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Watsonia, **19**, 1–19 (1992)

Distribution of Pteridophyta in Wales

G. HUTCHINSON and B. A. THOMAS

Department of Botany, National Museum of Wales, Cardiff, CF1 3NP

ABSTRACT

New 10-km square maps are presented for pteridophytes in Wales. The time-spans used for these maps are pre-1950, 1950–69 and 1970–1990.

INTRODUCTION

An interest by botany staff of the National Museum of Wales in recording the distribution of pteridophytes in Wales has been evident since H. A. Hyde and A. E. Wade wrote the original edition of *Welsh Ferns*. This descriptive handbook, published jointly by the National Museum of Wales and the University of Wales in 1940, was written in response to a perceived need for a simple and inexpensive text. Its usefulness outside the Principality was anticipated correctly by the inclusion of brief accounts of British species not occurring in Wales. Notes were given on the distribution of the species in Wales and lists included of specimens in the Welsh National Herbarium. Specimen lists for the very common species were impractical so only vice-counties were listed.

This system was followed in the next three editions, published in 1948, 1954 and 1962, although the third edition was largely a lithographical reprint of the second. There were, however, several changes in the fourth edition which reflected an increased knowledge of fern distribution in Wales. The three species of *Polypodium*, the two subspecies of *Asplenium trichomanes*, and hybrids of *Asplenium* and *Polystichum* were included for the first time. Details of *Dryopteris* hybrids were expanded. The varieties of *Asplenium*, *Athyrium*, *Ceterach*, *Cystopteris* and *Dryopteris*, which had been included earlier, were omitted.

The larger fifth edition (1969) was revised and expanded by S. G. Harrison, to include the clubmosses, quillworts and horsetails. The sixth edition (1978) gave many more descriptions of hybrids with corresponding details of their known distributions in Wales.

Throughout these six editions there was a marked increase in the number of listed herbarium specimens, thereby giving greater information on species, subspecies and hybrid distributions in Wales. For example, the number of listed specimens for *Phegopteris connectilis* increased from 20 to 51 and for *Hymenophyllum wilsonii* from 22 to 66. There is a clear increase in the number of sites listed for many taxa and therefore a greater known distribution for them. More species lists simply became too large so they were omitted when every vice-county in Wales was represented. The authors also recorded the overall increase in the total number of specimens held in the herbarium. Numbers of British ferns were given as 1,660 in 1940, 1,990 in 1948, 2,200 in 1954 and 2,260 in 1962, then the number of British Pteridophyta as 3,200 in 1969 and 3,900 in 1978. The herbarium now includes 6700 British Pteridophyta of which 3900 are Welsh.

Meanwhile, there was the general move towards recording the distribution of plants by the grid square system, rather than by vice-counties, and the publication of the *Atlas of the British flora* (Perring & Walters 1962). The pteridophyte maps in the latter were, however, widely accepted to be imperfect because they went to the printers within six years of the start of the mapping scheme (Jermy *et al*. 1978). This was rectified considerably when the *Atlas of Ferns of the British Isles* was published (Jermy *et al*. 1978). Even so, some of these later maps were clearly still incomplete, especially those of the commonly less well understood species, hybrids of *Polypodium* and *Dryopteris*, and the subspecies of *Asplenium trichomanes* and *Dryopteris affinis*.

It was against this background of recording the distributions of pteridophytes that we commenced work on a new edition of *Welsh Ferns*. Clearly, the idea of incorporating lists of herbarium

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COMPILATION OF MAPS

The base-maps used were those of Perring & Walters (1962) and Perring & Sell (1968) with nomenclature modified according to Derrick *et al.* (1987). To these were added records held by the Biological Records Centre, Monks Wood Experimental Station in November 1986 which included all the records of Jermy *et al.* (1978). Information from all the specimens at **NMW** was checked as was that from specimens of the more critical taxa at **BM**. Appropriate literature sources were also checked. The records in the Welsh Plant Records data-files held at **NMW** were added (including records received which applied up to the end of 1990).

Updated maps were sent, for modification and comment, to all Welsh vice-county recorders and several interested members of both the B.S.B.I. and the British Pteridological Society. However, maps of those taxa considered to be rare were only sent on a vice-county basis to the relevant vice-county recorder(s). Several records were added at this stage and recorders were also able to point out former mapping errors. A healthy correspondence on queries followed, which included obtaining more details from records at the Biological Records Centre. Generally, the wishes of vice-county recorders were complied with, especially the removal of doubtful records. Untraceable records were not used for the maps and on the boundary with England only records from the Welsh side of the 10-km square were included. The 10-km square records which appeared in the *Atlas of the British flora* as 1930 onwards that could not be traced are given a separate symbol because they cannot be assigned to either side of the 1950 time span boundary used in our maps.

Following this stage of the work it has been possible to add numerous records that resulted mostly either from field work associated with current county flora surveys or determinations of new specimens sent to **NMW**. Finally, the pteridophyte maps compiled from the B.S.B.I. Monitoring Scheme (1987–1988) were added.

The maps are presented in Figs 1–84, arranged in alphabetical order. Symbols used for the maps are as follows:–

● 1970–1990
◐ 1950–1969
⊖ 1930–1969 untraced *Atlas of the British flora* record
○ pre-1950
◆ Introduced 1970–1990
◇ Introduced pre-1970

Critical taxa have been looked at very carefully and many specimens of them examined. Maps for the main ones, which are outlined here, are still considered incomplete.

Asplenium trichomanes L. Since the *Atlas of the British flora*, a new subspecies (*A. trichomanes* subsp. *pachyrachis* (Christ) Lovis & Reichst.) and a nothosubspecies (*A. trichomanes* nothosubsp. *staufferi* Lovis & Reichst.) have been identified for Wales (Rickard 1989). *A. trichomanes* subsp. *trichomanes* is considered under-recorded especially in the southern half of Wales. New records for this area were only accepted after microscopic measurement of the exospores according to the method of Reichstein (Hegi 1984). The *A. trichomanes* distribution map is identical with that for *A. trichomanes* subsp. *quadrivalens* D. E. Meyer emend. Lovis, and is omitted.

Dryopteris affinis (Lowe) Fraser-Jenkins. An understanding of *Dryopteris affinis* as comprising three subspecies in the British Isles has only emerged in the second half of the 1980s (Fraser-Jenkins 1987). Var. *paleaceo-lobata* sensu Fraser-Jenkins is included under subsp. *affinis* and var. *robusta* (Oberholzer & von Tavel ex Fraser-Jenkins) Fraser-Jenkins & Salvo under subsp. *borreri* (Newman) Fraser-Jenkins, but records of these varieties were almost zero.

Polypodium vulgare L. agg. The records of *Polypodium vulgare* were treated with caution as many applied to *P. vulgare* sensu lato. Where accurate identification could not be established records were treated as *P. vulgare* agg. For *P.* × *font-queri* Rothm. and *P.* × *shivasiae* Rothm. only records confirmed by R. H. Roberts are mapped. Many of the records of the commonest hybrid, *P* × *mantoniae* Rothm., have also been confirmed by R. H. Roberts.

Ophioglossum azoricum C. Presl. Only the records recognized by Paul (1987) are included.

Trichomanes speciosum Willd. The distribution map includes only records for sporophytes. Other sites where only gametophytes have been found are not included.

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(*Accepted August 1991*)

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Asplenium trichomanes L. subsp. *trichomanes*
Asplenium viride Hudson
Athyrium filix-femina (L.) Roth
Azolla filiculoides Lam.
Blechnum spicant (L.) Roth
Botrychium lunaria (L.) Swartz
Cryptogramma crispa (L.) Hook.
Cyrtomium falcatum (L. f.) C. Presl
Cystopteris fragilis (L.) Bernh.
Diphasiastrum alpinum (L.) Holub
Dryopteris aemula (Aiton) Kuntze
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Dryopteris affinis (Lowe) Fraser-Jenkins subsp. *affinis*
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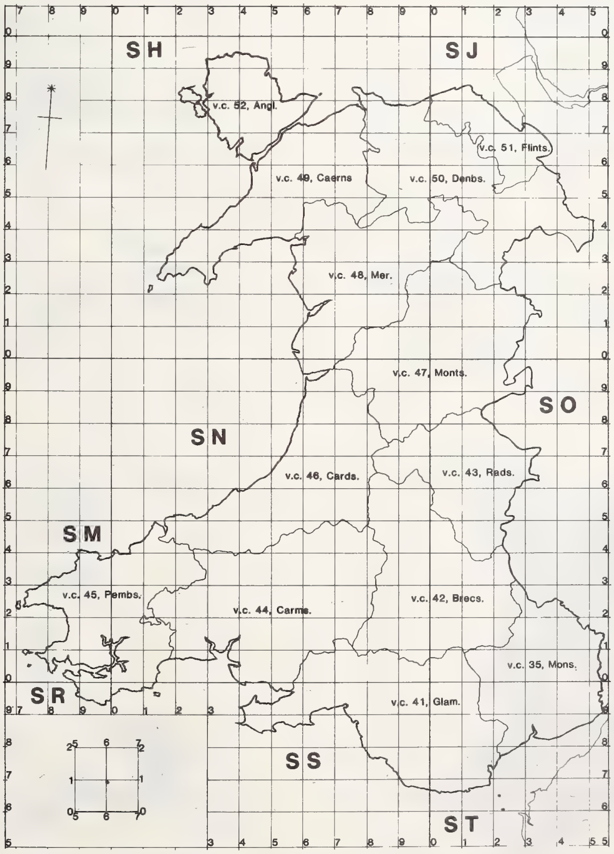
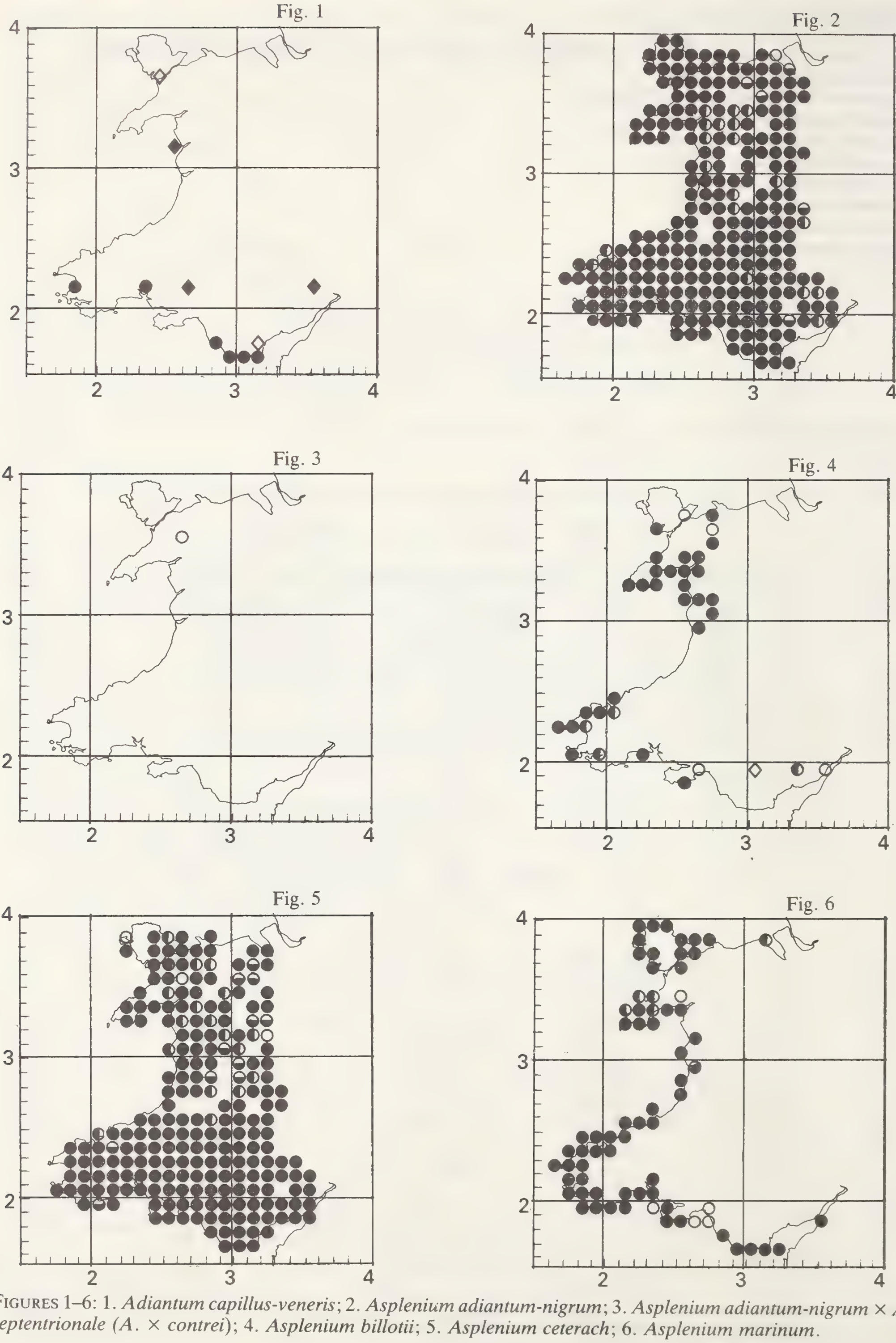
Dryopteris affinis (Lowe) Fraser-Jenkins subsp. *cambrensis* Fraser-Jenkins
Dryopteris affinis (Lowe) Fraser-Jenkins × *D. filix-mas* (L.) Schott (*D.* × *complexa* Fraser-Jenkins)
Dryopteris carthusiana (Vill.) H. P. Fuchs
Dryopteris carthusiana (Vill.) H. P. Fuchs × *D. dilatata* (Hoffm.) A. Gray (*D.* × *deweveri* (Jansen) Jansen & Wachter)
Dryopteris dilatata (Hoffm.) A. Gray
Dryopteris dilatata (Hoffm.) A. Gray × *D. expansa* (C. Presl) Fraser-Jenkins & Jermy (*D.* × *ambroseae* Fraser-Jenkins & Jermy)
Dryopteris expansa (C. Presl) Fraser-Jenkins & Jermy
Dryopteris filix-mas (L.) Schott
Dryopteris filix-mas (L.) Schott × *D. oreades* Fomin (*D.* × *mantoniae* Fraser-Jenkins & Corley)
Dryopteris oreades Fomin
Dryopteris submontana (Fraser-Jenkins & Jermy) Fraser-Jenkins
Equisetum arvense L.
Equisetum arvense L. × *E. fluviatile* L. (*E.* × *litorale* Kuhl. ex Rupr.)
Equisetum fluviatile L.
Equisetum hyemale L.
Equisetum palustre L.
Equisetum palustre L. × *E. telmateia* Ehrh. (*E.* × *font-queri* Rothm.)
Equisetum sylvaticum L.
Equisetum telmateia Ehrh.
Equisetum variegatum Schleicher ex Weber & Mohr
Gymnocarpium dryopteris (L.) Newman
Gymnocarpium robertianum (Hoffm.) Newman
Huperzia selago (L.) Bernh. ex Schrank & C. F. P. Mart.
Hymenophyllum tunbrigense (L.) Sm.
Hymenophyllum wilsonii Hook.
Isoetes echinospora Durieu
Isoetes lacustris L.
Lycopodiella inundata (L.) Holub
Lycopodium annotinum L.
Lycopodium clavatum L.
Matteuccia struthiopteris (L.) Tod.
Onoclea sensibilis L.
Ophioglossum azoricum C. Presl
Ophioglossum vulgatum L.
Oreopteris limbosperma (All.) Holub
Osmunda regalis L.
Phegopteris connectilis (Michx) Watt
Pilularia globulifera L.
Polypodium cambricum L.
Polypodium cambricum L. × *P. interjectum* Shivas (*P.* × *shivasiae* Rothm.)
Polypodium cambricum L. × *P. vulgare* L. (*P.* × *font-queri* Rothm.)
Polypodium interjectum Shivas
Polypodium interjectum Shivas × *P. vulgare* L. (*P.* × *mantoniae* Rothm.)
Polypodium vulgare L.

Polypodium vulgare L. agg.
Polystichum aculeatum (L.) Roth
Polystichum aculeatum (L.) Roth × *P. setiferum* (Forskål) Woynar (*P.* × *bicknellii* (Christ) Hahne)
Polystichum lonchitis (L.) Roth
Polystichum setiferum (Forskål) Woynar
Pteridium aquilinum (L.) Kuhn
Selaginella kraussiana (Kuntze) A. Braun
Selaginella selaginoides (L.) Link
Thelypteris palustris Schott
Trichomanes speciosum Willd.
Woodsia alpina (Bolton) Gray
Woodsia ilvensis (L.) R. Br.



