvoize, *Genera graminum* (1986), when so many recent works are listed. More seriously, perhaps, European botanists will be dismayed by the revival of the variety as *the* infraspecific taxon in the way that zoologists use it. Some British botanists may be disappointed by the scorn poured on work on microspecies "in such genera as *Taraxacum* and *Hieracium*, producing utter taxonomic confusion. Such treatments are simply not useful in understanding and communicating the pattern of diversity in nature, and not many of us take them seriously any more". Generally commonsensical and nearly always pragmatic, the author sometimes slips into garrulousness and slang: "the idea needs to be batted around a bit more" (p. 134), "My gut reaction? Gondwanaland" (p. 154), "We should realize that the game [the recognition of character polarity] is crooked, but also that it is the only game in town" (p. 163).

As to be expected from the author's writings on the subject, here is a vigorous attack on cladists, largely based on his paper in *Botanical Review* **53**: 1–52 (1987), arguing the case for an all-purpose classification rather than one based on hoped-for strictly monophyletic units. The arguments set out in the responses to his paper (*Botanical Review* **54**: 2 (1988) especially that in Humphries and Chappil, p. 139), are not really addressed. One is reminded of the resistance to the Natural System of classification put up by Sir James Edward Smith at the beginning of the last century. It is the stability of names and the recognition of variability in species, genera and, at a pinch, families which are important to the ordinary botanist and impinge on general biology.

Although Cronquist denies absolute monophylesis for the angiosperms, he finds it useful to talk of a hypothetical primitive angiosperm in determining the polarity of character-states. 'Possible ancestors' are examined as in 1968; the recent favourite 'sister-group', the Gnetopsida, is considered as a parallel development arising from some cycad-like ancestry; and Caytoniales emerge as clear favourites. Unlike Stebbins (1974) – see *New Phytologist* **77**: 527 (1977) – who completely misinterpreted it, Cronquist gives credit to that most ecological of theories, the Durian theory of Corner. Just as in 1968, he rather wistfully notes of that theory "the taxonomic consequences have not yet been fully evaluated". And so we find (p. 174) that "palms very probably have a herbaceous ancestry", clinging to the concept that they are different from 'typical trees', and atypical trees such as *Phytolacca dioica*, a familiar shade-tree in the Mediterranean, are derived from herbs. From the concept of the 'typical' tree (what were *its* ancestors like?) it is inevitable that woody Compositae are secondary and monocotyledons have an aquatic ancestry so that it becomes necessary to deal with fossil evidence as follows (p. 451): "The first modern family of monocots to be clearly represented in the fossil record is the Arecaceae (subclass Arecidae) . . . but palms are surely not primitive monocots". In beginning to 'fully evaluate' the Durian Theory readers should see Corner's 'The palm' (pp. 116–122 in T. T. P. Gunawardana *et al.* (1980), *P. E. P. Deraniyagala Commemoration Volume*).

The bulk of the volume outlines Cronquist's classification as in the first edition modified by recent work, particularly his 1981 text, though compared with that, Nothofagaceae are segregated from Fagaceae; following Takhatajan, Cronquist now recognizes Physenaceae (formerly in Capparidaceae) and suggests the family belongs with Hamamelidae; *Tepuianthus* (Tepuianthaceae), described in 1981, is put in Celastrales and not Sapindales suggested by its describers; recent work in

Myrtales is followed, in that Rhynchocalycaceae and Alzateaceae are recognized; though Cronquist submerges Nyssaceae in a broadly defined Cornaceae and a broad concept of Liliaceae is maintained, a broad view of Loganiaceae (including Buddlejaceae, Retziaceae) is not followed; Acoraceae are segregated from Araceae but Ptaeroxylaceae and Morinaceae recognized by recent monographers are not upheld. Cronquist still keeps Barclayaceae out of Nymphaeaceae, Cuscutaceae out of Convolvulaceae and Hippocrateaceae out of Celastraceae. The volume, well-printed and bound and remarkably free of printing errors, closes with a glossary, brief appendix, good index and geological time-scale. The book is a remarkable synthesis and, despite its self-admitted partiality and idiosyncrasies, will become a standard text.

D. J. Mabberley

Kew Index for 1987. Compiled by R. A. Davies & K. M. Lloyd. Pp. vi + 168. Clarendon Press, Oxford. 1988. Price £17.50 (ISBN 0–19–854245–3).

The decision to publish an annual supplement to *Index Kewensis* took effect in 1986, and this is the second such compilation. It includes names published at all taxonomic ranks at and below the level of family; names ranking higher than genus are arranged separately on the first two pages of this volume. An appendix on Pteridophyta occupies pages 161–168. In this section no family names are given against the genera, unlike the treatment in the main section, reflecting the slight difference in format between *Index Filicum* and *Index Kewensis*.

The production of annual supplements will further reduce the risk of publishing a name which has already been taken up, as well as helping to make revisions more up-to-date and comprehensive. There remains a need for a cumulative *Index Kewensis*, however, if only because the task of searching through the ever-increasing number of supplements becomes ever more tedious. Perhaps the advent of affordable micro-computers with large capacity hard disk storage will prompt the Kew Trustees to make it possible for every taxonomist's desk-top computer to have access to such a database.

J. R. Edmondson

Brambles of the British Isles. E. S. Edees & A. Newton. Edited by D. H. Kent. Pp. viii + 377 + 98 black & white plates, with 249 distribution maps. The Ray Society, London. 1988. Price £50 (ISBN 0–903874–20–2).

Following on from the works on British brambles by W. M. Rogers (1900) and W. C. R. Watson (1958), this book is by far the most important milestone in research into this difficult genus. It was originally planned as an account to be included in a new British Flora, but it is now being published as a separate work due to the support of the Ray Society. In comparison with Watson who produced an inadequate piece of work much influenced by H. Sudre's *Rubi Europae* (1908–13), this book takes an important step forwards. Only about half of the species and names which Watson presented could be kept. The rest proved to be mostly an incorrect identification of British brambles with continental species – a practice from which British batology has suffered from the very beginning. However, batology in Britain has now achieved an enviable level as a result of Edees and Newton's book which is the outcome of decades of investigation. Unlike earlier treatments, this book concentrates on the study of type specimens and thus puts the taxonomy and nomenclature on a secure basis for the first time.

After some introductory chapters on British batology, the geography and ecology of brambles, the individual species are treated partly systematically and partly – within each series – in alphabetical order. The type is given for almost every species with numerous taxa being lectotypified for the first time (mainly by A. Newton) although, unfortunately, some lectotypifications which have already been published are not considered at this point. Each species is described, mainly by E. S. Edees, in an exemplary fashion with a statistical elaboration of the distinctive features ("prickles 5–12 per 5 cm" instead of the indications which were previously often used like "prickles rather few") and, in addition, contrasted with similar species via diagnostic characters. 98 species are represented in photographs of well chosen herbarium specimens with additional close-up

photographs; the reader is directed to illustrations in other works for the remaining species. In addition to information as to habitat and ecology, distribution is shown by numerous dot maps (as in Perring & Sell's *Atlas*). The editor D. H. Kent has added a useful glossary. The keys give a guide which passes from the sections and series on to the individual species. This is a little unfortunate as those infrageneric taxa are not precisely contrasted with one another and can only be differentiated by impractical characteristics which are sometimes not evident at the time of collection (e.g. "stems rooting at tips in autumn").

All the taxa which have been validly published as species in Britain are treated even if they are only known from the type locality. Such biotypes can, however, hardly be considered as species within an apomictic complex. There must be thousands of those individual morphotypes in Britain which have developed from facultative hybridization and segregation – on the continent they run into millions. A taxonomic treatment of all these individual or local biotypes would serve to take batology *ad absurdum*.

Altogether, more than 300 species are treated, of which approximately 70% are endemic to Britain. If plants with a local distribution as yet undescribed were to be included, then the number would be above 500, as the authors reveal. Yet, for very good reasons, the taxonomic validation of these plants was not attempted.

The systematic arrangement and differentiation into "local", "regional" and "widespread" species adheres to the usual practice on the continent. Although an almost perfect consensus between British and continental batology has now been achieved, there are still a few exceptions. Thus the plant described as "*Rubus scissus*" with bluntly angled glabrous stems and dark prickles would really be *R. scissoides* according to continental opinion. However, the true *R. scissus* with sharply angled, (often densely) hairy stems and yellowish prickles occurs in England too. The British "*R. rhombifolius*" is markedly different in its nearly glabrous stems, leaves glabrous above and hairy anthers from the true *R. rhombifolius* which has a regional distribution in Germany. Furthermore, the synonymy of *R. procerus* (correct name *R. praecox* Bertoloni) and *R. armeniacus* (only this occurs in Britain) is not accepted in continental batology. However, these and some others are minor criticisms which scarcely carry any weight.