Map of Welsh vice-counties and 10-km squares.



FIGURES 1–6: 1. *Adiantum capillus-veneris*; 2. *Asplenium adiantum-nigrum*; 3. *Asplenium adiantum-nigrum* × *A. septentrionale* (*A.* × *contrei*); 4. *Asplenium billotii*; 5. *Asplenium ceterach*; 6. *Asplenium marinum*.

Fig. 7

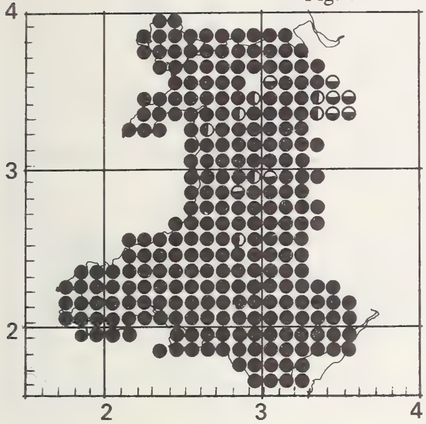


Fig. 8

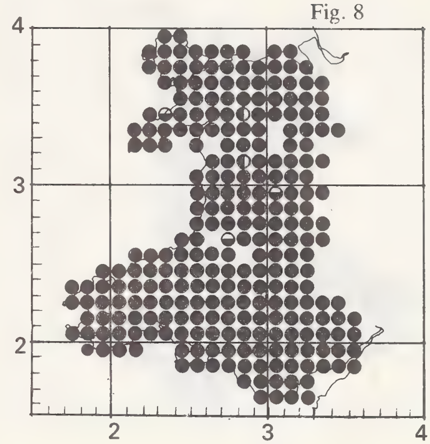


Fig. 9

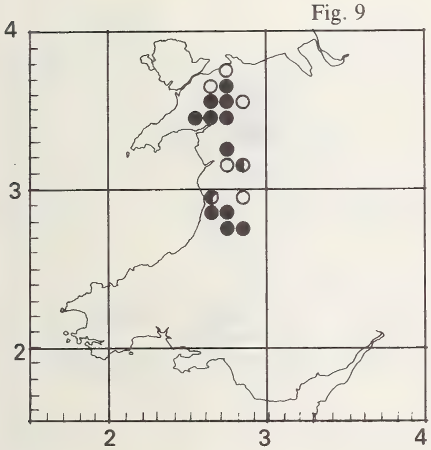


Fig. 10

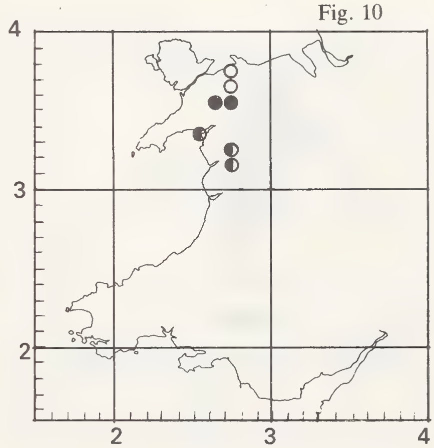


Fig. 11

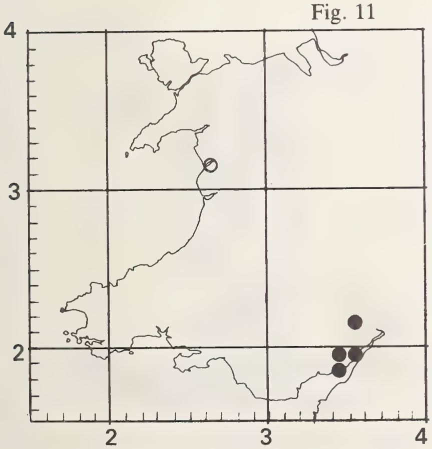
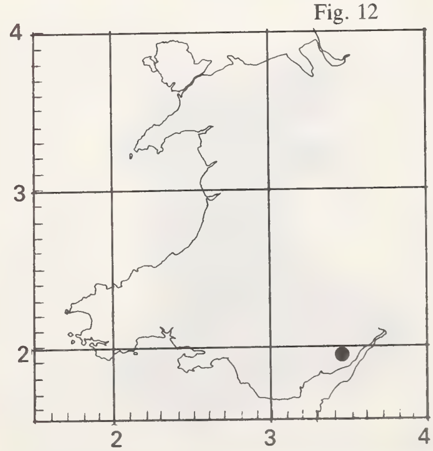


Fig. 12



FIGURES 7–12: 7. *Asplenium ruta-muraria*; 8. *Asplenium scolopendrium*; 9. *Asplenium septentrionale*; 10. *Asplenium septentrionale* subsp. *septentrionale* × *A. trichomanes* subsp. *trichomanes* (*A.* × *alternifolium* nothosubsp. *alternifolium*); 11. *Asplenium trichomanes* subsp. *pachyrachis*; 12. *Asplenium trichomanes* subsp. *pachyrachis* × *A. trichomanes* subsp. *quadrivalens* (*A. trichomanes* nothosubsp. *staufferi*).

Fig. 13

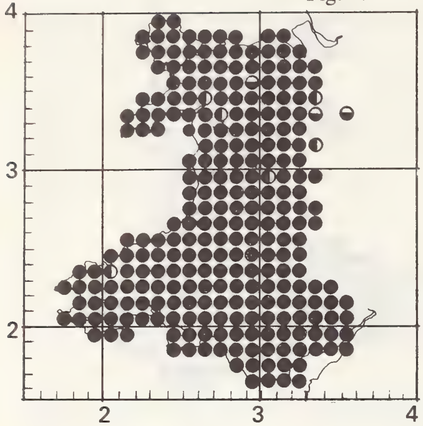


Fig. 14

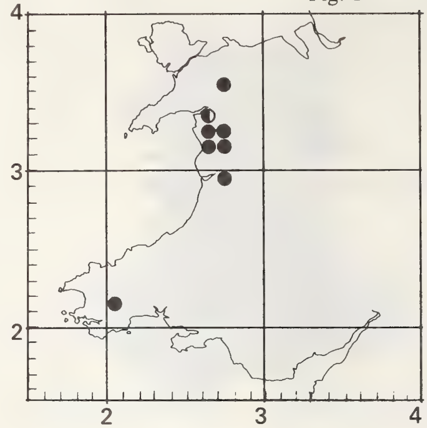


Fig. 15

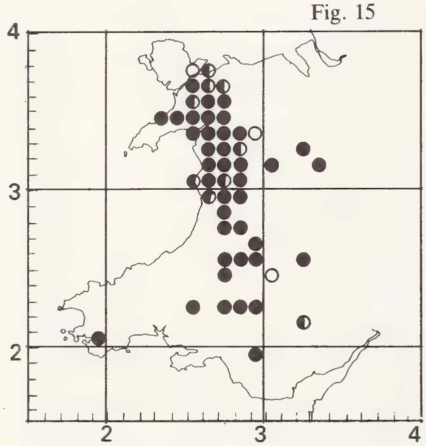


Fig. 16

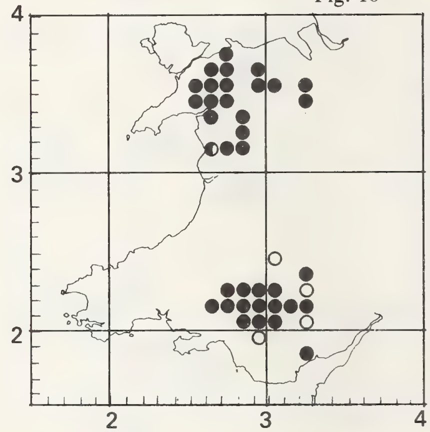


Fig. 17

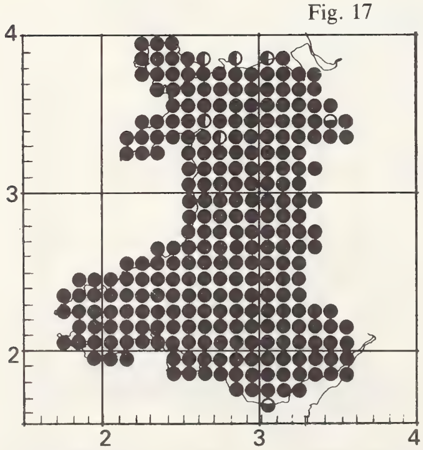
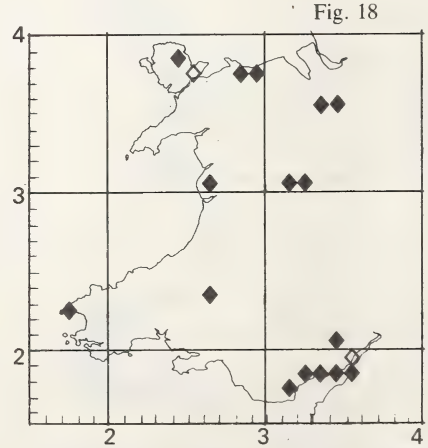


Fig. 18



FIGURES 13–18: 13. *Asplenium trichomanes* subsp. *quadrivalens*; 14. *Asplenium trichomanes* subsp. *quadrivalens* × *A. trichomanes* subsp. *trichomanes* (*A. trichomanes* nothosubsp. *lusaticum*); 15. *Asplenium trichomanes* subsp. *trichomanes*; 16. *Asplenium viride*; 17. *Athyrium filix-femina*; 18. *Azolla filiculoides*.

Fig. 19

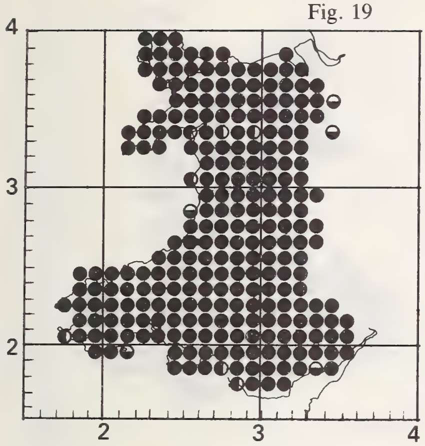


Fig. 20

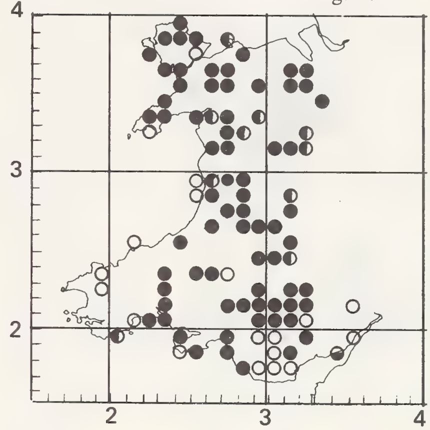


Fig. 21

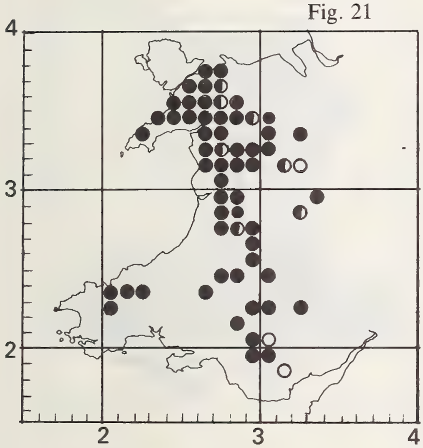


Fig. 22

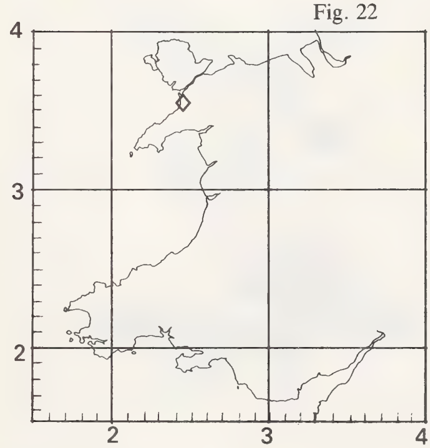


Fig. 23

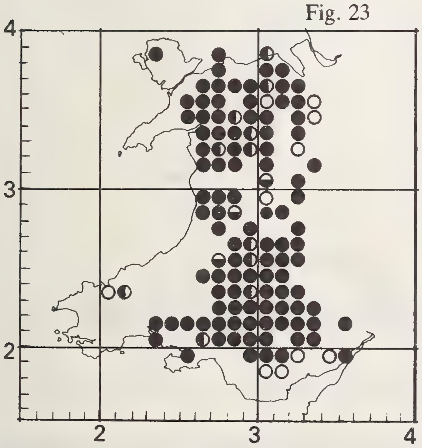
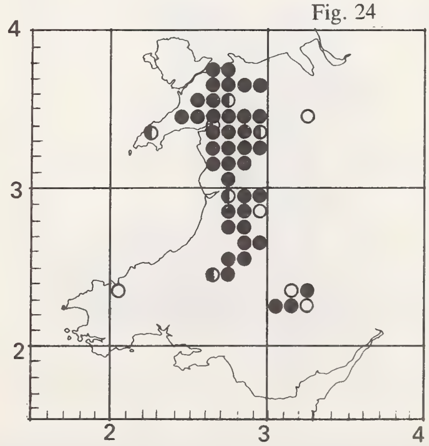


Fig. 24



FIGURES 19–24: 19. *Blechnum spicant*; 20. *Botrychium lunaria*; 21. *Cryptogramma crispa*; 22. *Cyrtomium falcatum*; 23. *Cystopteris fragilis*; 24. *Diphasiastrum alpinum*.

Fig. 25

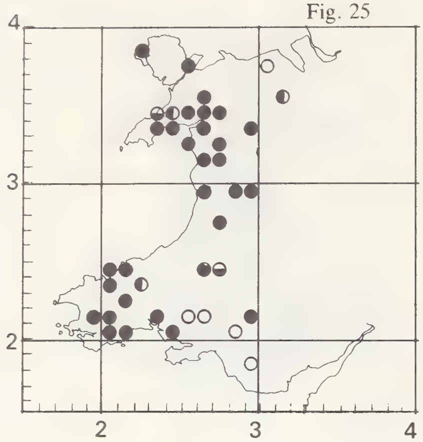


Fig. 26

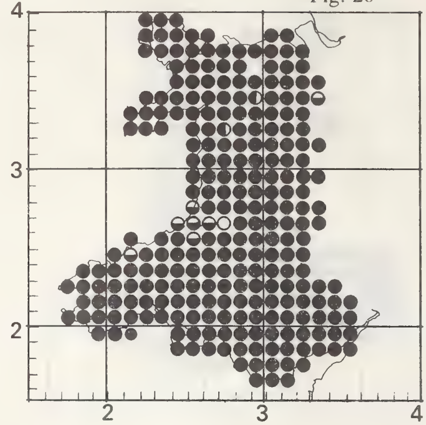


Fig. 27

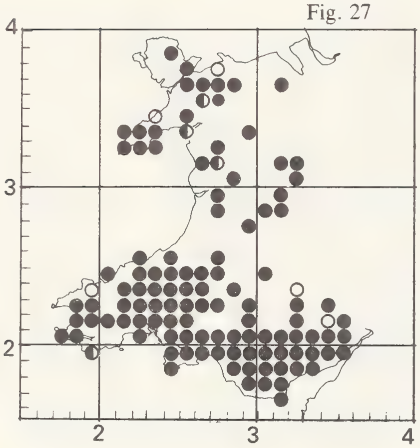


Fig. 28

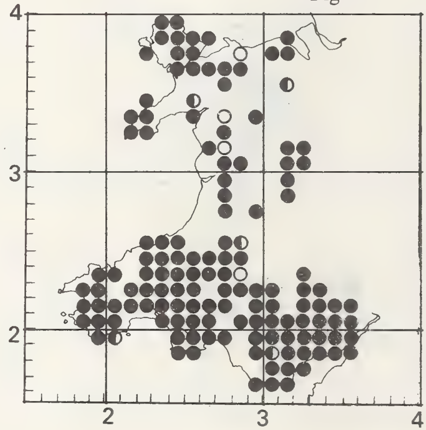


Fig. 29

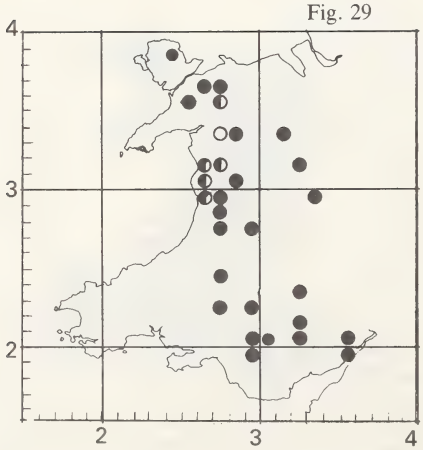
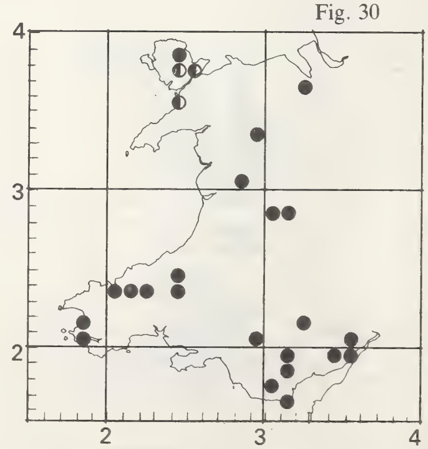


Fig. 30



FIGURES 25–30: 25. *Dryopteris aemula*; 26. *Dryopteris affinis*; 27. *Dryopteris affinis* subsp. *affinis*; 28. *Dryopteris affinis* subsp. *borreri*; 29. *Dryopteris affinis* subsp. *cambrensis*; 30. *Dryopteris affinis* × *D. filix-mas* (*D.* × *complexa*).