The layout and print-quality of the book are excellent. Research into the genus *Rubus* has now been brought to a temporary conclusion in Britain due to this absolutely thorough treatment. In contrast to all the earlier extensive portrayals of the *Rubus* flora of Britain, Edees and Newton have the honour of having produced a work which, for the first time, mirrors reality so that it provides a sound basis now and for further research into this interesting group of plants.

H. E. Weber

Vegetation ecology of central Europe. H. Ellenberg. 4th edition. Pp. xxii + 731, with 499 text figures and 130 tables. Cambridge University Press, Cambridge. 1988. Price £75 (ISBN 0–521–2342–8).

This first English translation of Ellenberg's classic work *Vegetation Mitteleuropas mit dem Alpen* is long overdue and greatly to be welcomed. One of the most important books on vegetation ever written, this translation is of the fourth edition, dated 1986, so is well up-to-date. Ellenberg defines "Central Europe" as Germany (East and West), Poland, Czechoslovakia, Austria, Switzerland, Luxembourg and Denmark, plus adjacent areas of Europe as appropriate. After an introduction to the vegetation of central Europe in general, encompassing climatic effects, vegetational history and the life forms and structural types, Ellenberg considers the influence of man in the moulding of vegetation as we see it, taking into account grazing and forest clearance, management of woodlands, effects of agricultural practice and finally an up-to-date summary of the effects of pollution.

Ellenberg then describes the vegetation of central Europe in a broadly phytosociological way, dealing first with the more natural types, woodland and scrub, mires, dunes, mountain vegetation, before moving on to vegetation largely owing its existence to man's activities, such as grassland, dwarf shrub heaths, forestry plantations, weed communities and vegetation of abandoned land. To suggest that the book merely gives a phytosociological account of the vegetation would be to commit a grave injustice, for the book is much more than that. It is an integration of almost all that is known about the vegetation, covering geographic range and variability in species composition, relationships to controlling ecological factors such as climate, geology and soils, the dynamics of the species

relationship within the vegetation, the eco-physiology of the component species, the impact of man and other animals and even the effects of fungal attack. The wealth of detail in the book, illustrated by diagrams, tables of data, photographs and line drawings, gives one the chance to really understand what is happening in the vegetation and why it is the way it is. The book concludes with an extensive list of references and a good index to species.

What does this book have for the readers of *Watsonia*? Even though Britain is not within its remit, this mine of information on species and vegetation is of inestimable value for those wishing to explore the responses of species to their environment and dynamics within vegetation. Much of this information is directly relevant to the British flora and all of it is thought-provoking. C.U.P. is to be congratulated for publishing such an important book in English, even though the diagrams and pictures have suffered in reproduction and a magnifying glass is required to read the references. It is a pity the book is so expensive, but I recommend readers to start saving like mad!

A. J. C. Malloch

Lilacs: the genus Syringa. J. L. Fiala. Pp. 266, with 100 colour plates, 101 black and white figures and diagrams, and 1 map. Christopher Helm, London. 1988. Price £35 (ISBN 0–7470–1010–2).

Although the common lilac, *Syringa vulgaris*, is naturalized here and there in Britain, this book is really one for gardeners rather than naturalists. Yet, so popular is the lilac as a garden flower that a brief consideration of this work may still be of interest to readers of *Watsonia*.

From the horticultural point of view John Fiala's *Lilacs* is very comprehensive. Chapters deal with cultivation, landscaping (including suitable companion plants), methods of propagation and hybridization, and diseases and pests (although all from the American point of view); there is even an appendix on lilacs in floral arrangements and how to treat them as cut plants. Some 700 or so cultivars of *Syringa vulgaris* are mentioned (out of a possible 2000 which have been named), usually in lists of those recommended on grounds of colour (i.e. pink, purple, magenta, white, single, double, etc.). Many of the best, about 170, are illustrated by colour photographs, some of them very beautiful, as well as over 100 depicting the botanical species and other hybrids.

However, the text is not just an account of lilacs themselves but includes potted biographies and anecdotes of people who have been involved in expeditions in China and the collection of species from the wild, together with those of prominent breeders. But the major criticism (apart from numerous silly errors like "Chipping Campers" for Chipping Campden on p. 34) must be levelled at the idiosyncratic nomenclature. There can be no quarrel with the majority of the names used but the invalid publication of others should never have taken place.

As a taxonomist I have been put off by these mistakes and unorthodoxies, and in addition I must admit, by the somewhat precious and intimate style of writing. For me they detract from a book which otherwise, and for the general gardener and lilac grower, will no doubt prove a fund of information. Enthusiasm oozes from every page and anyone keen on lilacs will want to possess a copy.

P. S. Green

Collins' New Generation Guide to wild flowers of Britain and northern Europe. A. H. Fitter. Pp. 320. Collins, London. 1987. Price £10.95 hardback (ISBN 0–00–219773–1); £7.95 paperback (ISBN 0–00–219777–4).

The 'Field Guide' has been around now since the mid-1950s and has become an indispensable part of British natural history. Some, such as Barrett and Yonge's *Collins' Pocket Guide to the Sea Shore* and Peterson, Mountfort and Hollom's *A Field Guide to the Birds of Britain and Europe* have become minor classics of the natural history literature. The limitations of field guides are well-known and accepted as the price of compactness. Even so the view has been frequently expressed that the field guide tends to encourage the attitude that identification is an end in itself and that the aims of natural history are simply to put a name to any organism that one encounters. This problem is particularly acute with the larger taxonomic groups where space does not allow more than a cursory note on habitat and distribution in addition to the description.

Collins' New Generation Guides have been conceived with the admirable objective of combining accurate identification with an account of the natural history of the group for "those who want to take their investigations further and to understand why what they find is the way that it is, and how it relates to the other organisms around it".

The book is divided into two more or less equal parts, the 'Directory of Species' and the 'Natural History of Wild Flowers' prefaced by a ten-page piece on the 'Plant Kingdom'. The latter sketches out the evolution of flowering plants, the characteristics of the Angiosperms and the appearance of insect pollination. Unfortunately the section is too brief to allow the author to do justice to the subject. Brevity has forced such misleading comments as, "it is clear that the pollen grain is the spore . . .", when comparing the life-cycle of a flowering plant with that of a fern.

The 'Directory of Species' aims to enable all British non-woody flowering plants and all but the rarest and most inconspicuous plants of north-west Europe to be identified – a tall order in less than 140 pages. The arrangement is in three parts: a main section comprising illustrated descriptions of the common species, an introductory 'Keys to Families' and an Appendix of scarce British species not included in the main part. Sadly, I don't think that this section of the book will always enable the average inexperienced user confidently to arrive at an accurate identification of an unfamiliar plant. The initial 'keys' are not really keys but tables setting out the characteristics of the main families, so that, for example, within the Monocotyledons, anyone puzzling over *Arum*, *Tamus*, *Triglochin* or *Lemna* would not know where to begin as their families do not appear in the 'keys'. Many of the illustrations are actually very good given the constraints of space, but to encourage expectations of accurate identification of, for example, grasses, sedges, pondweeds and umbellifers using this format is unrealistic. The habitat and distribution information is given in the form of a rather complex system of symbols, which, however, once grasped do give a reasonably comprehensive picture of the ecology of the plant. The existence of closely related rare species treated in the Appendix is indicated by appropriate cross-referencing but it is doubtful if the descriptions given in the Appendix would often lead to accurate naming.

By way of contrast the second part of the book achieves precisely what it sets out to do. It is an accurate, informative and fascinating introduction to every aspect of the natural history of wildflowers. There are essays on everything from seed dormancy to apomixis, from incompatibility mechanisms to insectivorous plants all written in a style admirably suited to non-specialists seeking to extend their knowledge. The one obvious omission is anything on community ecology, one of the aspects of plant natural history most likely to interest the average reader. The reason, presumably, is that space would not allow an adequate account of the full range of British habitats. For my money I would have preferred a format where the 'flora' part of the book was replaced by habitat accounts which included lists of characteristic species together with means to their identification. This would have obviated the need for taxonomic comprehensiveness and given us the benefit of more of the author's pen. He could safely leave the business of identification to other titles in the Collins' library with which he has been involved.

D. Streeter

Wildflowers of Canada. T. Fitzharris. Pp. iv + 156 with 140 colour photographs. Oxford University Press, Toronto. 1986. Price £24 (ISBN 0–19–540566–8).

This is a collection of photographs of 116 Canadian wildflowers. It takes the form of plant portraits, often enlarged and with associated feeding or resting insects. Brief species descriptions are provided by Audrey Fraggalosch and line drawings by Diana Thompson. The photographs are arranged into four broad habitat groupings each preceded by an introduction to that habitat in Canada.

Several plants familiar to British botanists are illustrated, however some such as *Daucus carota*, *Achillea millefolium* and *Iris pseudacorus* are introductions into Canada. Transatlantic exchanges are less commonly illustrated apart from some garden escapes such as *Ribes sanguineum* and *Rubus spectabilis*. The photograph of Pacific Dogwood (*Cornus nuttallii*) does not do justice to this handsome spring-flowering shrub, curiously rare in British gardens. Similarly the photograph of Skunk Cabbage (*Lysichiton americanus*) does not prepare one for the majesty of this plant in our water gardens, or in its native British Columbian marshes and ditches.

Perhaps of main interest to the plant photographer, particularly as there is a section on

photographic techniques, this book could also serve as an introduction to the variety of Canadian wildflowers.

B. D. Greenwood

A bicentenary history of the Linnean Society of London. A. T. Gage & W. T. Stearn Academic Press Ltd, London. 1988. Pp. ix + 242, with 20 plates. Price £25 (ISBN 0–12–273150–6).

Few people among the crowds going to see an exhibition at the Royal Academy realize that they are passing the portals of the august Linnean Society as they throng into the forecourt of Burlington House off Piccadilly. If they did, they might well stop and ring for admittance – to see the portraits of distinguished botanists and zoologists who have been its fellows (many of them very good paintings) and to admire the charming library upstairs, a repository of many rare and wonderful works as well as of the society's numerous publications and records.

Just as the atmosphere of the Linnean Society is highly civilized and deliciously old fashioned, so is this book. It represents the research and thinking of four men over forty years: Benjamin Daydon Jackson in the 1920s, Andrew Thomas Gage and Spencer Savage in the 1930s and finally William T. Stearn in the 1980s. It is, of course, a chronological history and, as one might expect of a scholarly institution, crammed with meticulous detail.

The book explains how two doctors, a clergyman, an Exchequer official, a Swedish botanical librarian, a Scottish nurseryman, and a customs official brought the Society into being, charts the turbulent years from foundation (1788) to incorporation (1802) and chronicles the long drawn out purchase of the great Linnaean collections which was complete by 1858.

After Charles Darwin and Alfred Russel Wallace expounded their theory of evolution at one of the Society's meetings in 1858, there are few outstanding events. But the authors do identify some amusing highspots, such as the Centenary celebrations in 1888 and the battle of nerves which took place over the admission of women. The account of this struggle, which was finally won in 1905, is absolutely riveting and written with such a fine sense of wit and irony that it deserves to become a classic of women's history.

For anyone interested in the history of science there is much information about the Society's members, its botanical and zoological collections and library. What is missing is any clear or dispassionate assessment of the Society's value and importance during the first 200 years of its existence. One senses that this was never part of the authors' brief and it may well represent a danger signal about its future.

C. Davidson

River plants of western Europe. S. M. Haslam. Pp xiv + 512, with many line drawings and maps. Cambridge University Press, Cambridge. 1987. Price £75.00 (ISBN 0–521–26427–8).

It is difficult to think of anyone currently writing in English with a wider knowledge and experience of the vegetation of watercourses than Sylvia Haslam. This book is a testimony to that accomplishment and develops many of the themes earlier outlined for Britain and North America (Haslam (1978) *River plants*) in a western European context. With the collaboration of Pat Wolseley, she has combined a large number of published sources with her own research funded by the E.E.C. to examine the distribution and ecology of river plants within the Community excluding Greece, Spain and Portugal but including a small area of south Norway.

The development of rivers from prehistory into the era of human impacts is outlined, and various ways of classifying rivers are described. Dr Haslam's preferred system uses water force, rock type, stream size and landscape to arrive at site types, which may subsequently be assessed in terms of their 'Cover-Diversity number' (a combination of the number of macrophyte species with their percentage cover). Chapters on climate and river discharge are followed by a very detailed discussion of species distribution in relation to physical factors, where a somewhat confusing format follows the introduction of a χ^2 analysis. Chapter 7 introduces Dr Haslam's idea of 'Colour banding' as a means of describing the trophic status of watercourses. This technique ranks species and their nutrient status in an empirical way, making use of 'Cation Number' and 'Hardness Ratio' to classify

streams and the plant groups occurring within them. Dr Haslam develops this scheme over the next two chapters prior to examining the changes that have occurred in the European rivers over the past century (due to navigation, power generation, regulation of flow, drainage and land-use factors) and in particular the last ten years where she has been able to monitor the changes in a series of sites. Her use of river maps in the next chapter to reflect the variation in a river from source to mouth is useful and informative.

The special contribution of this book, however, is the nation-by-nation description of plant communities which is derived from her own study of nearly 28 000 sites distributed through western Europe. The communities are shown in chapter 25 to have rather more to do with 'site-types' (in the sense of Finnish mire classification for example) than a more typical phytosociological approach. The book's value to anyone with an interest in conservation lies especially in the concluding five chapters, where management and pollution of watercourses are discussed. She looks at problems associated with canals, boating, herbicides and groundwater pollution and examines management options as diverse as shading, dredging and herbivorous fish. There are suggestions on the amelioration of pollution, and her proposals for a consistent assessment of 'Damage Rating' are reiterated (Haslam & Wolseley (1981) *River vegetation: its identification, assessment and management*).

One cannot but be impressed by the detail and breadth of information here but a number of matters leave one uneasy. Her reliance on the χ^2 test as the only means of analysis means that the data have gone through a preliminary sort without further more rigorous testing. This requires the reader to make a 'leap of faith' and take some of Dr Haslam's assertions on trust when the tabulated data still leave one confused. Some of the terminology is at least ambiguous (what is meant by 'more nearly eutrophic'? – Tables 1.2), and the use of words or phrases like 'nutrient rich species' is clearly a shorthand which taken at face value makes no sense. It possibly reflects a cautious mind on my part, but I would have liked the links between her very detailed knowledge of European rivers and the generalizations made about them to be worked out in greater detail. One is left believing that someone with her experience is probably correct on most points, but there remains the question: "How can she be certain?". The labelling of the tables and diagrams is often very confusing indeed and requires the reader to check through a lot of text to ensure the correct interpretation. The index has many omissions of species and river names, such that a student or amateur naturalist interested in their local stream and some of its special plants may have to read a great deal to answer a small question (I very nearly missed an informative description of the River Idle in Nottinghamshire). This problem, linked to Dr Haslam's very individual approach, can mean that it is less useful as a reference work to dip into than one would hope. Readers intent on really understanding the subject will have no alternative but to work carefully through the text and in doing so will find a lot of fascinating material.

This is an important book and an attractive one thanks to Pat Wolseley's illustrations of individual streams, but one despairs of C.U.P.'s pricing policy, which will surely dissuade many people from giving it the time and effort it needs.

J. O. Mountford

100 families of flowering plants. M. Hickey & C. King. 2nd edition. Pp. xvi + 619, with numerous line illustrations, 7 tables and a foreword by S. M. Walters. Cambridge University Press, Cambridge. 1988. Price £25 (paperback; ISBN 0–521–33700–3); also available in hard covers (ISBN 0–521–33049–1).

This splendidly produced second edition comes in a larger format with a new layout of text and improved illustrations. Drawings of whole plants are now included, second representatives have been added to certain families, Ulmaceae has been omitted and Grossulariaceae incorporated in Saxifragaceae, with Balsaminaceae and Elaeagnaceae substituted. The introduction has been revised and new comparative tables added. As Walter's foreword indicates, this new edition is, moreover, "considerably improved in the light of experience", the authors having considered and responded to many valuable comments by users of the first edition. The general scheme and principles for the choice of the 100 families out of a world total of between 300 and 400, the basis of the classification used, the two-part treatment – with a family outline followed by specific

'representative' examples – have been clearly set out in the review of the first edition (*Watsonia* **14**: 93, 1982).

This attractive book clearly meets a need, for it brings together in succinct form much information on the range of features found within each family, notes on economic and ornamental members and on distributions, a pollination summary, an outline classification, and, where appropriate, special full-page illustrations of the range of fruit types found (Cruciferae, Leguminosae, but not Umbelliferae). The emphasis is on floral structures, with little indication of vegetative characters, however diagnostic. The treatment of seed or fruit is curiously inconsistent: *Verbascum* seed is drawn but not *Papaver* despite text comment on economic use; an excellent Mallow fruit but an immature Buttercup achene and obscure *Lamium* nutlets.

The so-called 'typical' representatives of each family have been chosen to be readily available either as members of the native flora or as commonly cultivated garden or greenhouse plants. Much of the material used for the illustrations came from the University Botanic Garden, Cambridge. Thus 'typical' is not used in a taxonomic sense, but as 'familiar' and available to those living in lowland England. I suspect that users from the more extreme western and northern parts of the British Isles may need to resort to the alternatives suggested (for *Lamium album*?). A very high proportion of the examples are of horticultural provenance. This points to the book being aimed at the less specialized botany students, especially those of horticulture, and the keen knowledgeable amateur gardener from the British Isles (rather than North America). It is a handbook to accompany classroom instruction. This book cannot be used as a reference in the way that Rendle's *The Classification of Flowering Plants* (1938) and Heywood's *Flowering Plants of the World* (1978) can with their complete coverage. Moreover I doubt that relationships between families (as is suggested) can be gleaned here, for only in the Contents are the families placed under Orders. But the comparative tables of family characters are an excellent feature. This book will be much admired and consulted.