Fig. 31

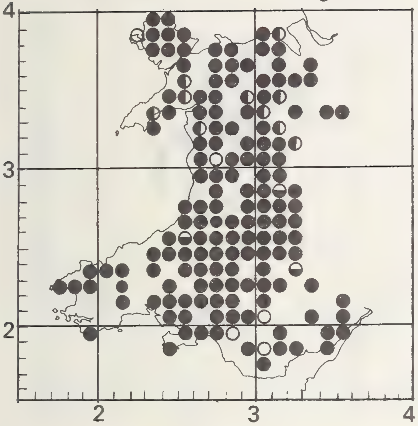


Fig. 32

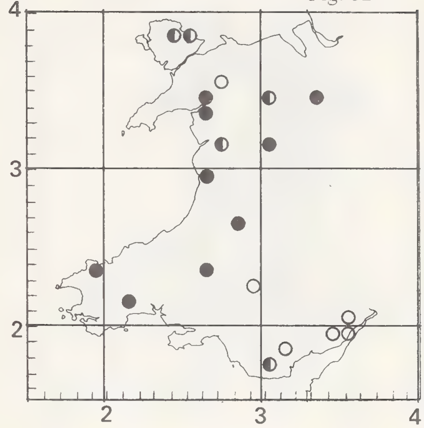


Fig. 33

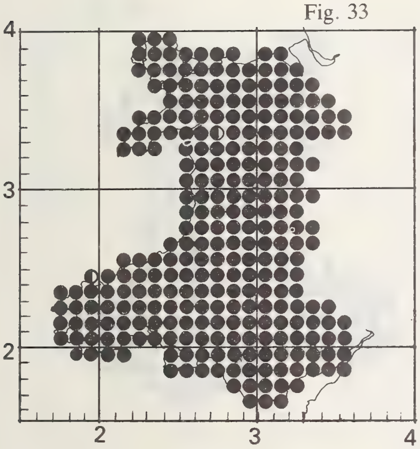


Fig. 34

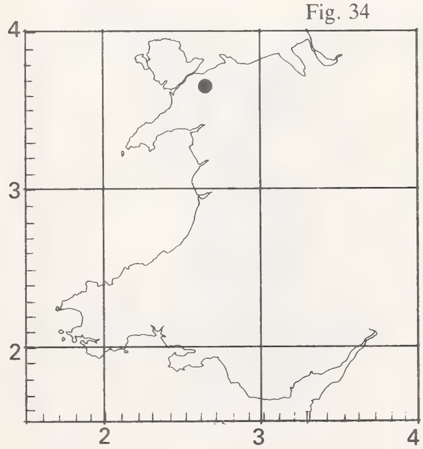


Fig. 35

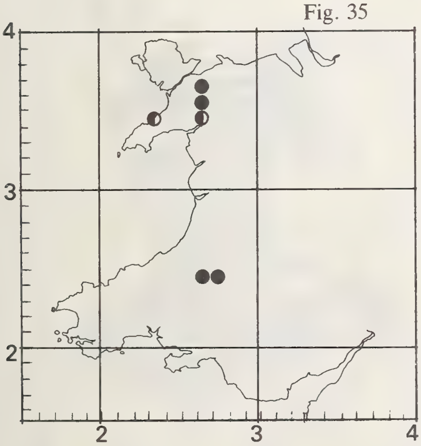
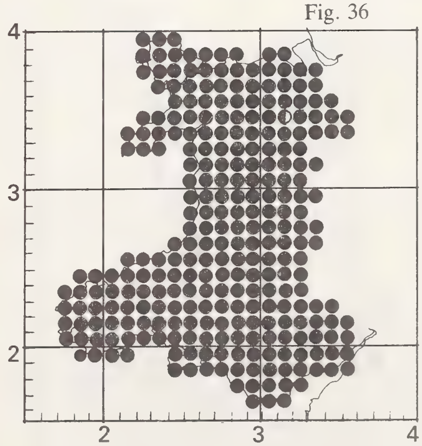


Fig. 36



FIGURES 31–36: 31. *Dryopteris carthusiana*; 32. *Dryopteris carthusiana* × *D. dilatata* (*D.* × *deweveri*); 33. *Dryopteris dilatata*; 34. *Dryopteris dilatata* × *D. expansa* (*D.* × *ambroseae*); 35. *Dryopteris expansa*; 36. *Dryopteris filix-mas*.

Fig. 37

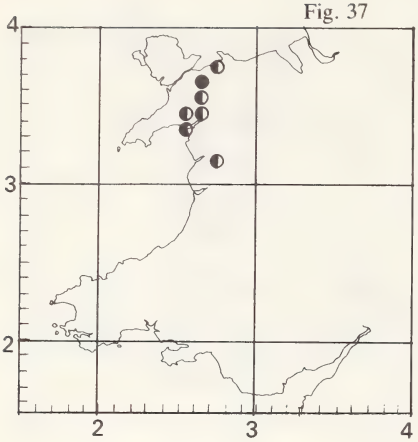


Fig. 38

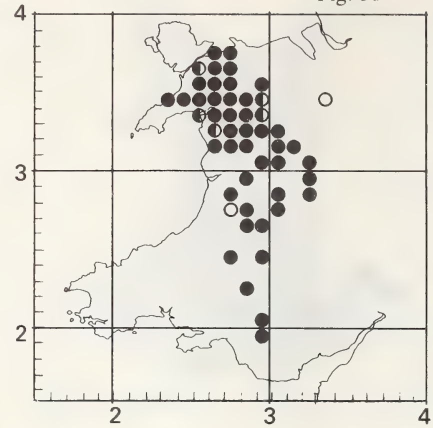


Fig. 39

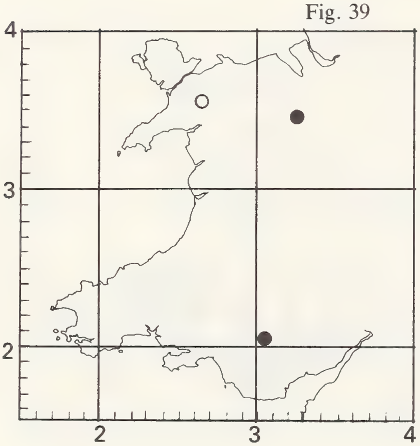


Fig. 40

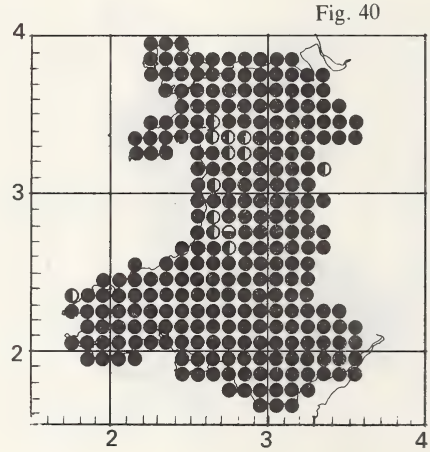


Fig. 41

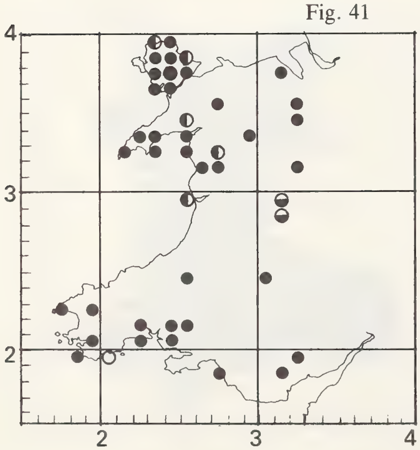
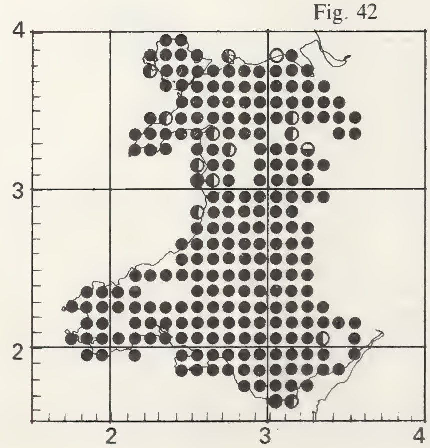


Fig. 42



FIGURES 37–42: 37. *Dryopteris filix-mas* × *D. oreades* (*D.* × *mantoniae*); 38. *Dryopteris oreades*; 39. *Dryopteris submontana*; 40. *Equisetum arvense*; 41. *Equisetum arvense* × *E. fluviatile* (*E.* × *litorale*); 42. *Equisetum fluviatile*.

Fig. 43

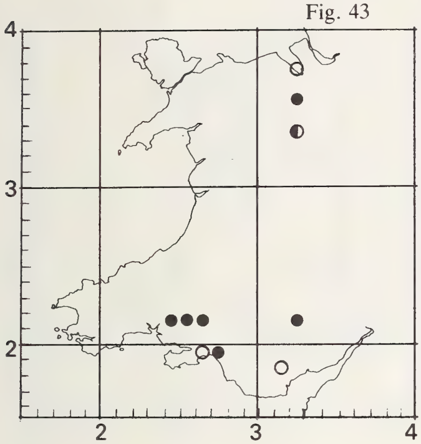


Fig. 44

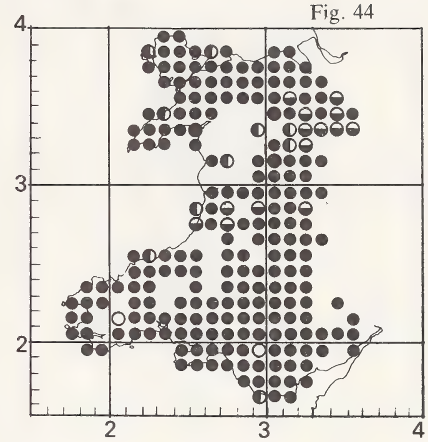


Fig. 45

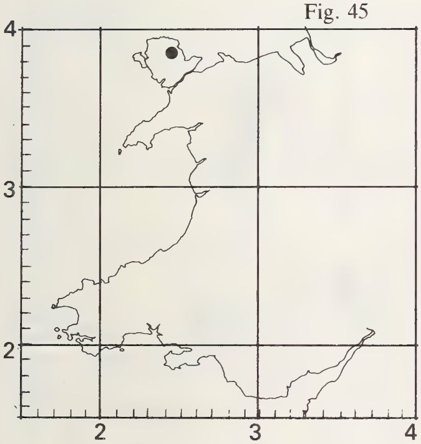


Fig. 46

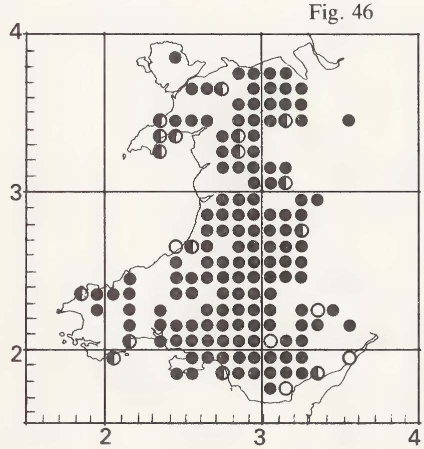


Fig. 47

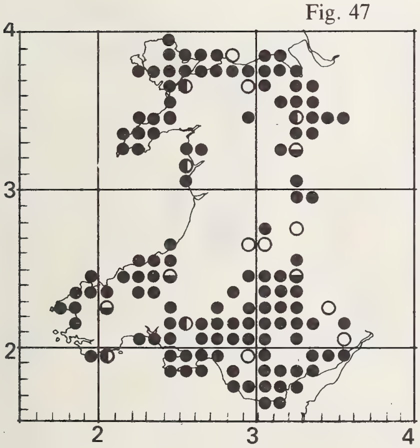
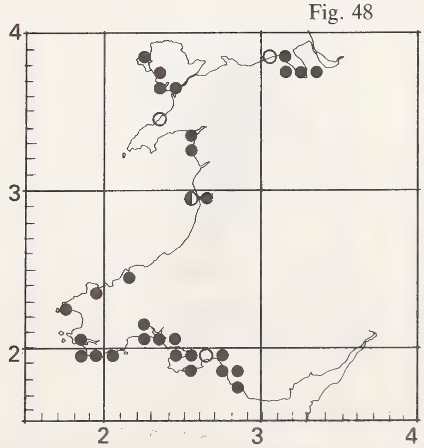


Fig. 48



FIGURES 43–48: 43. *Equisetum hyemale*; 44. *Equisetum palustre;* 45. *Equisetum palustre* × *E. telmateia* (*E.* × *font-queri*); 46. *Equisetum sylvaticum*; 47. *Equisetum telmateia*; 48. *Equisetum variegatum*.

Fig. 49

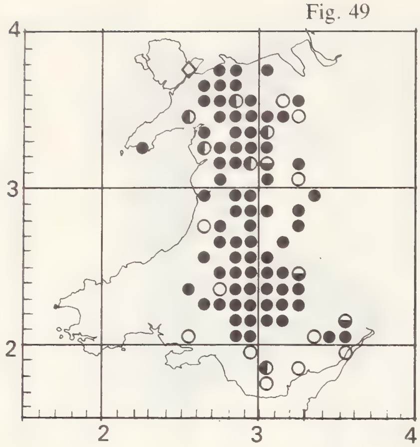


Fig. 50

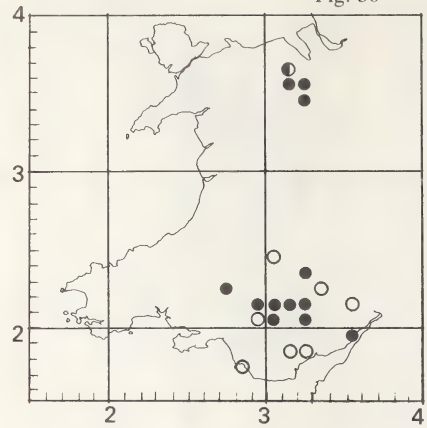


Fig. 51

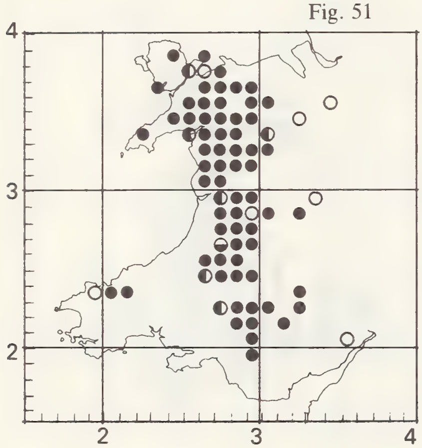


Fig. 52

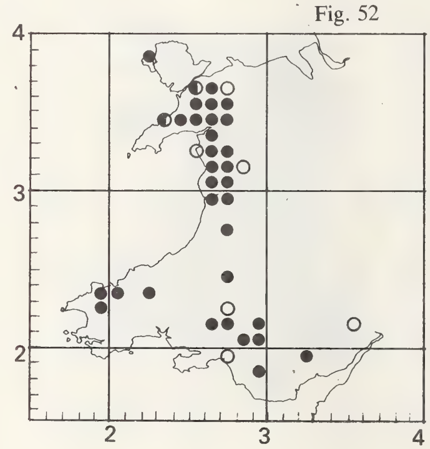


Fig. 53

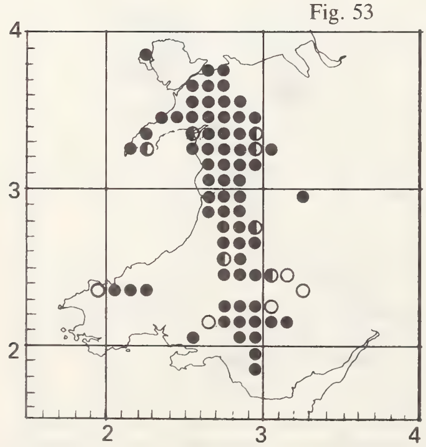
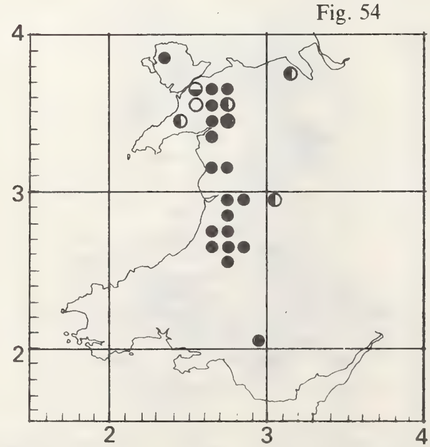


Fig. 54



FIGURES 49–54: 49. *Gymnocarpium dryopteris*; 50. *Gymnocarpium robertianum*; 51. *Huperzia selago*; 52. *Hymenophyllum tunbrigense*; 53. *Hymenophyllum wilsonii*; 54. *Isoetes echinospora*.