A. P. Conolly

The archaeology and the flora of the British Isles. Edited by M. Jones. Pp. 122, with 44 line drawings and black and white photographs. Oxford University Committee for Archaeology Monograph Number 14/Botanical Society of the British Isles Conference Report Number 19. Oxford University Committee for Archaeology, Oxford. 1988. Price £15 (ISBN 0–947816–14–3).

This volume arises out of a joint meeting of the Botanical Society of the British Isles and of the Association for Environmental Archaeology. The postglacial history of the British flora is now recognized to be inextricably bound up with human use, and abuse, of the landscape – and so with environmental archaeology. The contributions vary greatly in geographical scope, from a brief but stimulating comparison between North American and British woodlands to a report on two important coleopteran fossils from Hampstead. Each, however, addresses one of the big issues in the history of human impact on the vegetation: the nature of early postglacial 'wildwood', the evidence for pre-neolithic clearance episodes, the nature and causes of the elm decline, the formation of lowland grasslands and upland moors, the usage of coastal vegetation and development of urban ruderal and arable weed communities.

The wildwoods of Britain differ from their North American counterparts in having fewer combustible species (Rackham). Nonetheless there is now an impressive array of evidence for pre-elm decline clearance episodes, many associated with traces of fire and some with artefactual indications of human activity. Clearance significantly enriched floristic diversity and also increased the abundance of edible plants and, indirectly, of game (Innes & Simmons).

A welcome advance is palaeoecological analysis at smaller temporal and spatial scales more relevant to human activity. The elm decline is both widespread and long-lasting, but close palynological sampling reveals that in some places the major 'landnam' episode is preceded by initial thinning of the woodland canopy, which Scaife attributes to pastoral activity. It should be noted, however, that this need not indicate "a predominantly woodland-based pastoral economy" (Scaife p. 28, also R. Jones p. 102): animal husbandry is more extensive than arable farming and so may well be better represented palynologically without being more important. Girling's discovery of *Scolytus scolytus*, the bark beetle carrier of the Dutch Elm Disease fungus (*Ceratocystis ulmi*), in a

pre-elm decline context reinforces suggestions of a prehistoric outbreak of this disease, which would have been greatly facilitated by human assaults on the wildwood.

Whatever the mechanisms of woodland clearance, one of the most important developments – both floristically and economically – in postglacial Britain has been the shift in emphasis in stock rearing from woodland browse and leafy hay to open pasture and, eventually, grassy hay. The contributions charting the development of lowland grassland (Greig; Lambrick & Robinson; McDonald) admirably integrate palynological, plant macrofossil, faunal (insect and molluscan) and documentary evidence. Plant *communities* are strongly emphasized in these contributions, both as entities of intrinsic historical interest and as an aid to ecological interpretation of plant fossils. Greig is surely wrong, however, to suggest that the Zürich-Montpellier system of phytosociological classification has been so little used in Britain through ignorance or inability to master its complex nomenclature. The system has serious drawbacks – such as its reliance on unique character species and inability to cope with floristic gradients – and it would be unwise to assume that present-day associations also existed in the past. In fairness, what Greig practices is far sounder than what he preaches, though his loose use of terminology is confusing: e.g. are 'typical plants' those commonly found in an association, phytosociological 'character species' or 'character species' plus 'companions'?

Uniformitarian assumptions about communities are avoided by M. Jones in documenting increasing diversity through time in the weed flora, a process related both to the colonization of new arable habitats and to the introduction of new agricultural methods. The concurrent broadening of the range of crops, and the occasional arbitrariness of the crop/weed distinction, are further points of interest. Hall uses the uninspiring ruderal flora from urban excavations to expose the sordid nature of life in our early towns. The final section of the volume stresses the great importance for past economies and present vegetation of human exploitation of coastal (R. Jones) and upland areas (Chambers; Moore), now marginal to modern land use.

The issues tackled in these papers are complex and debate will doubtless continue on the nature and significance of human impact on vegetation change. Archaeologists may be disappointed that greater emphasis is not placed on the reconstruction of human behaviour as the ultimate goal of these contributions. But this chapter in the history of the British flora underlines the dynamic interaction between man and nature in the prehistoric and historic past and in so doing exemplifies the active contribution now being made by environmental archaeology to its parent biological disciplines.

G. Jones & P. Halstead

Atlas Florae Europaeae. Edited by J. Jalas and J. Suominen. Vol. 7: Caryophyllaceae (Silenoideae). Published by the Committee for Mapping the Flora of Europe and Societas Biologica Fennica Vanomo, Helsinki. 1986. Price £55 (ISBN 951–9108–06–8).
Fytokartograficke synteszy ČSR (A summary of plant distributions in the Czech Socialist Republic). B. Slavik (compiler, and sole or joint author of most of the maps). Pruhonice, 1986. In Czech, with a 2½ page English summary. Price not stated.

The latest part of the 'Atlas', subtitled "distribution of vascular plants in Europe", contains 296 maps, and the accompanying text gives for each taxon its synonymy, references to nomenclature, chromosome number(s), and distribution by *Flora Europaea* territories. The treatment differs in one important respect from the previous parts: the data on chromosome numbers are now accompanied by lists of countries for which each number has been recorded. *Silene* is by far the largest genus treated, followed by *Dianthus*. In both genera there are species with extremely clear-cut distribution patterns: map 1167 (*Silene acaulis*) is an excellent example of an arctic-alpine, while map 1115 (*Silene uniflora*, formerly known as *S. maritima*) shows a typically coastal Atlantic species. There are also some puzzling patterns: map 1485 (*Silene giganteiformis* subsp. *pontederae*) shows a plant practically endemic to Hungary, while on map 1074 *Silene viscosa* hugs the western and northern coasts of the Baltic sea while spurning its southern and eastern shores. As in previous volumes, there are concise summaries of the "deviations from *Flora Europaea*" as well as a nicely laid out index. The work is far more than just an Atlas; it serves also as a commentary on, and bibliography of, the European flora as well as a concordance of the often contradictory European

chorological literature. The team which contributes to this very worthwhile project consists of a committee with more than 40 members and a similar number of advisers. The results of their efforts are very instructive, not only for understanding plant distribution *per se*, but also for testing the taxonomy of the European flora.

The Atlas of the Czech flora has been planned to accompany the 8-volume *Flora of the Č.S.R.* and to complement its distributional data. It employs the Central European grid system which is based on units of ten minutes of longitude and eight of latitude; these units are approximately one third larger than the area of a 10 × 10 km grid square, and allow the compilers of the Central European mapping scheme to use the data directly. The maps were compiled manually, but computerization of future volumes is envisaged. The thoroughness of the survey can be gauged by the fact that the commonest species are unrecorded from only a handful of squares. By contrast, the number of species confined to the area around Breclav is also striking. According to the summary, literature sources have provided the bulk of the data, except for rare and declining species for which herbaria have also been scanned. As the title indicates, only the Czech Republic (the western part of Czechoslovakia) is mapped. The compilers express the hope that although the number of voluntary contributors to this volume was small, by international standards, "a more active collaboration is planned". The mapping of the Slovakian flora is also in progress, and together these atlases will provide a worthwhile eastern extension to the detailed mapping of the flora of Central Europe.

J. R. Edmondson

Collins photoguide to wild flowers of Britain and northern Europe. O. Polunin, edited for publication by J. R. Akeroyd. Pp. 508, with 128 colour plates and numerous text line drawings. Collins, London. 1988. Price £9.95 (ISBN 0–00–219709–X).

This is the latest in the line of Collins' guides to wild flowers and the last to be written by the great field botanist Oleg Polunin. His unfinished manuscript has been enhanced with extra information, and prepared for publication by John Akeroyd (aptly one of Oleg's former pupils). As a pocket guide to the British and northern European flora this book stands alongside those previously written by Fitter *et al.* (1974), *Wild Flowers of Britain and N. Europe*, and others, and one may question the need for yet another guide. The area covered is roughly the same as that of Fitter *et al.*, and similarly Polunin has left out the grasses, sedges, rushes (and related species) and all trees and shrubs over 1 m tall. However, unlike these previous publications this book seeks to provide a comprehensive coverage of the flora with many rare and critical plants nestled in amongst the more familiar common flowers. As such it stands alone on the shelves of 'popular flower guides', and is a worthy addition. The book contains just over 700 colour photographs, of varying quality, taken by Oleg Polunin. These are arranged in order of their flower colour, generally with six photographs to a page, and occasional full page plates (e.g. Alpine Sawwort, Bastard Balm, Hemlock, etc.) pleasantly breaking up the blocks of photographs. Most other guides use colour paintings as illustrations, and thus this book would appeal to those who prefer photographs. The lack of any keys can make identifications from scratch somewhat tricky, but unknown plants can be matched to the photographs, and perusal of the main text around similar species should result in an accurate identification. In these respects I think it is fair to say that this book is not aimed at the complete novice, but rather towards the more experienced field botanist who requires the extensive coverage of a full flora condensed into a manageable pocket guide.

The text is arranged according to the systematic order used in *Flora Europaea*, and the 1780 species included are numbered through the book. The photographs are labelled with the vernacular name and species reference number. Within the main text each species is given a short description containing the salient characters of the plant, its ecology and distribution. Many high quality line drawings by Rosemary Wise complement the descriptions.

The book is well written and presented. It is bound in a waterproof, plastic flexicover which should stand up to field usage. Like Fitter *et al.*, the index is split into English and Latin names. I find this inconvenient as I frequently find myself looking in the wrong part, and I much prefer a combined index. In a similar vein I feel that Latin names would be helpful, with the English names, under the photographs. Unfortunately a few mistakes have crept in, like the transposition of photographs of *Vincetoxicum* and Wild Madder (p. 200), and should the Scarlet Pimpernal really be

found amongst the yellow flowered plants (p. 229)? Overall for the quantity and technical quality of the information it stores, this book is excellent value and will soon become invaluable to any B.S.B.I. member when botanizing at home and in northern Europe.

M. F. Watson

Flora of Leicestershire. Edited by A. L. Primavesi & P. A. Evans. Pp. 486, with 34 colour plates, 34 text figures and 1080 distribution maps. Leicestershire Museums, Art Galleries and Records Service, Leicester. 1988. Price £30 (ISBN 0–85022–230–3).

This fourth Flora of Leicestershire (excluding Rutland) is very much in the style of such recent county Floras as those of Shropshire and Durham, providing not only tetrad maps but an apparatus of historical and ecological information almost as long as the systematic part of the book. The maps, gathered together at the end, cover all species except casuals (the Flora deals only with vascular plants), and mostly have just a single date class, being based on records gathered between 1968 and 1981, together with any significant additions up to 1987. While changes in the flora are thus not shown on the maps, they are neatly indicated in the text by means of a resumé of the status of each species from the last, extremely detailed Flora of the county by A. R. Horwood & C. W. F. Noel (3rd Earl of Gainsborough), *The Flora of Leciestershire and Rutland* (1933). These changes are discussed habitat by habitat in a valuable chapter that includes a striking table of losses from the flora since 1720. It is interesting that most of the extinctions took place in the period between 1900 and 1930, although the greatest habitat changes have taken place since then. This prompts pertinent comments on the redistribution of species among the changing habitats, and on the reliability and completeness of recording at different periods and in different habitats. A most readable chapter on 'Man and the Leicestershire flora' provides the historical context for these changes.

The section on local botany and botanists, concentrating on work done since 1900, and on botanists deceased since 1933, contains a great deal of original material, and there is a thorough bibliography. The excellent chapters on the physical background suffer slightly from the fact that the maps showing geology, altitude and other features lack a tetrad grid and are at a much larger scale than the species maps, making correlation difficult. The chapter on habitat studies includes species lists from 107 sites, the species being grouped under the conventional frequency headings from 'abundant' to 'rare' (curiously, although dominants are sometimes mentioned in the site descriptions, there is no separate heading for them). The 30 colour photos are the best and most informative I have seen in a county Flora. Another exceptional feature is the annotated gazetteer which doubles as a botanists', and indeed as a local historians', guide to the county and is cross-referenced to the habitat studies.

The systematic part of the Flora is admirably concise and informative and includes for each species general statements on ecology and distribution, coded lists of habitats, first records, and lists of herbaria that contain specimens. Detailed records are given for those species with 15 or fewer records. The larger critical groups are all well covered, with unusually thorough accounts of *Taraxacum*, *Rosa* and *Ulmus*. Infraspecific taxa are, however, rather poorly covered in general, there being no mention, for example, of which subspecies occur in such species as *Ranunculus ficaria* and *Carex muricata*. In *Montia fontana* only subsp. *chondrosperma* is given, although Horwood & Gainsborough and S. M. Walters, *Watsonia* **3**: 1–6 (1953), give two others. One has again to refer to the earlier Flora for information on such matters as the variation within *Allium vineale* and *Anthyllis vulneraria*. Even if much infraspecific variation could not be mapped, it is a pity that it is so often not even mentioned. *Poa subcaerulea*, given for 14 sites by Horwood & Gainsborough, is unaccountably completely omitted. Such quibbles apart, the editors and their co-workers are to be congratulated on having produced a most substantial county Flora to rank in many of its features among the best. It is very well designed and compact and a pleasure to handle. Vice-county 55 is now well-covered by the combination of this book and its companion, K. G. Messenger's *Flora of Rutland* (1971).

A. O. Chater

Taming the flood. J. Purseglove. Pp. vii + 307 with 16 colour plates. Oxford University Press, in association with Channel 4 Television Co. Oxford & New York. Price £17.50 (ISBN 0–19–215891–0).

This is a book written from the heart, and with great skill, by a man who has worked in the water industry for more than a decade defending the natural resources and historical interests associated with rivers and their floodplains. Although parts of the book do deal with disastrous ecological consequences of the eras of land drainage and unsympathetic river management, it is not a tirade against those responsible. It does however recognize why much of such work was executed, the changes in legislation which made it possible, and the dream that reality and common sense will work together to put the clock back in the decades to come.

The book has eight chapters; merely listing their titles would not indicate the breadth of topics covered in them and the depth of research which so clearly has gone into the wealth of subjects tackled. This book is not just for botanists but for anyone with an interest in our cultural and ecological heritage. The historical aspects of 'claiming the fens' and the 'drainage of wetlands' adds to the interest of the book; for those with a realistic curiosity in deciphering what has happened through the ages to retain some of our last vestiges of wetland it is a must.

One of the great attractions of the book is the skilled way in which many topics are related to one another, linking the historical, human and botanical aspects of wetlands. However knowledgeable you may be on our wetlands, there is bound to be something new and interesting you will will learn from this book. Examples include learning that 'Somerset' derived from Anglo-Saxon times to mean 'summer dwellers', those grazers who could only use the levels during the summer, and that King George III was known as 'Farmer George' because of his financing of drainage improvement.

The book also contains a wealth of information on the history and flora of many key wetland sites – Cricklade, Derwent Ings, Halvergate, Hatfield Chase, Otmoor, Romney Marsh, Wicken Fen, etc. No other book has so clearly and attractively looked at what we have today and so meticulously linked it to the pastimes of our forebears. A large element of the book also looks at how the riches of our riversides have been an under-valued resource which previously had been linked to the lives and times of the 'fenmen' – pollards for stakes, osiers for basket making, cricket bats from willows, bomb fuses from Alder Buckthorn, aspirin from Meadowsweet and an endless list which includes the Medicinal Leech. For those who saw Jeremy knee-deep in a swamp, his legs festooned in these blood-suckers, in the television series which accompanied the book this was a painful reminder of the author's dedication to get a total feel for the subject he is reporting on.

Without doubt this is one of the most readable, and excitingly written, books on the cultural history and wildlife of our wetlands. It can be read avidly for hours or picked up for a few minutes at a time to gather snippets of great interest which awaken visions of bygone years of vast wilderness wetlands – and dreams of what it might be like in years to come. A brilliant read delivered with great passion and skill.

N. T. H. Holmes

Census catalogue of the flora of Ireland (Clár de Phlandaí na hÉireann), 2nd edition. M. J. P. Scannell & D. Synnott. Pp. 171, including a colour fold-out map showing the 40 Irish botanical vice-county divisions. The Stationery Office, Dublin. 1987. Price IR£4.80

Few other publications have been as warmly welcomed by Irish botanists as has the new edition of Scannell & Synnott's *Census Catalogue*. The first edition was published in 1972 and was constantly and widely used by resident botanists and visitors. Nevertheless it had become considerably out of date and the appearance of the new edition was timely.

Since 1972 considerable and significant advances have been made in knowledge of the distribution of the flora, with several new discoveries located as well as many new invasive and alien plants established and naturalized. As a result the new edition contains an additional 305 taxa of which 174 are considered native. Some of the most notable new additions include *Hydrilla verticillata* in H16, *Luzula pallescens* in H39, *Trifolium occidentale* in several counties along the south-east coast, *Carex depauperata* in H5, *Parapholis incurva* in H21 and *Cardamine impatiens* newly discovered in a native habitat in H23. Many of these additions result from recent taxonomic studies and include 95 *Taraxacum* microspecies and 60 *Rubus* microspecies. 42 species have been added to the list of naturalized and established aliens.

The book is made up of a series of short introductory chapters followed by a systematic list of the Irish vascular flora. Included in the introduction are two lists of species protected in the Republic

and in Northern Ireland as well as comments on the vice-county system (or botanical divisions), nomenclature and Irish and English names used, all of which are concise and useful for the interpretation of the systematic information that follows them.