Fig. 55

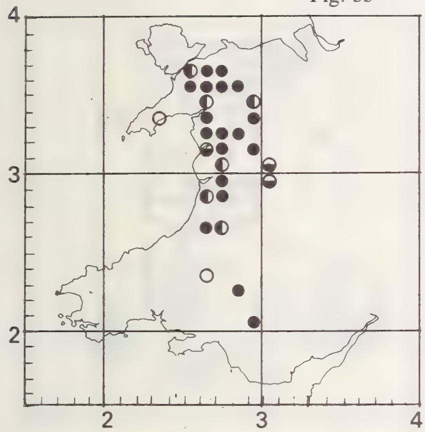


Fig. 56

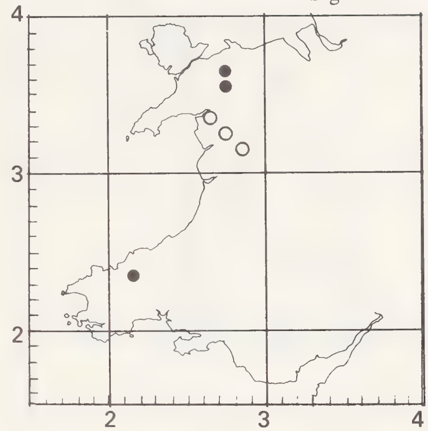


Fig. 57

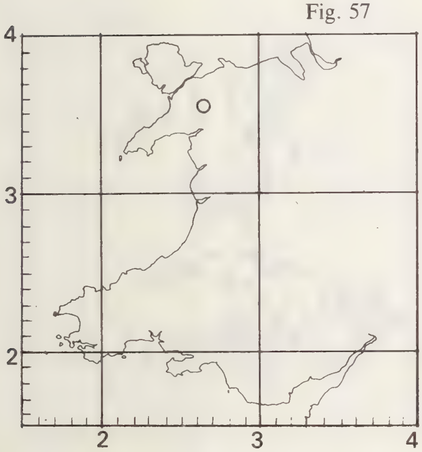


Fig. 58

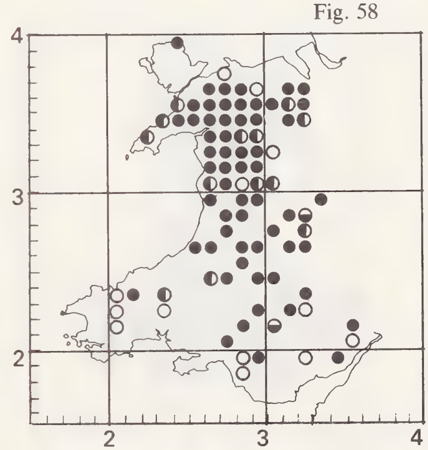


Fig. 59

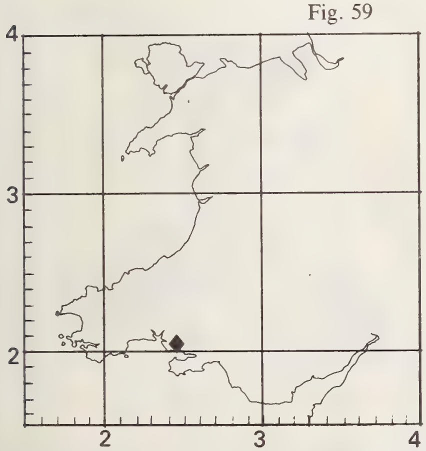
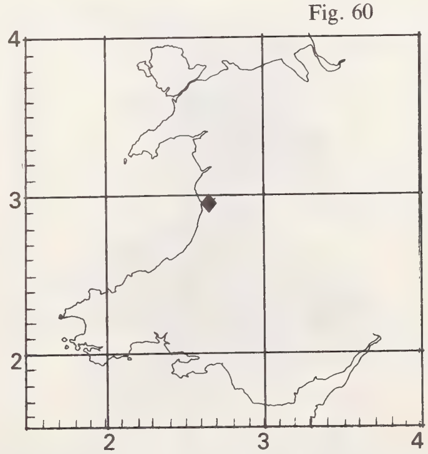


Fig. 60



FIGURES 55–60: 55. *Isoetes lacustris*; 56. *Lycopodiella inundata*; 57. *Lycopodium annotinum*; 58. *Lycopodium clavatum*; 59. *Matteuccia struthiopteris*; 60. *Onoclea sensibilis*.

Fig. 61

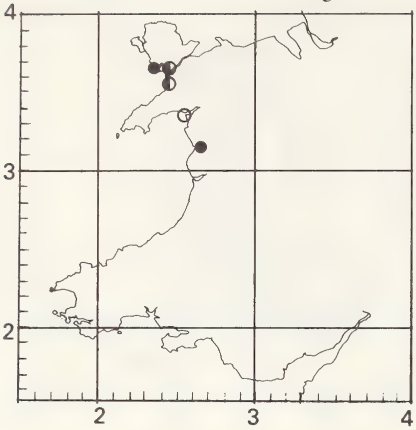


Fig. 62

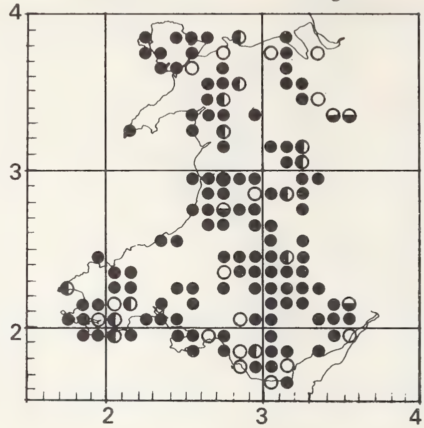


Fig. 63

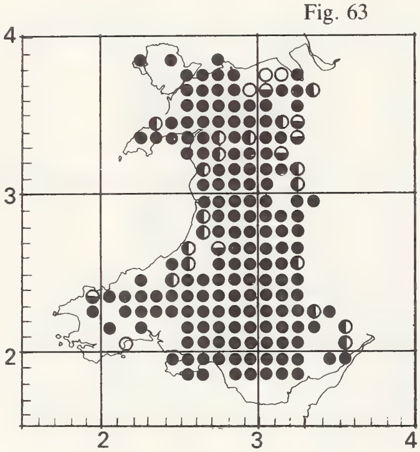


Fig. 64

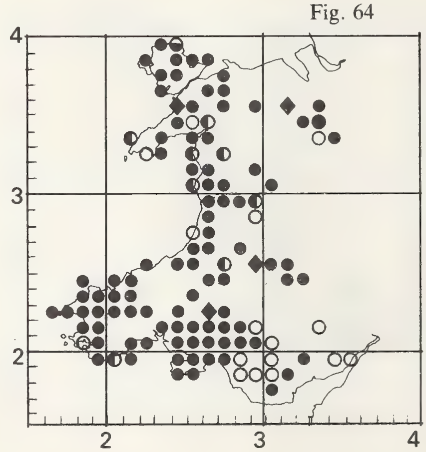


Fig. 65

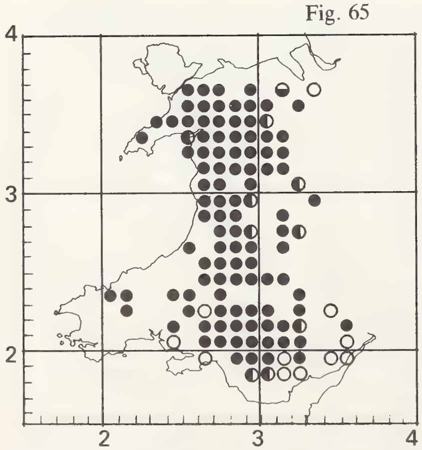
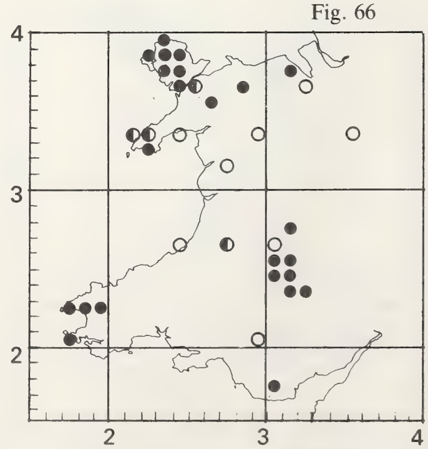


Fig. 66



FIGURES 61–66: 61. *Ophioglossum azoricum*; 62. *Ophioglossum vulgatum*; 63. *Oreopteris limbosperma*; 64. *Osmunda regalis*; 65. *Phegopteris connectilis*; 66. *Pilularia globulifera*.

Fig. 67

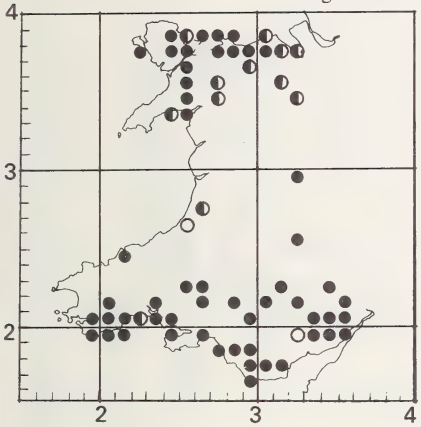


Fig. 68

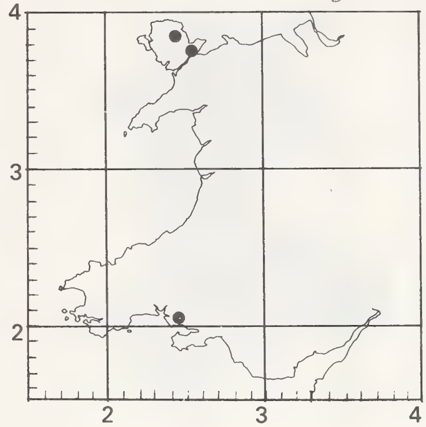


Fig. 69

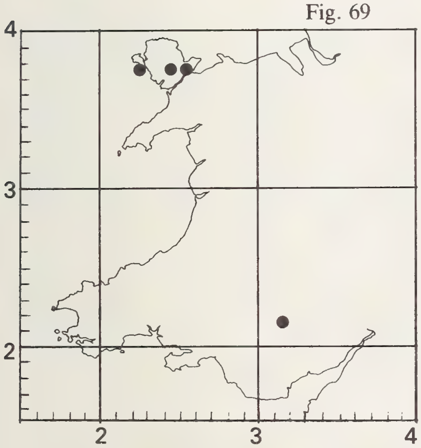


Fig. 70

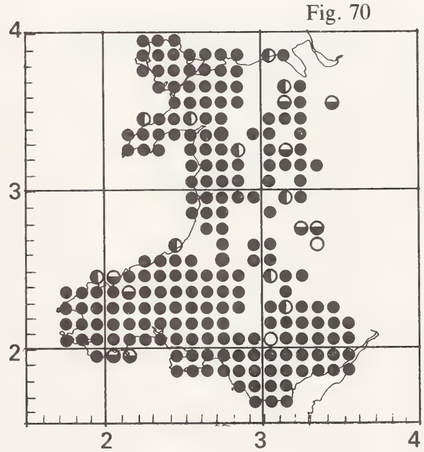


Fig. 71

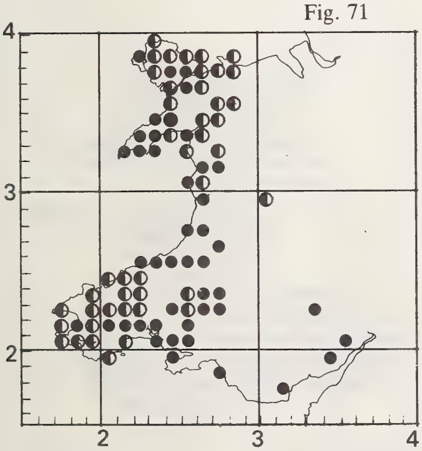
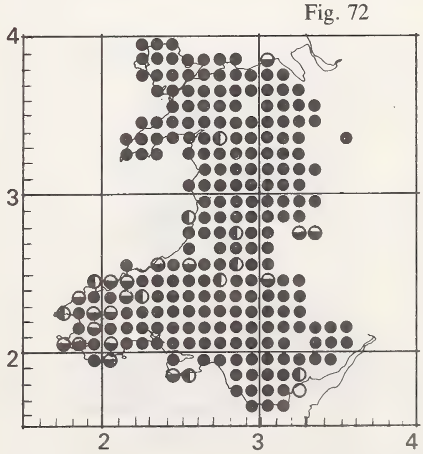


Fig. 72



FIGURES 67–72: 67. *Polypodium cambricum*; 68. *Polypodium cambricum* × *P. interjectum* (*P.* × *shivasiae*); 69. *Polypodium cambricum* × *P. vulgare* (*P.* × *font-queri*); 70. *Polypodium interjectum*; 71. *Polypodium interjectum* × *P. vulgare* (*P.* × *mantoniae*); 72. *Polypodium vulgare*.