The systematic section lists each taxon (species, subspecies or hybrids, not varieties) and its authority, some synonyms, Irish and English names and its vice-county distribution. A symbol is also provided to suggest whether the taxon is native or not. Where the taxon has not been seen since 1950 the vice-county number is given in brackets, thus providing an incentive for present-day botanists and vice-county recorders to track down the old records. Occasionally taxa are annotated with very brief notes on status, taxonomy or distribution. The English names given are those published in *English Names of Wild Flowers* (Dony, Jury & Perring 1986) but alternative commonly used names in Ireland are also given in brackets. The list of Irish names is an extremely valuable asset as such a comprehensive list is not easily available elsewhere.

The ideal time to write a review of any book is perhaps about one year after it has been published. By that time one will know whether it is really useful or simply takes up another inch of precious shelf space, rarely to be opened or consulted again. The *Census Catalogue* was published in 1987 and since that time it has become a valuable reference work and indispensable companion for all serious Irish botanists. My own copy is now well thumbed, dog-eared and has become, like the first edition, the base on which I have been able to plan the field work and urgent research necessary for botany in the vice-county for which I am recorder. As well as that, the book provides a handy source of species authorities and common names that can be consulted much as one would use a dictionary for spellings. I would have liked to see rather more synonyms included in the list than have been given so that some of the old and rather obscure taxonomy used in early Floras can be easily compared with modern day usage for the same taxa. Nevertheless some would probably argue, with considerable justification, that to include these would clutter the text and make the work much less useful for the non-specialist.

There are apparently few errors and the work has been completed with meticulous attention to detail. I hope that if errors are found over the next few years that the authors will consider publishing a list of errata so that we may use the book with considerable continued confidence in its accuracy. The systematic section is well and clearly laid out, each page has plenty of space for scribbled notes and other comments. The production of the book is also good with high quality paper and robust binding. The front cover has a good colour illustration depicting various grassland plant species against a fine blue sky; it is a very great improvement on the dull cover provided for the first edition. Inside several attractive line drawings by Rosamond Praeger from the National Botanic Gardens collection are also included.

In the introduction, we are told, the sources for each county record given is available on a card index, maintained at the National Herbarium (**DBN**). This is essential information for botanists wishing to pursue individual records further, especially as some are based on unpublished herbarium material or information received by the authors from correspondents.

Irish botanists are well served by this book and its authors. Most of us have come to take it for granted as an essential part of our botanical libraries, forgetting that of the two major islands of the British Isles, Ireland is the only one to have had such a catalogue compiled in recent years. Indeed one sometimes wonders how botanists in Britain have managed without one similar for so long.

P. S. Wyse Jackson

A checklist of the flowering plants and ferns of East Lothian. Edited by A. J. Silverside & E. H. Jackson. Botanical Society of Edinburgh, 1988. Price £2 (ISBN 0–903–077).
A checklist of the flowering plants and ferns of Midlothian, Edited by Douglas R. McKean. Botanical Society of Edinburgh, 1988. Price £2 (ISBN 0–903077–05–1).

These checklists will be warmly welcomed as heralding the significant progress towards the major objective of the Botany of the Lothians. This project was initiated by the Botanical Society of Edinburgh with the ready and vital collaboration of the Royal Botanic Garden, the University and the enthusiastic support of local botanists.

The trilogy will be completed by the publication of a West Lothian checklist which is in an advanced state of preparation. These lists have depended heavily on the dedicated industry of Miss

E. P. Beattie who until recently was B.S.B.I. recorder for the three Watsonian vice-counties. The final work will be more than a three-county flora and is planned to include floristic maps and authoritative accounts of the physical background which will reflect enormous changes in the environment, particularly in the present century.

The cover illustrations appropriately recall the area being recorded: the wind-blown coastal pines of Yellowcraig, East Lothian in one case and on the other with the species-rich volcanic mass of Arthur's Seat, elephantine in more ways than one, towering over Scotland's capital.

The checklists, it is hoped, will stimulate collecting by indicating areas and groups still requiring particular attention. The field work is planned by Dr Philip Smith on the basis of one kilometer squares. He plans meetings of recorders and is largely responsible for tactics and strategy. He has marshalled an impressive band of volunteers for the survey and is a most powerful and persuasive advocate for the whole scheme. Naturally, new records and recent sightings of species long overlooked have been made as the Survey has proceeded. Sadly too some extinctions are feared though, generally speaking, the flora is changing rather than shrinking. The aliens associated with the riverside milling operations are fewer but Leith, the seaport of Edinburgh, is still a rewarding locale for botanists. But not all is doom and gloom, for example, in the light, sandy soils of East Lothian where changes include the rapid spread of *Amsinckia* spp.

The Lothians are ecologically and climatically diverse and generally under-valued for botanical interest. Even the main urban area, Edinburgh itself, is threaded by ancient watercourses acting as wildlife corridors, has extensive green places and many trees.

These checklists are well-indexed, usefully annotated and well laid out. A jaundiced eye has been applied to suspect old records and the presumption of native status has been intelligently reviewed in many cases. Selected locations are cited to keep the size of the work within bounds and there are indications of frequency. B.S.B.I.-recommended English names are generally followed and are cited as synonyms where the Scottish name is more apposite. Thus Scottish Sticky Willie has priority over English goosegrass, even though it refers to a poorly regarded Englishman – William Augustus, Duke of Cumberland. Undoubtedly wild, he too was difficult to shake off in the mid-eighteenth century.

One purpose of checklists is to stimulate or provoke the reader to extend the record or to challenge it. These two publications should achieve this admirably.

SIR G. TAYLOR

Birds and berries. A study of an ecological interaction. B. & D. Snow. Pp. 268, with 12 figures and 83 tables. T. & A. D. Poyser, Calton. 1988. Price £16 (ISBN 0–85661–049–6).

This book is a tribute to the observational stamina of the authors. The bulk of the book draws on data obtained from nearly 1700 hours of recording between 1980 and 1985 in the countryside and gardens of Buckinghamshire. The authors made systematic observations of fruit-eating birds feeding on the native fleshy-fruited plants of the British Isles. These plants are mainly woody shrubs such as hawthorn, rowan and elder, and the book concentrates their interactions with the native fruit-eating birds of the British Isles.

It has been an achievement to analyse and compile these data into a most informative and fascinating book. The first part discusses the 39 native fruit bearing species and summarizes the use made of the fruit by fruit-eating birds. The most common fruit-eating species are the thrushes and finches, though tits, starlings, pigeons and some warblers will also take fruit. Interestingly, at least some fleshy fruits are available throughout the whole year, such as the evergreen yew, holly and ivy.

The second part discusses the fruit-eating birds themselves and the range of fruits taken by each species. Differences are noted in the preference of species, a preference not always dependent on the size of the fruit, though this can be important. The mistle thrush is one of the larger fruit-eating species and is capable of defending an especially rich source of fruit from other birds. This defence is a survival mechanism to enable the thrush to have a source of food during difficult times. A fully laden section of otherwise bare hawthorn hedge in early January is probably being defended by a mistle thrush.

The third part widens the discussion of relationships between birds and fruit-bearing plants by drawing the authors' U.K. data into a world-wide context. We are familiar with the concept of the

dispersal of seed by fruit-eating birds and the mutual dependence of the two parties. However, we are less familiar with the relative food content of different fruits and the adaptations present in both birds and plants to facilitate their co-existence. The co-evolution of plants and birds is also considered in this section.

This book is presented in the normal Poyser high quality format with which ornithologists rather than botanists will be more familiar. The text is well written, and the data have been presented in a way which is readily accessible from a study of the contents and index. This is important because the first two parts of the book are predominantly a reference source. This is perhaps a criticism which can be levelled at this book, though it is difficult to see how it could have been written in any other way. Many of the data are presented in figures and tables which have deliberately been kept simple for easy reading.

This book provides a great deal of evidence on the nature conservation importance of much of our native, mainly shrub flora and consequently the importance of hedgerows and similar habitats to our native birdlife. The book also gives clear guidance on the most effective species to plant for nature conservation purposes. As both a botanist and an ornithologist I can recommend this book as it has done much to heighten my own awareness of the subject and to encourage me to make my own observations.

D. M. Parker

Flowers of the Himalaya – a supplement. A. Stainton. Pp. 86, with 128 pages of colour plates. Oxford University Press, Delhi. 1988. Price £15 (ISBN 0–19–217756–7).

The title of this book explains just what it is – a supplement to the excellent field guide *Flowers of the Himalaya* produced by Oleg Polunin and Adam Stainton and published in 1984. It retains the same format of brief but highly informative descriptions coupled with a large number of colour photographs. In fact the supplement illustrates all of the 350 species described within its pages and a good many that were included in the first publication but either lacked an illustration or were simply provided with a line drawing. Those from the original publication are cross-referenced back to it – effectively making the supplement an integral part of and essential companion to the parent volume.

In the supplement the author has included some species from subtropical altitudes, a few species well-known to Europeans but perhaps less familiar to others and also common showy introductions, thus broadening the scope of the first book. The new material is, of course, excluded from the brief keys in the earlier work which is a little unfortunate but the informed descriptions compensate for this. The quality of reproduction of the colour photographs is in general very good both in sharpness and colour; the few exceptions do not seriously detract from this high standard.

One might be tempted to wonder why, as one juggles the two books on the back of a patient yak, the new material was not simply integrated with the old and published as a revised edition. The author discusses this option but mentions the prohibitive cost of such an amalgamation and in my opinion this factor alone fully justifies his sensible alternative. It would be a great shame to prohibit any keen naturalist or, for that matter, any interested tourist, from acquiring the expanded version of this invaluable guide.

R. A. King

Vegetation of inland waters. Edited by J. J. Symoens. Pp. xiv + 385. Kluwer Academic Publishers, Dordrecht. 1988. Price £76.50 (ISBN 90–6193–196–7).

This is volume 15/1 of an academic series entitled *Handbook of Vegetation Science*. It is the first of two dealing with aquatic vegetation – it concentrates on the vegetation of inland waters whilst its companion concentrates on wetlands of the world.

There are eleven chapters in the book, some of general interest to the field botanist, the majority of which are rather academic and aimed at the professional scientist working in the 'water environment' or the student. This is not a criticism since many of the chapters are well written, clearly structured (but sparsely illustrated) and providing very good background into such subjects as 'Water as an environment for plants', 'Photosynthesis of aquatic plants', 'Algal communities in

continental waters' and 'Aquatic plants in extreme environments'. There is, somewhat surprisingly, a chapter on the flora of periodically flooded plains and another on fens. Considering the companion volume is supposed to be devoted to wetlands these two chapters appear out of place in this book which did not accommodate chapters on lakes or ponds.

There are two interesting chapters on macrophytes in rivers, one detailing the relationship between water flow and vegetation, the other looking at systems of surveying, assessing and then applying such information for academic or practical purposes. Both highlight the great importance of macrophytes as creators of habitat for aquatic animals. In diverse systems they are less important but where there is little habitat variability the structure of the aquatic plant community is the main determinant of the animals assemblage. This aspect, and many others, is beautifully expounded by the much respected C. den Hartog and a colleague from the Catholic University in the Netherlands.

The brief outline of contents indicates that this is not a volume which will have great appeal to the majority of B.S.B.I. members. This does not suggest however that it is not a valuable book for the undergraduate or post-graduate student of aquatic sciences or the practising biologist in the water industry. It should find its way on to library shelves in universities and water authorities but could hardly be commended to even the most intrepid plant recorder with webbed feet.

N. T. H. Holmes

Domestication of plants in the Old World. D. Zohary & M. Hopf. Pp. ix + 249, with 39 figures and 25 maps. Oxford University Press. 1988. Price £35 (ISBN 0–19–854198–9).

This book is an authoritative, succinct and clearly written account of the ancestry, domestication and spread of many of our most familiar crop plants. The authors concentrate on S. W. Asia, Europe and the Nile valley, although reference is made to regions further to the east; the story begins in about 7500 B.C. with the growth of farming villages, combining cereal cultivation with animal husbandry, in the Near East. Not only are cereals and pulses discussed, but also oils and fibres, fruits and nuts, vegetables and condiments, and even wild-collected produce such as beech mast and the fruits of *Crataegus*. Frequent reference is made to weeds, the evolution of which is so closely tied in with that of crops.

Of particular value are sections on sources of evidence and methodology in archaeology, and representative sites with listings of species reported from them, arranged by country. There is an extensive bibliography and the text is liberally illustrated by maps and figures, notably showing diagnostic features of modern and, often carbonized, ancient plant structures from archaeological remains. These bring the historical context vividly to life.

This excellent synthesis of archaeological and genetical data is an essential reference work for those interested in the evolution of crops (and weeds), and for the interpretation of plant remains in archaeological studies. Hopefully it will encourage further cooperation between these disciplines.

J. R. Akeroyd

Saxifrages of Europe. With notes on African, American and some Asiatic species. D. A. Webb & R. J. Gornall. Pp. viii + 307, with 61 figures (line drawings and monochrome photographs), 3 tables, 75 distribution maps and 60 colour plates. Christopher Helm, London. 1989. Price £30 (ISBN 0–7470–3407–9).

The authors of this book have produced an authoritative and yet highly readable account which covers all the European species of saxifrage together with shorter notes on saxifrages found in other parts of the world, most especially in North America. It is a book with enough detail both to satisfy the taxonomist and to appeal to the naturalist and gardener. It is illustrated with many attractive colour photographs, some of which have been taken in the wild.

The book starts with a description of the taxonomy and biology of the genus *Saxifraga* which includes an account of the origin of the genus and its evolution to its present highly diverse range of sections and species. This part of the book illustrates a characteristic of the whole publication in that the treatment of the relevant literature is scholarly and, to the best of my knowledge, complete. The

introductory sections also include a historical account of the classification and naming of the saxifrage species together with notes on their general ecology.

The greater part of the book, over 200 pages, is taken up with a systematic treatment of all 119 European species. For each species information is given in a number of areas which will be of varying interest depending on the needs of the reader. The first sections are on nomenclature and description, including notes on species recognition, the existence of hybrids and the known chromosome number(s) of the species. The account then considers the distribution and habitat of the species and gives some guidance on the most accessible sites where the readers may see the species in the wild. This will be valuable information for the touring botanist and naturalist. Accurate distribution maps for many species are published here for the first time.

With many of the European saxifrage species being part of a much more extensive Eurasian and North American distribution, the final chapters of the book discuss, quite concisely, species which are endemic to Madeira, Africa, the Near East and Caucasus, and the Himalayan region. The 65 species of North American saxifrage are considered in more detail in the final chapter of the book. This chapter has aimed to bring together information on the complete North American flora and has succeeded admirably in this aim, though my only regret is that the treatment is not in as much detail as in the European species.

I have no hesitation in recommending this book to anyone like myself who has a weakness for saxifrages as a group but who wishes to have more confidence in being able to correctly identify a plant and, following that, to be able to read more about the distribution, biology and ecology of the species. It is an adaptable book which can be used, for the European species, both as a working Flora (keys are included) and as a source of reference for the less taxonomically minded. Finally, the standard of printing and production and the ordering of information in the book should nurture an interest in saxifrages amongst a much wider audience.

D. M. Parker

Obituary

E. JOAN GIBBONS
(1902—1988)

When Joan Gibbons died on 2 December 1988, Lincolnshire lost a lady who had dominated the botany of her adopted county for over 50 years, and the B.S.B.I. and the Wild Flower Society one of their most dedicated and hard-working members.

Joan Gibbons was born in Essex but, at the age of five, moved with her family to Holton-le-Moor, 16 miles north-east of Lincoln where her father, Rev. Thomas Gibbons, had inherited an estate. In these rural surroundings, six miles from the small town of Market Rasen, she soon developed an interest in wild flowers stimulated by her father who took her to her first Lincolnshire Naturalists' Union meeting when she was only eleven: thus began a pursuit which she followed avidly for the rest of her life. She joined the L.N.U. when she was 18 and became Botanical Secretary in 1936, a position she held for nearly 50 years, and had the distinction of being elected President of the L.N.U. for the first time in 1939 when she was still in her thirties.

Miss Gibbons joined the B.S.B.I. in 1946 and, almost immediately, was appointed Recorder for the two Lincolnshire vice-counties – a duty which she performed with thoroughness and accuracy for the next 40 years: without her our knowledge of the flora of that enormous county, second only to Yorkshire in size (and divided into five v.cc.), would be poor indeed and her contribution to the B.S.B.I. Distribution Maps Scheme is inestimable. Arguably she made the single largest voluntary contribution – certainly in England. The task which faced her in 1954 was formidable – 90 10-km squares and very few local members to call on for support (the B.S.B.I.'s *Year Book* for 1952 listed only two!). But by dogged determination, in sensible shoes with her felt hat firmly pinned in place and with the welcome assistance of Brenda and Leaver Howitt in the west and of John Chandler in the south, she worked her way up and down and across the county until, by 1960, recording in Lincolnshire was as good as, if not better, than the rest of the country.

Her *forte* though was not just current field records: Miss Gibbons was a wonderful gatherer of information from the past – both botanical and human. During the ten years of the Maps Scheme she sent in information, species by species, each on a separate sheet of identical lined paper, which included a full account of their distribution as well as charming biographical sketches of the Recorders, especially if they were clergymen.