Fig. 73

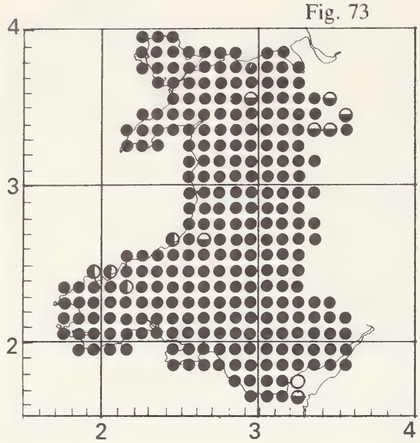


Fig. 74

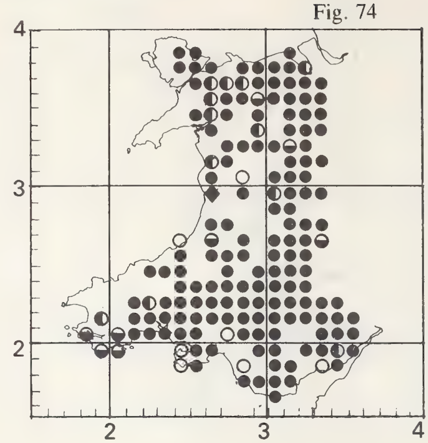


Fig. 75

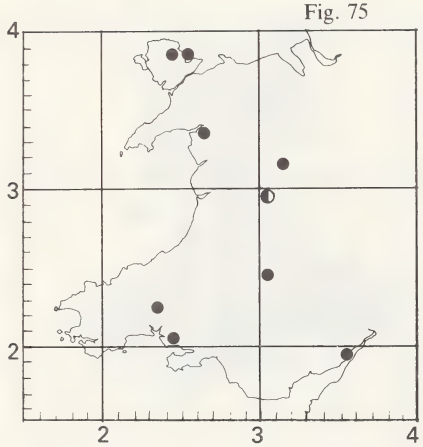


Fig. 76

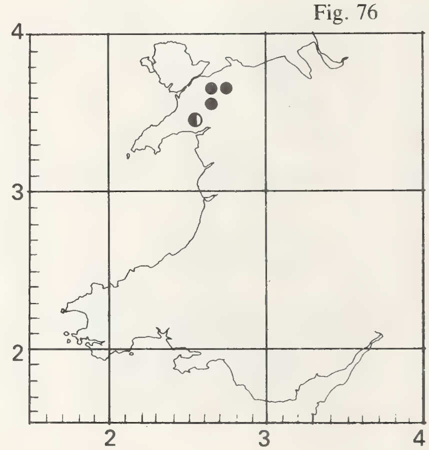


Fig. 77

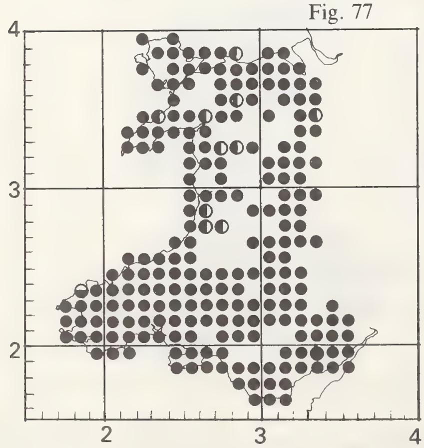
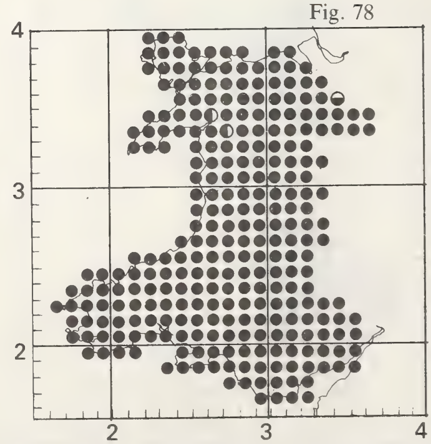


Fig. 78



FIGURES 73–78: 73. *Polypodium vulgare* agg.; 74. *Polystichum aculeatum*; 75. *Polystichum aculeatum* × *P. setiferum* (*P.* × *bicknellii*); 76. *Polystichum lonchitis*; 77. *Polystichum setiferum*; 78. *Pteridium aquilinum*.

Fig. 79

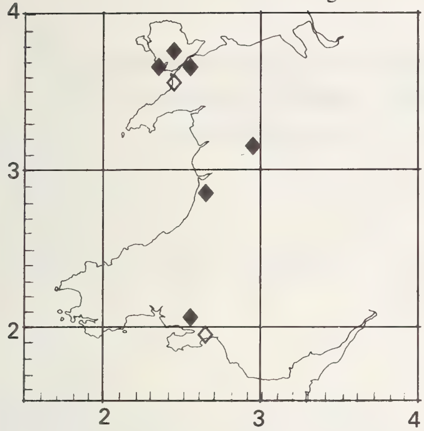


Fig. 80

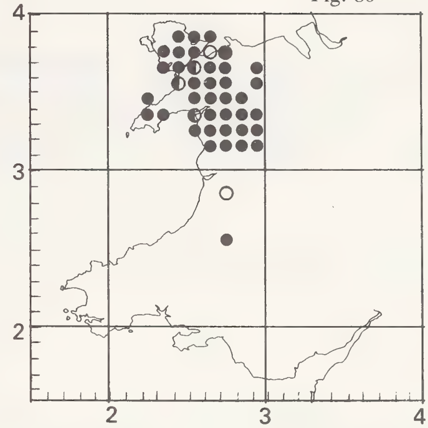


Fig. 81

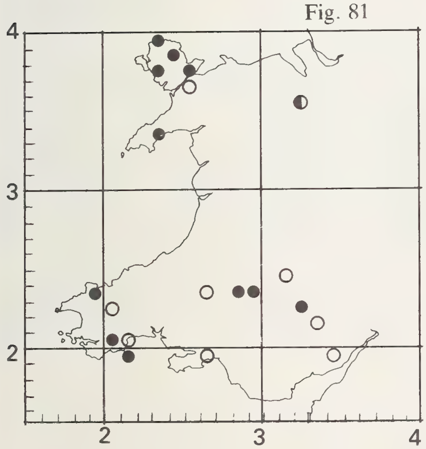


Fig. 82

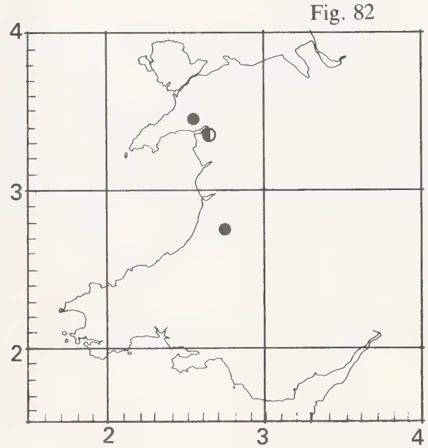


Fig. 83

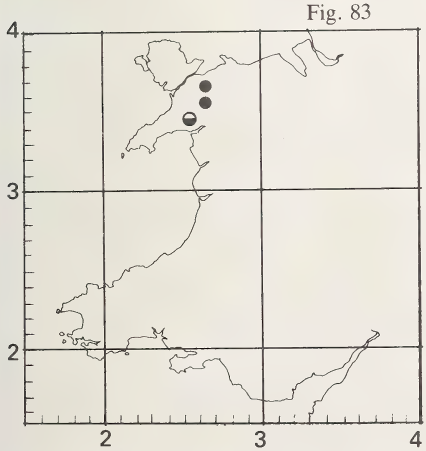
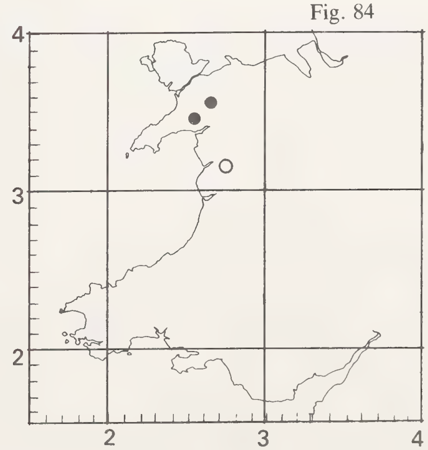


Fig. 84



FIGURES 79–84: 79. *Selaginella kraussiana*; 80. *Selaginella selaginoides*; 81. *Thelypteris palustris*; 82. *Trichomanes speciosum*; 83. *Woodsia alpina*; 84. *Woodsia ilvensis*.

Peroxidase isoenzyme and morphological variation in *Sorbus* L. in South Wales and adjacent areas, with particular reference to *S. porrigentiformis* E. F. Warb.

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ABSTRACT

The delimitation of microspecies of *Sorbus* L. (Rosaceae) occurring in South Wales, the Wye Valley, the Bristol area and Mendip is considered in relation to their peroxidase phenotypes and leaf, fruit and growth-habit characters. On isoenzyme evidence, *S. minima* (A. Ley) Hedl., *S. leyana* Wilmott, *S. anglica* Hedl. and *S. bristoliensis* Wilmott all appear essentially uniform and well delimited. *S.* × *vagensis* Wilmott is variable in peroxidase phenotype, as expected of a sexual hybrid. *S. leptophylla* E. F. Warb. appears genetically uniform, but plastic in habit and leaf size. Its established distribution is limited to two localities in Brecs. (v.c. 42); peroxidase evidence and fruit characters confirm a probable relationship to plants on Craig Breidden, Monts. (v.c. 47). *S. eminens* E. F. Warb. from near Symonds Yat is genetically different from plants in the Bristol – Mendip area, which show similarities in peroxidase, leaf, fruit and growth-habit characters to trees on the Menai Straits and to *S. hibernica* E. F. Warb. Plants which have been named *S. porrigentiformis* E. F. Warb. in South Wales include: (a) a widespread plant, of uniform peroxidase phenotype, with obovate leaves and broad crimson fruits, typically forming a twiggy shrub with rather slender shoots (the holotype appears identical with this); and (b) a much more local plant in the Mynydd Llangattock – Cwm Clydach area and the Black Mountains, of different peroxidase phenotype, commonly growing into a small tree, with more oblong biserrate leaves and larger subglobose scarlet fruits. Plants from near Symonds Yat growing with and somewhat resembling *S. porrigentiformis*, differ from both (a) and (b) in peroxidase phenotype. Like *S. porrigentiformis*, they appear more closely related to *S. graeca* (Spach) Kotschy than to *S. aria* (L.) Crantz, sensu stricto; they need further study.

INTRODUCTION

The British species of *Sorbus* L. (Rosaceae) comprise three sexually reproducing diploids, *S. aucuparia* L., *S. aria* (L.) Crantz and *S. torminalis* (L.) Crantz, and a number of polyploids all of which are probably normally apomictic. These form populations of essentially identical individuals which can be recognized as distinct microspecies (Warburg 1952, 1962; Perring & Sell 1968). The microspecies distinguished in the British Isles fall into three groups. The largest number (making up the *S. aria* aggregate) appear to be derivatives of diploid *S. aria* sensu lato. A group including *S. anglica* Hedl. show characters intermediate between *S. aria* sensu lato and *S. aucuparia*; the *S. latifolia* group are similarly intermediate between *S. aria* sensu lato and *S. torminalis*.

All but four of the described microspecies of *Sorbus* in the British Isles occur in the area around the Bristol Channel. The sites at which they grow fall into three broad groups. In an eastern group of sites, on the Carboniferous Limestone of Mendip, the Avon Gorge and the Wye Valley, the apomicts occur in contact with sexual *S. aria* as well as *S. aucuparia* and *S. torminalis*. The other two groups, on the Carboniferous Limestone crags of Breconshire and West Glamorgan and on the Old Red Sandstone of the North Devon and West Somerset coast, are beyond the western limit of *S. aria* and the Whitebeam populations appear to be wholly apomictic.

Sorbus in the Bristol Channel area thus presents a picture of some complexity, and potentially of great interest as a model for studying the evolution and ecology of an apomictic group. Proctor *et al.* (1989) investigated populations in Devon and West Somerset, and showed the usefulness of peroxidase isoenzyme phenotypes in helping to delimit and characterize apomictic *Sorbus* populations. Isoenzymes provide additional characters and make possible an interplay of hypothesis and test between biochemical and morphological evidence; they also extend the possibilities for assessing genetic relationships between populations.

Warburg (1952, 1957) indicated the occurrence of some variation within *S. anglica*, *S. eminens* E. F. Warb. and *S. porrigentiformis* E. F. Warb. The experience of a number of field botanists has suggested that there are real difficulties in the characterization and identification of several of the species, especially *S. porrigentiformis* in South Wales. Warburg (1952) gave chromosome numbers of 2n = 51 and 2n = 68 in that species. In this paper we present the results of a survey of peroxidase phenotypes in apomictic *Sorbus* populations in South Wales and neighbouring areas, and consider the results in relation to some morphological characters of the plants, and their geographical distributions.

MATERIALS AND METHODS

PEROXIDASE ISOENZYMES

Shoot samples were collected in the field in the summers of 1989 and 1990, and brought back fresh to the laboratory. The extracts used for electrophoresis were of 'bark' tissue scraped from (usually) second-year shoots. They were made as soon as possible after collection, but we found that even in summer shoots remained in good condition for a week or more if kept in polythene bags in a refrigerator. The extracts were run on vertical polyacrylamide slab gels. Details of the methods used are given by Proctor *et al.* (1989), and the conventions used to describe peroxidase phenotypes here are the same as in that paper. The bands obtained on the gels can conveniently (but arbitrarily) be divided into six groups (Fig. 1). Two slow-running groups (A and B) and a fast-running band (F) tend to be rather diffuse and present in most or all samples, so are of little taxonomic interest. Bands in groups C and E are well defined, and occur in varying combinations in all the British apomictic *Sorbus* species. One or two bands of group D, characteristic of *S. aucuparia*, occur in the apomicts of the *S. anglica* group.

LEAF, FLOWER AND FRUIT CHARACTERS

We collected herbarium material from most of the populations we examined; the specimens have been retained by M.C.F.P. In addition, we collected and pressed a number of samples of representative individual leaves from short shoots; these were photocopied as a convenient means for record and comparison. The colour of both leaf surfaces was recorded from some of the material while still fresh by matching with the R.H.S. Colour Chart (Royal Horticultural Society 1966). Fresh pollen samples from flowers collected in June 1989 were examined microscopically after staining in aceto-carmine, and samples from the same inflorescences were tested for germination in 15% sucrose solution. Fruit was collected in September and early October. Length and breadth of samples of well-formed fruits were measured to the nearest 0·2 mm using a sliding caliper-rule. To provide a reproducible and quantitative basis for recording fruit colour, fresh fruits were matched with a limited sub-set of the shades in the R.H.S. Colour Chart, chosen so that their coordinates in the system of the *Commission Internationale d'Eclairage* (C.I.E.) formed a reasonably evenly graded series. Individual fruits tend to run through the whole or a part of this series as they ripen; broad differences between species are easily established, but for rigorous comparisons fruits need to be at the same stage of ripeness. The C.I.E. chromaticity and reflectance coordinates for the shades used are given in Appendix 1.

RESULTS

The peroxidase phenotypes found in our material are summarized diagrammatically in Fig. 1, and the fruit measurements in Table 1.

S. ANGLICA AND ITS ALLIES

Samples of *S. anglica* from the Mynydd Llangattock area, the Wye Valley, the Avon Gorge,

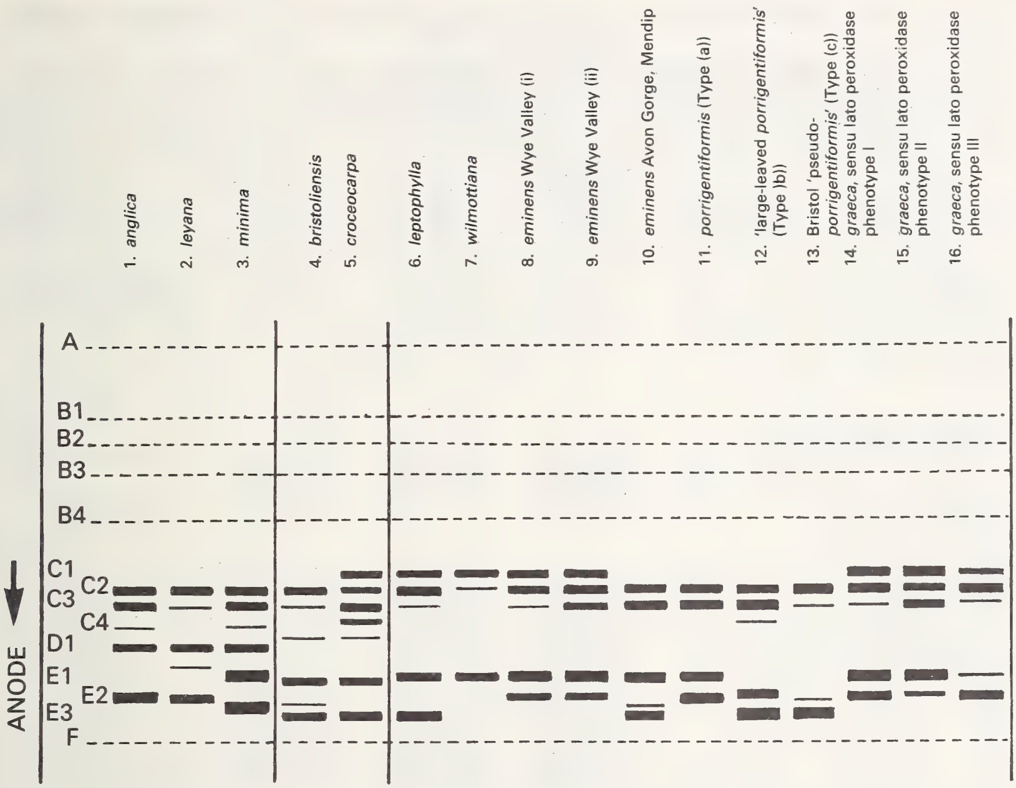

FIGURE 1. Schematic diagram of peroxidase phenotypes of apomictic *Sorbus* populations from South Wales and adjoining areas. Conventions follow Proctor *et al.* (1989).