The value of this dual interest is exemplified by this extract from the introductory pages to her *Supplement to the Flora of Lincolnshire* (1985) "[Rev. E. A. Woodruffe Peacock] dated the herbarium 1835 unfortunately, which was unlikely as Susan Skipworth would only have been 11 years old. Very few of the 300+ specimens are localised unfortunately but of those which are, about 20 of them are from Cleethorpes, Claxby Wood, Grantham and Kidderminster. Her sisters were married and living at Claxby and Kidderminster. Other plants which are present are likely to be from South Kelsey where she was born and brought up, until she married in 1858, John Lewis Ffyche of Thorpe Hall, Louth, a noted antiquary. Her cousin, Mary Elizabeth Dixon of Caistor, kept a Withering's Botany . . ."

This of course post-dates her major achievement – *The flora of Lincolnshire* published in 1975. It was the first Flora of the county, the first full Flora of an English county to be written by a woman, and the county Flora that covers the single largest area (there has never been a complete Flora of Yorkshire). The Lincolnshire Naturalists' Union marked the occasion by electing her as President for a second term, the first woman to be honoured in this way.

In 1948 the Conservation sub-committee of the L.N.U. separated to become the Lincolnshire Naturalists' Trust. Joan Gibbons was a founder member of its Council and, had she not died on the day of the 40th Anniversary celebrations of the Trust, would have been one of only four of that original group of enthusiastic conservationists to survive. Her botanical knowledge was of enormous value to the Trust in establishing its early Nature Reserves and, more recently (1988) in publishing a *Red Data Report* for the county. She herself undertook the rescue of *Iris spuria* when its sites

became threatened and transported material to Cambridge University Botanic Gardens where it survives to this day.

Joan Gibbons was a remarkable lady: not only did she take to the fields dressed for botany, but she was also a Guider – Assistant County Secretary for 28 years and County Secretary for handicapped Guides. During the war she helped the then Lindsey and Holland Rural Community Council with the collection of medicinal herbs and rosehips.

In 1972, on the death of her brother and after 60 years at Holton-le-Moor, Miss Gibbons moved, with her two surviving sisters, to Northlands House, Glentworth. There her interest in family history developed even more strongly as she worked on the Codd and Key families which had both lived in the house, and she was a prominent member of the Society for Lincolnshire History and Archaeology. She was elected a Fellow of the Linnean Society of London in 1969.

F. H. Perring & I. Weston

B.S.B.I. Conference Reports

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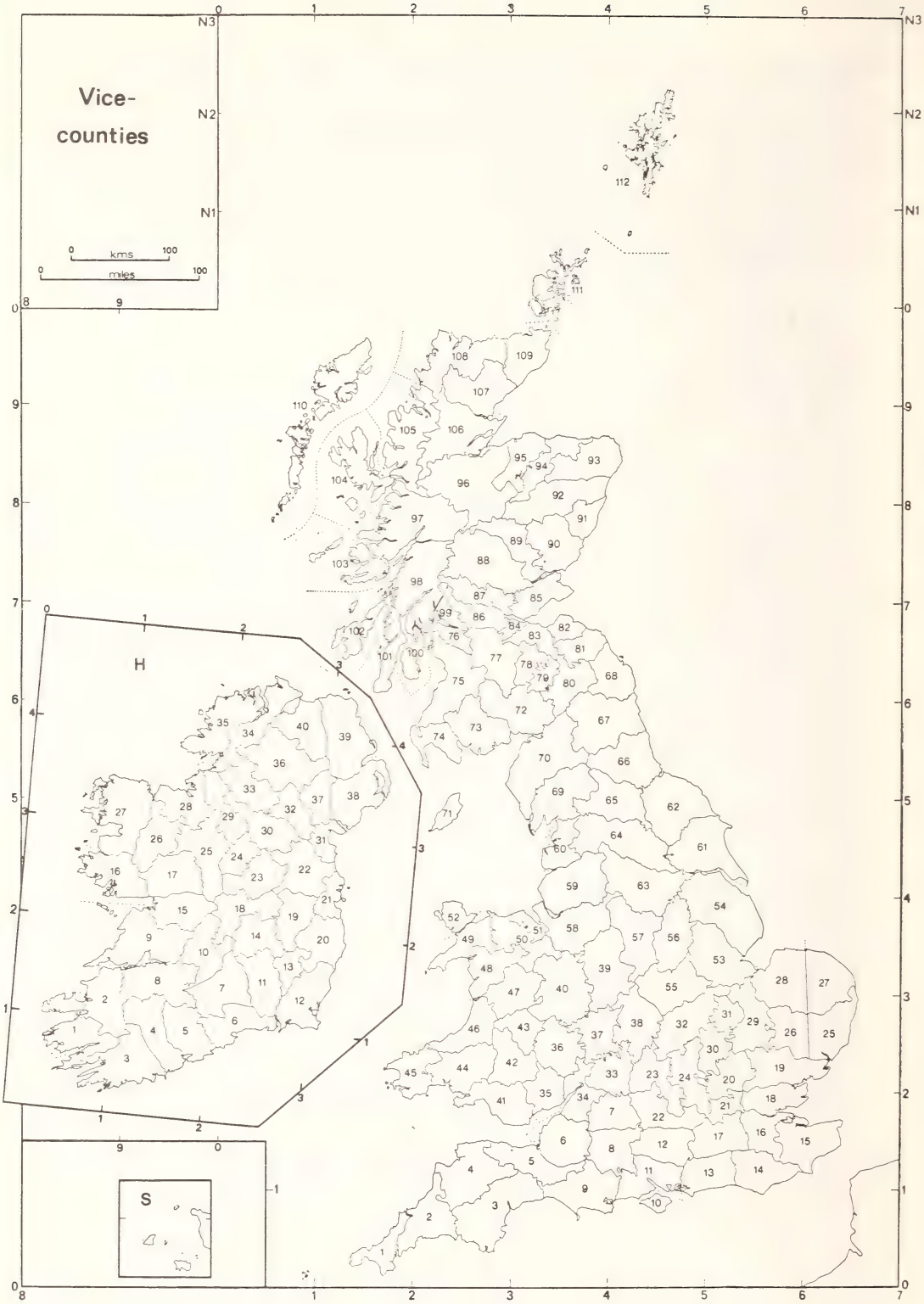
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NAMES OF VICE-COUNTIES IN *WATSONIA*

ENGLAND, WALES AND SCOTLAND

1. W. Cornwall
1b. Scilly
2. E. Cornwall
3. S. Devon
4. N. Devon
5. S. Somerset
6. N. Somerset
7. N. Wilts.
8. S. Wilts.
9. Dorset
10. Wight
11. S. Hants.
12. N. Hants.
13. W. Sussex
14. E. Sussex
15. E. Kent
16. W. Kent
17. Surrey
18. S. Essex
19. N. Essex
20. Herts.
21. Middlesex
22. Berks.
23. Oxon
24. Bucks.
25. E. Suffolk
26. W. Suffolk
27. E. Norfolk
28. W. Norfolk
29. Cambs.
30. Beds.
31. Hunts.
32. Northants.
33. E. Gloucs.
34. W. Gloucs.
35. Mons.
36. Herefs.
37. Worcs.
38. Warks.
39. Staffs.
40. Salop
41. Glam.
42. Brecs.
43. Rads.
44. Carms.
45. Pembs.
46. Cards.
47. Monts.
48. Merioneth
49. Caerns.
50. Denbs.
51. Flints.
52. Anglesey
53. S. Lincs.
54. N. Lincs.
55. Leics.
55b. Rutland
56. Notts.
57. Derbys.
58. Cheshire
59. S. Lancs.
60. W. Lancs.
61. S.E. Yorks.
62. N.E. Yorks.
63. S.W. Yorks.
64. Mid-W. Yorks.
65. N.W. Yorks.
66. Co. Durham
67. S. Northumb.
68. Cheviot
69. Westmorland
69b. Furness
70. Cumberland
71. Man
72. Dumfriess.
73. Kirkcudbrights.
74. Wigtowns.
75. Ayrs.
76. Renfrews.
77. Lanarks.
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Format should follow that used in recent issues of *Watsonia*. Underline where italics are required. Names of periodicals in the References should be abbreviated as in the *World list of scientific periodicals*, and herbaria as in *British and Irish herbaria* (Kent & Allen 1984). Further details on format can be found in *B.S.B.I. News* **51**:40–42 (1989).

Tables, figure legends & appendices should be typed on seperate sheets and attached at the end of the manuscript.

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Contributors are advised to consult the editors before submission in cases of doubt. Twenty-five offprints are given free to authors of papers and short notes; further copies may be purchased in multiples of 25 at the current price. The Society takes no responsibility for the views expressed by authors.

Submission of manuscripts

Papers and Short Notes: Dr R. J. Gornall, Botany Dept., The University, Leicester, LE1 7RH.

Books for Review: Dr J. R. Edmondson, Botany Dept., Liverpool Museum, William Brown St, Liverpool, L3 8EN.

Plant Records: the appropriate vice-county recorder, who should then send a collated list to C. D. Preston, Biological Records Centre, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, PE17 2LS.

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