Cheddar, Breidden and Llangollen all show the same peroxidase phenotype as that found in a plant of Avon Gorge origin by Proctor *et al.* (1989). The trees varied slightly in leaf shape but in general had somewhat more angular and deeply incised lobes than plants from Devon (Fig. 2). There appears also to be a consistent difference in fruit shape between trees on Breidden and those farther south (Table 1).

The geographically very restricted *S. minima* (A. Ley) Hedl. (five trees) and *S. leyana* Wilmott (three trees) show consistent and distinctive peroxidase phenotypes. In *S. minima* Proctor *et al.* (1989) indicated a pair of bands in positions D2 and E1; the latter generally stains more strongly and the two are often not clearly resolved. Pollen of both species showed virtually no germination in 15% sucrose solution, and a large proportion of misshapen and empty grains, suggesting that both are probably triploid (Liljefors 1953).

THE *S. LATIFOLIA* GROUP

Four trees of *S. bristoliensis* Wilmott from the Leigh Woods side of the Avon Gorge were consistent in their peroxidase phenotype, erroneously shown by Proctor *et al.* (1989) as including band C4; this is absent in *S. bristoliensis*, although the weak band C5 is present. *S. croceocarpa* (Sell 1989), of which there are planted and naturalized trees around Bristol, has a peroxidase phenotype differing from that of *S. devoniensis* E. F. Warb. most conspicuously in the very much stronger band C3; the same phenotype is found consistently in material from the type area in Anglesey and at Nantporth on the Bangor side of the Menai Straits.

Four trees of *S.* × *vagensis* Wilmott all gave different peroxidase phenotypes, a result consistent with the supposition that this is a sporadically occurring sexual hybrid.

TABLE 1. FRUIT DIMENSIONS AND COLOURS FROM *SORBUS* POPULATIONS, SEPTEMBER–OCTOBER 1989–90

Fruit dimensions are given for individual trees; n is the number of fruits measured. Length/breadth ratios were calculated individually for each fruit. Fruit colour assessments are based on all the material available from a particular locality at the time of scoring.

Species and locality	n	Length mean (s.d.) (mm)	Breadth mean (s.d.) (mm)	Length/breadth mean (s.d.)	Fruit colour (R.H.S. Colour Chart)
S. aucuparia					
Countisbury, N. Devon (v.c. 4)	—	—	—	—	44A(–45A)
Lynmouth, N. Devon (v.c. 4)	—	—	—	—	33A
S. anglica					
N. Whilborough Common, S. Devon (v.c. 3) (i)	10	10·2 (0·51)	11·0 (0·46)	0·93 (0·036)	44A–45A
(ii)	10	9·9 (0·86)	10·6 (0·50)	0·93 (0·051)	,,
Woody Bay, N. Devon (v.c. 4)	10	11·0 (0·43)	12·4 (0·62)	0·89 (0·045)	(44A–)45A
Cheddar, N. Somerset (v.c. 6)					
(i)	8	10·8 (0·64)	11·8 (1·07)	0·91 (0·039)	45A(–46A)
(ii)	10	10·9 (0·56)	11·9 (0·29)	0·92 (0·038)	,,
Lover's Leap, Mons. (v.c. 35)	10	10·7 (0·63)	11·6 (0·94)	0·92 (0·024)	45A
Cwm Clydach, Glam. (v.c. 41)	10	10·9 (0·68)	11·6 (0·63)	0·95 (0·080)	44A(–45A)
Breidden, Monts. (v.c. 47)					
(i)	5	10·1 (0·48)	10·1 (0·44)	1·00 (0·037)	45B
(ii)	5	10·6 (0·22)	10·6 (0·61)	1·00 (0·047)	,,
(iii)	5	11·7 (0·52)	11·3 (0·50)	1·04 (0·059)	,,
(iv)	5	11·2 (0·88)	11·4 (0·68)	0·98 (0·052)	,,
S. aria					
Cheddar, N. Somerset (v.c. 6)					
(i)	5	12·4 (0·43)	12·7 (0·56)	0·98 (0·035)	(33A–)44A(–45A)
(ii)	15	14·1 (0·77)	13·6 (0·68)	1·04 (0·048)	,,
(iii)	10	12·3 (0·39)	13·5 (0·55)	0·91 (0·045)	,,
(iv)	10	11·4 (1·09)	11·3 (0·97)	1·01 (0·034)	,,
Seven Sisters Rocks, Herefs. (v.c. 36)	10	12·8 (0·79)	11·6 (1·25)	1·09 (0·079)	(28A–)32A(–33A)
S. leptophylla					
Craig-y-Rhiwarth, Brecs. (v.c. 42)					
(i)	15	14·7 (0·56)	13·8 (0·64)	1·07 (0·058)	(44A–)45A
(ii)	6	14·3 (0·73)	13·0 (0·61)	1·10 (0·037)	,,
(iii)	9	14·4 (0·32)	13·1 (0·52)	1·11 (0·043)	,,
(iv)	8	13·3 (0·68)	12·5 (0·43)	1·07 (0·053)	,,
Craig-y-Cilau, Brecs. (v.c. 42)	10	14·8 (0·71)	14·3 (0·63)	1·04 (0·057)	44A–45A
S. aff. *leptophylla*					
Breidden, Monts. (v.c. 47)	5	14·3 (0·30)	11·6 (0·75)	1·23 (0·067)	—
S. wilmottiana					
Bristol, W. Gloucs. (v.c. 34)	10	10·7 (0·54)	10·4 (0·61)	1·03 (0·035)	—
S. eminens					
Bristol, W. Gloucs. (v.c. 34)	10	13·8 (0·77)	15·4 (0·64)	0·89 (0·029)	(44A–)45A
Leigh Woods, N. Somerset (v.c. 6)	15	12·0 (0 92)	13·8 (0·91)	0·87 (0·045)	(33A–)44A–45A(–46A)
Worlebury, N. Somerset (v.c. 6)	10	12·7 (0·81)	14·0 (0·62)	0·91 (0·057)	45A–46A

TABLE 1. *continued*

Species and locality	n	Length mean (s.d.) (mm)	Breadth mean (s.d.) (mm)	Length/breadth mean (s.d.)	Fruit colour (R.H.S. Colour Chart)
Cheddar, N. Somerset (v.c. 6)					
(i)	5	10·9 (1·12)	13·2 (1·01)	0·83 (0·056)	(44A–)45A–46A
(ii)	3	14·2 (1·06)	16·5 (0·64)	0·86 (0·031)	,,
(iii)	10	12·0 (0·32)	14·3 (0·42)	0·85 (0·030)	,,
(iv)	10	11·2 (0·38)	13·4 (0·61)	0·84 (0·029)	,,
Seven Sisters Rocks, Herefs. (v.c. 36) (i)	5	10·6 (0·39)	11·5 (0·18)	0·97 (0·034)	45A
(ii)	4	10·2 (0·19)	11·6 (0·52)	0·88 (0·043)	,,
S. aff. *eminens*					
Bangor, Caerns. (v.c. 49)					
(i)	12	12·0 (0·66)	13·4 (0·46)	0·90 (0·044)	45A(–46A)
(ii)	10	11·2 (0·39)	13·2 (0·79)	0·86 (0·031)	,,
S. hibernica					
Dromineer, N. Tipperary (v.c. H10)	12	13·8 (0·65)	14·8 (0·58)	0·94 (0·032)	(44A–)45A
Rathdrum, Co. Wicklow (v.c. H20)	5	12·3 (0·46)	13·2 (0·39)	0·93 (0·028)	—
S. porrigentiformis					
('Type (a)')					
Anstey's Cove, S. Devon (v.c. 3)	20	10·6 (1·11)	13·8 (1·22)	0·78 (0·067)	46A
Woody Bay, N. Devon (v.c. 4)	10	9·1 (0·68)	11·8 (0·58)	0·78 (0·045)	45A–46A–53A
Cheddar, N. Somerset (v.c. 6)	9	10·2 (0·55)	13·4 (0·93)	0·77 (0·035)	46A–53A
Heale Ladder, N. Somerset (v.c. 6)	10	9·3 (0·18)	11·0 (0·17)	0·84 (0·041)	(45A–)46A(–53A)
Wick Rocks, N. Somerset (v.c. 6)	10	10·6 (0·42)	12·4 (0·38)	0·86 (0·033)	46A(–53A)
Craig-y-Rhiwarth, Brecs. (v.c. 42) (i)	10	9·6 (0·50)	11·4 (0·40)	0·85 (0·049)	45A–46A
(ii)	10	9·8 (0·49)	12·3 (0·37)	0·80 (0·035)	,,
Craig-y-Cilau, Brecs. (v.c. 42)	10	9·0 (0·52)	11·7 (0·40)	0·78 (0·034)	45A
Aberedw Rocks, Rads. (v.c. 43)	10	10·8 (0·62)	13·0 (0·86)	0·84 (0·042)	—
('Type (b)')					
Daren Disgwylfa, Brecs. (v.c. 42) (i)	10	11·0 (0·61)	12·4 (0·45)	0·90 (0·028)	44A–45A(–46A)
(ii)	10	12·2 (0·67)	13·7 (0·48)	0·90 (0·042)	,,
(iii)	10	11·2 (1·15)	12·0 (0·82)	0·93 (0·043)	,,
Blackrock, Glam. (v.c. 41)	7	11·8 (0·24)	12·0 (0·58)	0·99 (0·035)	45A
Craig-y-Cilau, Brecs. (v.c. 42)	5	11·4 (0·59)	13·6 (0·40)	0·84 (0·026)	(33A–)44A(–45A)
Cwm Clydach, Glam. (v.c. 41)					
(i)	6	11·3 (0·70)	12·0 (0·69)	0·94 (0·064)	45A
(ii)	3	11·1 (0·42)	12·7 (0·12)	0·88 (0·025)	,,
(iii)	10	12·2 (0·64)	12·6 (0·40)	0·97 (0·037)	,,
Daren Lwyd, Brecs. (v.c. 42)	4	12·4 (0·75)	12·7 (0·75)	0·98 (0·022)	—
Taren-yr-Esgob, Mons./Brecs. (v.c. 35/42)	5	11·6 (0·27)	13·6 (0·33)	0·86 (0·011)	—

TABLE 1. *continued*

Species and locality	n	Length mean (s.d.) (mm)	Breadth mean (s.d.) (mm)	Length/breadth mean (s.d.)	Fruit colour (R.H.S. Colour Chart)
S. graeca, sensu lato, Seven Sisters Rocks, Herefs. (v.c. 36)					
Peroxidase phenotype I					
(i)	5	10·2 (0·37)	12·6 (0·57)	0·82 (0·039)	45A–46A
(ii)	15	10·7 (0·59)	12·9 (0·61)	0·83 (0·036)	46A
(iii)	6	10·9 (0·43)	13·3 (0·43)	0·82 (0·026)	,,
(iv)	5	9·6 (0·33)	12·5 (0·64)	0·78 (0·018)	,,
(v)	10	10·1 (0·63)	12·2 (0·45)	0·83 (0·025)	46A–53A
Peroxidase phenotype II	5	11·0 (0·66)	12·2 (0·58)	0·90 (0·038)	(45A–)46A
Peroxidase phenotype III	7	10·8 (0·41)	11·9 (0·67)	0·91 (0·043)	46A
S. rupicola					
Brixham, S. Devon (v.c. 3)					
(i)	6	12·8 (0·58)	14·3 (0·50)	0·90 (0·021)	(33A–)44A(–45A)
(ii)	10	12·1 (0·91)	13·6 (0·87)	0·89 (0·026)	,,
(iii)	10	11·4 (0·85)	13·5 (0·72)	0·85 (0·029)	,,
Trentishoe, N. Devon (v.c. 4)	10	13·0 (0·62)	14·9 (0·60)	0·87 (0·041)	45A–46A
Breidden, Monts. (v.c. 47)					
(i)	5	11·2 (0·36)	12·6 (0·56)	0·89 (0·015)	—
(ii)	5	10·5 (0·23)	11·7 (0·23)	0·90 (0·023)	—
(iii)	5	11·0 (0·70)	12·3 (0·42)	0·89 (0·042)	—
Tighnabruaich, Main Argyll (v.c. 98)	1	12·0 (—)	12·8 (—)	0·94 (—)	—

THE *S. ARIA* GROUP

S. leptophylla E. F. Warb. most characteristically forms a sprawling tree with long more or less pendulous branches and large leaves (Fig. 3a–b), rooted into shady vertical limestone cliff faces. Plants of this form grow at both of its two known Breconshire localities, and at both sites have the same constant peroxidase phenotype. It is probably fortuitous that this matches that of 'Taxon D', an unnamed apomict from the North Devon – West Somerset coast, resembling *S. vexans* E. F. Warb. but with broader and darker red fruits (Proctor *et al.* 1989), as the two plants are quite different in habit and leaf and fruit characters. At Craig-y-Rhiwarth *S. leptophylla* is the predominant species (Fig. 3c–f), and the erect individuals in full sun at the top of the cliff appear at first sight very different from those beneath the tree canopy. It is evidently plastic, and small trees can be difficult to distinguish vegetatively from the biserrate-leaved *porrigentiformis*-like plant that accompanies it at Craig-y-Cilau. We have no evidence of its occurrence anywhere in South Wales other than the two localities mentioned. Pollen samples showed a high percentage of well-formed grains and good germination in 15% sucrose solution.

Warburg (1957) indicated that *S. leptophylla* probably occurred also in Montgomeryshire (on Craig Breidden). Some plants on the west crags of Breidden have leaves similar in shape to typical *S. leptophylla* but smaller (Fig. 3g–h). One tree of this type that we sampled appears identical in peroxidase phenotype with Breconshire *S. leptophylla*, and has fruits similar in size, shape, colour and lenticel size and distribution. Specimens collected on the north crags of Breidden by P. J. M. Nethercott in 1990 may also belong to the same form, their somewhat larger leaves reflecting response to a shadier and less drought-stressed habitat.

S. wilmottiana E. F. Warb. (Warburg 1962, 1967) is a rare species of the Avon Gorge at Bristol. We have been able to examine only two trees, which gave a distinctive peroxidase phenotype (C1 C2 E1).

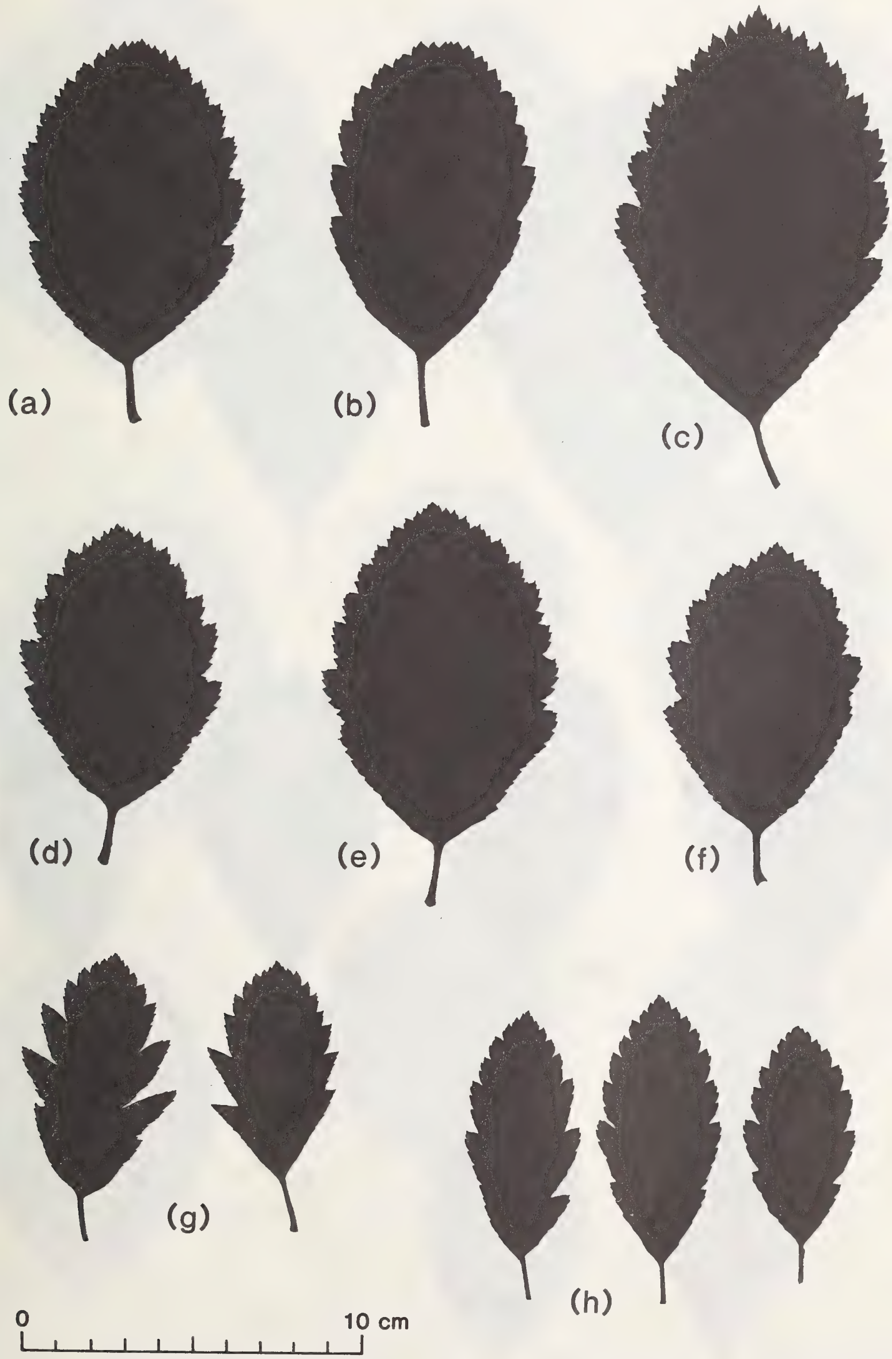

FIGURE 2. Silhouettes of representative leaves. (a)–(f) *S. anglica* (a) N. Whilborough Common, S. Devon, v.c. 3, (b) Woody Bay, N. Devon, v.c. 4, (c) Cheddar, N. Somerset, v.c. 6, (d) Lover's Leap, Mons., v.c. 35, (e) Cwm Clydach, Glam., v.c. 41, (f) Breidden, Monts., v.c. 47; (g) *S. leyana*, Daren Fach, Brecs., v.c. 42; (h) *S. minima*, Craig-y-Cilau, Brecs., v.c. 42.

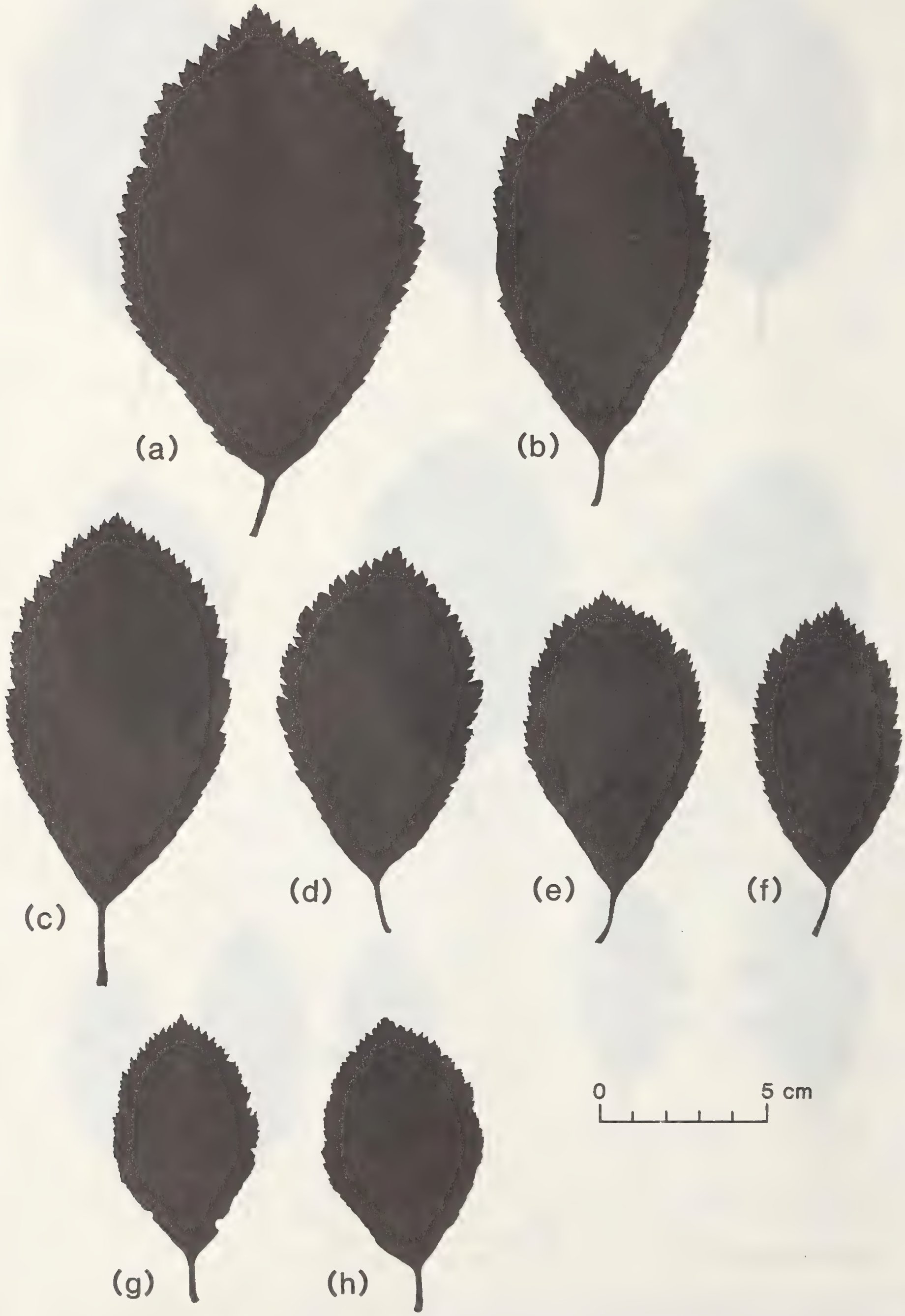

FIGURE 3. *S. leptophylla*: silhouettes of representative leaves. (a) and (b) Craig-y-Cilau, Brecs., v.c. 42; (c)–(f) Craig-y-Rhiwarth, Brecs., v.c. 42; (g) and (h) *S.* aff. *leptophylla*, Breidden, Monts., v.c. 47.

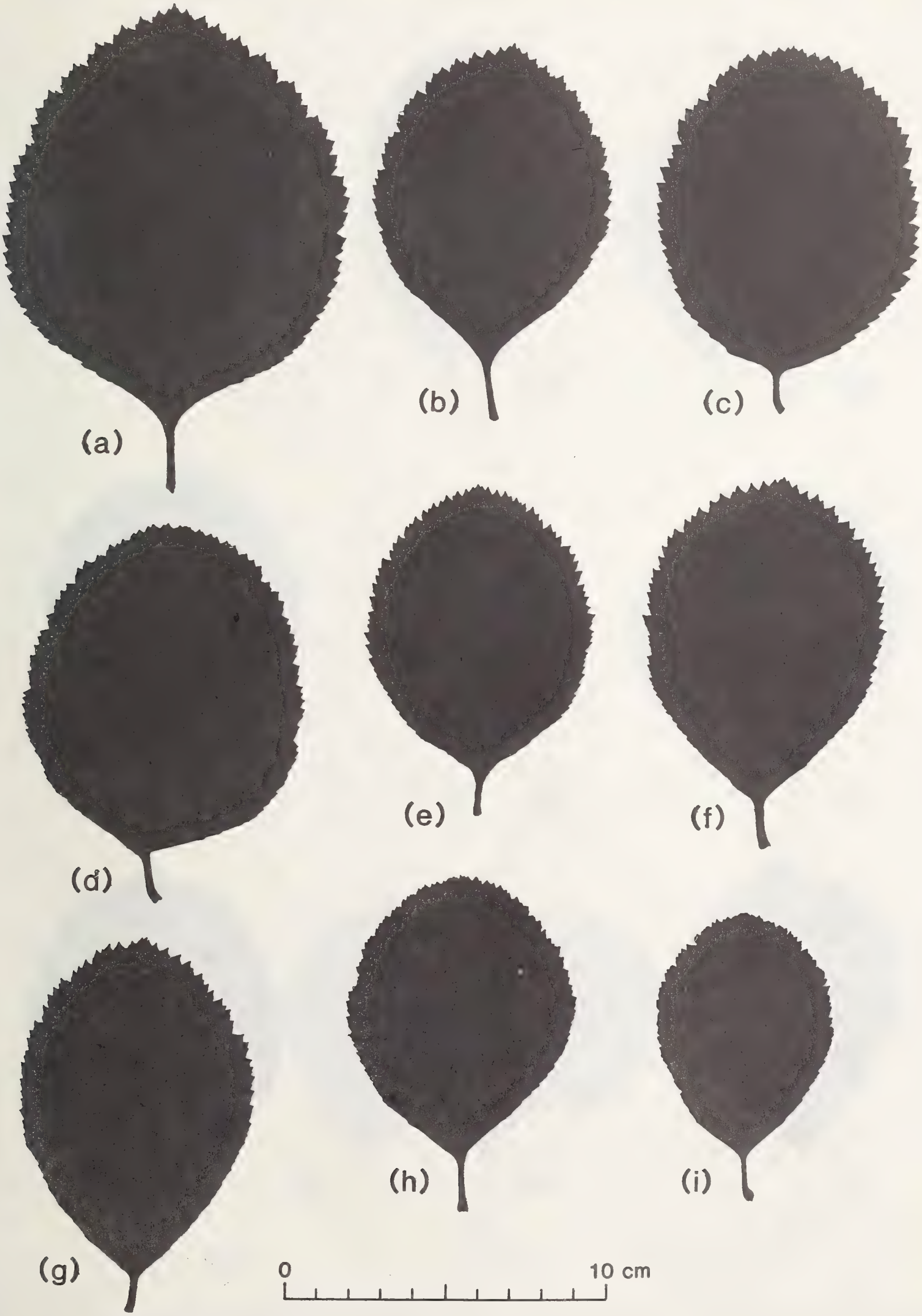

FIGURE 4. Silhouettes of representative leaves of *S. eminens* sensu lato, and related populations. (a) Seven Sisters Rocks, Herefs., v.c. 36 (Wye Valley phenotype (i)), (b) Seven Sisters Rocks (Wye Valley phenotype (ii)), (c) Leigh Woods, N. Somerset, v.c. 6, (d) Bristol, W. Gloucs., v.c. 34, (e) Worlebury, N. Somerset, v.c. 6, (f) Cheddar, N. Somerset, v.c. 6, (g) Nantporth, Bangor, Caerns., v.c. 49, (h) *S. hibernica*, Dromineer, N. Tipperary, v.c. H10, (i) *S. hibernica*, Rathdrum, Co. Wicklow, v.c. H20.

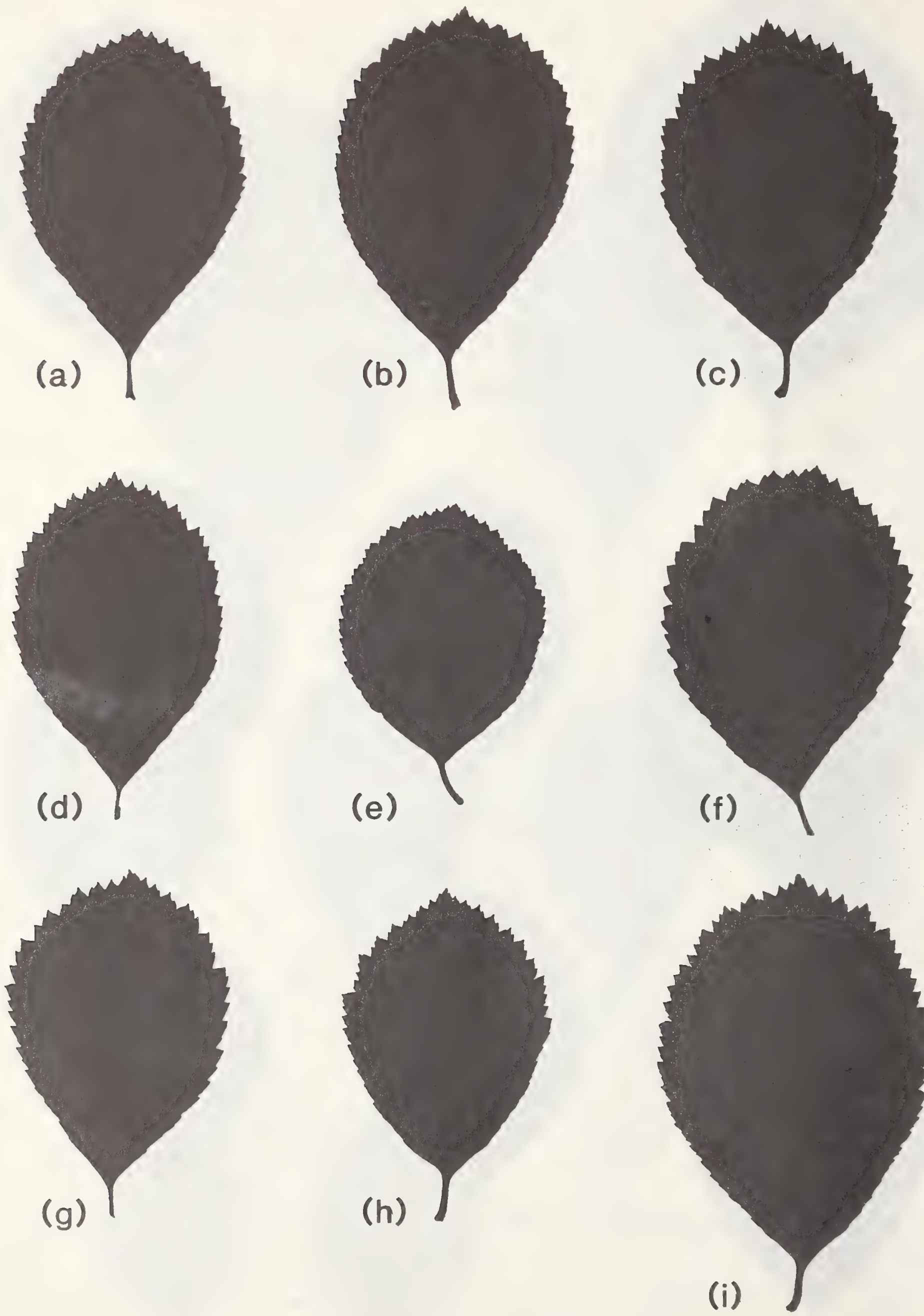

FIGURE 5. Silhouettes of representative leaves of *S. porrigentiformis* and related apomictic populations. (a)–(i) *S. porrigentiformis* (Type (a)) (a) Babbacombe, S. Devon, v.c. 3, (b) Wick Rocks, W. Gloucs., v.c. 34, (c) Cheddar, N. Somerset, v.c. 6, (d) Leigh Woods, N. Somerset, v.c. 6, (e) Seven Sisters Rocks, Herefs., v.c. 36, (f) Nicholaston, Glam., v.c. 41, (g) Craig-y-Rhiwarth, Brecs., v.c. 42, (h) Craig-y-Cilau, Brecs., v.c. 42, (i) Aberedw, Rads., v.c. 43;

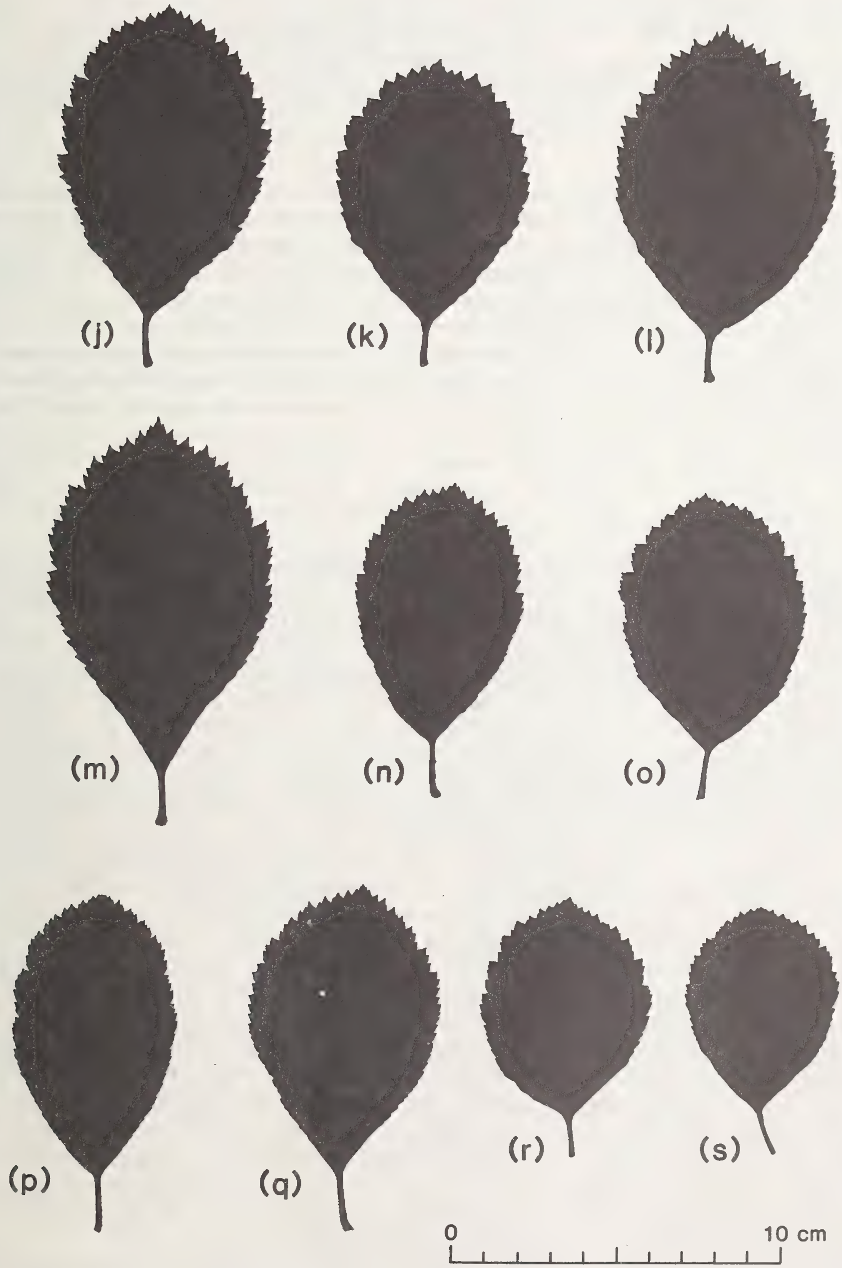

Fig. 5. *continued*
(j)–(o) 'large-leaved *porrigentiformis*' (Type (b)) (j) Cwm Clydach, Glam., v.c. 41, (k) Daren Disgwylfa, Brecs., v.c. 42, (l) Craig-y-Cilau, Brecs., v.c. 42, (m) Taren-yr-Esgob, Mons./Brecs., v.c. 35/42, (n) Daren Lwyd, Brecs., v.c. 42, (o) Cwmyoy, Mons., v.c. 35; (p) Bristol Type (c), Leigh Woods, N. Somerset, v.c. 6; (q)–(s) *S. graeca* sensu lato, Seven Sisters Rocks, Herefs, v.c. 36, (q) peroxidase phenotype I, (r) peroxidase phenotype II, (s) peroxidase phenotype III. Leaves (e), (o), (r) and (s) are from material collected at flowering time in late May; their small size is mainly due to this, rather than inherent difference from other comparable populations.

S. eminens E. F. Warb. was described (Warburg 1952, 1957) as occurring in woods on the Carboniferous Limestone of the Wye Valley and the Avon Gorge. Three trees from shady beech woodland above Seven Sisters Rocks (Fig. 4a), and a small plant with similarly shaped but smaller and firmer leaves in nearby open rocky scrub all showed a constant peroxidase phenotype (C1 C2 (C3) E1 E2); two further trees of similar leaf shape (Fig. 4b) differed in showing a stronger band C3. Warburg (1957) stated that *S. eminens* around Symonds Yat has proportionately longer, more rhomboid and more deeply-toothed leaves than plants from the lower Wye Valley or the Avon Gorge. We have found no trees of *S. eminens* matching the Avon Gorge form in the lower Wye Valley. Herbarium specimens from this area, including Warburg's type in **BM**, appear essentially similar to other Wye Valley material, and agree well with Warburg's description and illustration.

Samples collected from a uniform population in the shady lower fringe of Leigh Woods in the Avon Gorge showed a constant peroxidase phenotype (C2 C3 E1 E3). We found the same peroxidase phenotype in uniform populations of trees in rocky grassland or open scrub near Weston-super-Mare and in Cheddar Gorge. The Avon Gorge and Mendip populations are similar in most leaf, fruit and growth-habit characters; the Mendip plants have rather firmer leaves with a broadly cuneate base and their fruits have larger lenticels. Field observation suggests that the difference in leaf texture may be mainly due to the more exposed habitat of the Mendip trees, but that the difference in shape of the leaf base is, at least in part, genetic. Two other *Sorbus* populations resemble the Avon Gorge and Mendip '*S. eminens*' in peroxidase phenotype and leaf characters. These are a population at Nantporth near Bangor, Gwynedd, which has been named *S. porrigentiformis* but is clearly not that species, and the widespread Irish *S. hibernica* E. F. Warb. Both have fruits similar in size, shape and colour to the Avon Gorge plant (Table 1).

S. porrigentiformis is by far the most widely recorded species in our area. There are at least four clearly different peroxidase phenotypes which correlate with morphological characters (Fig. 5, Table 1), and appear relevant to a satisfactory delimitation of this species.

(a) The most widespread, with peroxidase phenotype C2 C3 E1 E2, occurs throughout the recorded range of the species from Torbay and Gower to Radnorshire and the Bristol-Mendip area. It is typically an open shrub (rarely a small tree) with rather angular and 'twiggy' branching, and relatively slender twigs. The leaves are dark green above (usually 147A on the R.H.S. Colour Chart), obovate, with an entire cuneate base and almost simple outwardly directed teeth (Fig. 5a–i); the fruit is broader than long (length/breadth ratio c. 0·75–0·85), and a deep crimson red when ripe. Samples of pollen from Gower and Craig-y-Rhiwarth showed 72–84% of well-filled grains and about 20% germination in 15% sucrose solution; Dr Q. O. N. Kay has obtained chromosome counts of 2n = (67–)68 in plants from Woody Bay (v.c. 4), Wick Rocks (v.c. 34) and Craig-y-Cilau (v.c. 42) (unpublished). The holotype of *S. porrigentiformis* in **BM** appears identical with this form.

(b) The plant which has been called 'large-leaved *porrigentiformis*' from Craig-y-Cilau and some other crags in the Mynydd Llangattock area has a different peroxidase phenotype (C2 C3 (C4) E2 E3). It readily grows into a well developed tree, usually with rather more robust shoots. The leaves are somewhat more oblong in outline, and tend to be biserrate (Fig. 5j–o); the fruits are rather larger, subglobose (length/breadth ratio c. 0·85–0·95) and a brighter red. We have found material with this peroxidase phenotype and morphological characters on Carboniferous Limestone at Craig-y-Cilau and crags to the east on Mynydd Llangattock, in Cwm Clydach, and on Old Red Sandstone at Taren-yr-Esgob, Daren Lwyd and near Cwmyoy in the Black Mountains. Dr Q. O. N. Kay has obtained chromosome counts of 2n = 68 in plants from Cwm Clydach (v.c. 41) and Daren Disgwylfa (v.c. 42). The population at Taren-yr-Esgob has leaves with a more narrowly cuneate base and sharper and more deeply incised teeth (Fig. 5m). The leaf-shape difference appears to be correlated with a consistently clearer separation between peroxidase bands E2 and E3 in this population than elsewhere, but both differences are rather slight.

(c) A morphologically uniform population of rather small trees in the Avon Gorge shows consistently the peroxidase phenotype C2 (C3) (E2) E3. In leaf shape (Fig. 5p) and habit this plant could be mistaken at first sight for *S. porrigentiformis*, but it has lighter green leaves (usually 146A on the R.H.S. Colour Chart) which more nearly resemble a small *S. aria*. The Bristol '*porrigentiformis*' discussed by Proctor *et al.* (1989) is this plant.

(d) Plants on Seven Sisters Rocks near Symonds Yat in the Wye Valley, growing with *S. porrigentiformis* and showing a general resemblance to it in leaf-shape (Fig. 5q–s), habit, and fruit shape and colour have the peroxidase phenotype C1 C2 (C3) E1 E2; several morphologically different groups of individuals differ in the relative intensity of the bands. Similar phenotypes occur in *S. eminens* from the same area, and appear to be common in crimson-fruited forms of *S. aria* sensu lato, in the Wye Valley generally. These plants cannot be genetically identical with any of the other *S. porrigentiformis*-like populations we have examined.

The very widely distributed *S. rupicola* (Syme) Hedl. is rather sporadically scattered in our area. Samples examined from Gower, Craig-y-Cilau and Craig Breidden agree in peroxidase phenotype with material from Devon, Yorkshire and Scotland (Proctor *et al.* 1989 and unpublished data).

ANOMALOUS INDIVIDUALS

We have not searched systematically for aberrant individuals within otherwise uniform apomictic populations, but a few examples have come to light in the course of our sampling. One individual at the top of Craig-y-Rhiwarth, in a population mainly of *S. leptophylla* with a few *S. porrigentiformis* (type (a) above), has distinctive ovate leaves and gave a peroxidase phenotype (C2 E1 E3) different from either. A tree below Leigh Woods, Bristol, with long cuneate-based many-veined leaves, clearly differing from *S. aria* or any of the named apomicts, also has a unique peroxidase phenotype. A single tree with rather narrow rhomboid leaves at Cwmyoy gave a peroxidase phenotype similar to but not identical with *S. wilmottiana*.

DISCUSSION

Our results are consistent with accepted taxonomic views for the more geographically restricted apomictic species, namely *S. minima*, *S. leyana*, *S. bristoliensis*, *S. leptophylla* and *S. wilmottiana*. The peroxidase isoenzyme variation confirms that *S.* × *vagensis* is probably a sporadically occurring sexual hybrid. However, the most interesting findings relate to *S. eminens* and *S. porrigentiformis*.

The isoenzyme evidence confirms the difference between *S. eminens* from the Avon Gorge and material from the Symonds Yat area (Fig. 6). Indeed the difference in peroxidase phenotype suggests that the two populations may not be very closely related. On the other hand, the peroxidase evidence links the Avon Gorge form with trees on Mendip, with the population that has been named *S. porrigentiformis* on the Menai Straits, and with *S. hibernica*. Warburg verbally suggested an affinity between a specimen from Cheddar and *S. hibernica*, without identifying it with that species (P. J. M. Nethercott, in litt.). These plants all show similarities in leaf form and toothing, and in growth habit, and their relationships need further investigation.

Our observations on *S. porrigentiformis* and related plants show why there have been problems in delimiting this species in South Wales, and suggest how these may be resolved. The widespread plant (type (a) above; Fig. 7) corresponds to the generally accepted concept of *S. porrigentiformis* (Warburg 1952, 1957; Butcher 1961) and appears identical with the Wye Valley specimen on which Warburg typified this species (Offa's Dyke, Tidenham, 18 September 1933, *A. J. Wilmott (no. 4484)* (**BM**)). It is locally accompanied or replaced in the Mynydd Llangattock-Cwm Clydach area and the Black Mountains by genetically distinct populations (type (b); Fig. 8) which should be regarded as an independent taxon. The uniform but probably more local plant in the Leigh Wood quarries (type (c)) needs further study in the context of other Avon Gorge, Mendip and Wye Valley populations.

Warburg & Kárpáti (1968) associate *S. porrigentiformis* with *S. graeca* (Spach) Kotschy rather than with *S. aria* sensu stricto. The *S. porrigentiformis*-like plants which accompany true *S. porrigentiformis* near Symonds Yat are clearly genetically different from any we have examined elsewhere, but they share *S. graeca*-like characters (cuneate-based obovate leaves and crimson subglobose fruits with few lenticels) with *S. porrigentiformis* and a number of our other apomicts. Field observations and herbarium material both indicate the existence of much variation in the Wye Valley. In South Wales, as in South-west England, the peroxidase variation in *Sorbus* seems nicely matched to the morphological variation and to the needs of recognizing and delimiting the apomictic populations. In the Symonds Yat area it appears that this is not so, and that considerable morphological variation may be accompanied by little or no variation in the peroxidase enzymes, especially among the more *S. graeca*-like plants. In general, if two individuals show different isoenzyme phenotypes under the same conditions, they cannot be genetically identical, but the fact that two individuals are identical with respect to a particular enzyme system does not necessarily

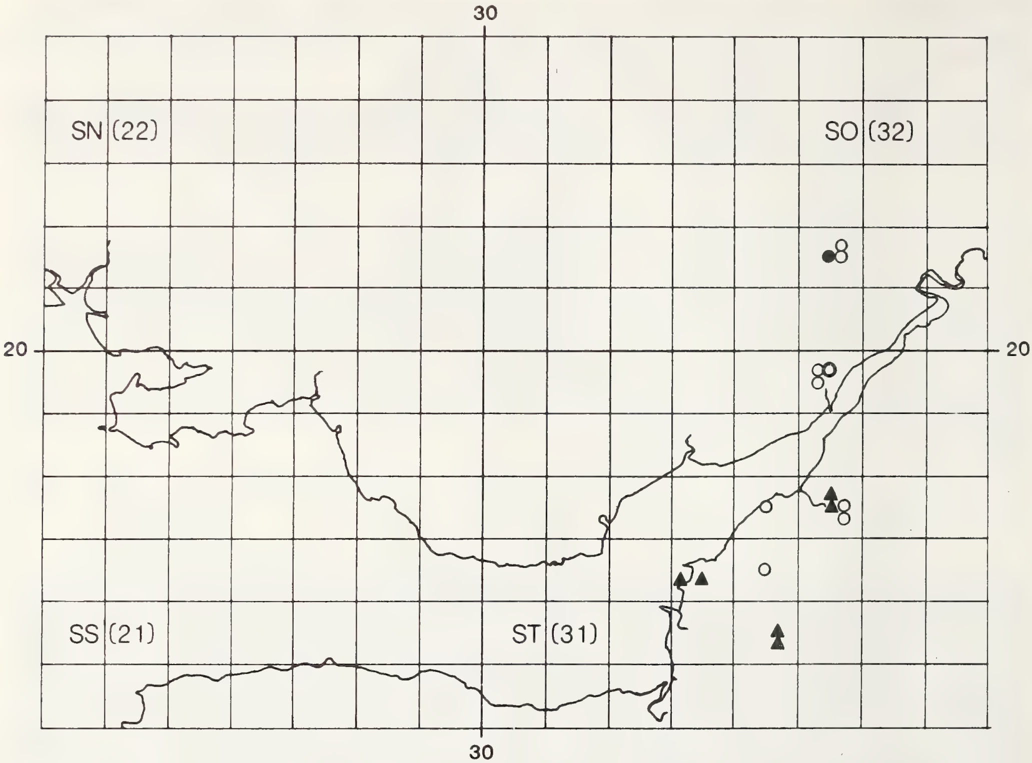

FIGURE 6. Distribution of *S. eminens* E. F. Warb. in 2-km squares (tetrads) of the National Grid. ● Symonds Yat-type peroxidase phenotype; ▲ Avon Gorge-type peroxidase phenotype; ○ other records of *S. eminens* sensu lato. The **O** shows the locality of the holotype specimen.

mean that they are identical in other respects. More work is needed on the Wye Valley populations, and exploration of other enzyme systems may well prove useful in this.

The apomictic *Sorbus* species we have considered are all confined to crags and rocky ground, an essentially disjunct habitat. Their present distribution must reflect an interplay between colonization and extinction on these 'islands' in a 'sea' of country they cannot colonize (Macarthur & Wilson 1967). *S. rupicola* has by far the widest total range (Perring & Sell 1968), in which wide disjunctions suggest fragmentation of a once more continuous area, perhaps in the more open landscape of the early Post-glacial (Pigott & Walters 1954; Birks 1973; Boyd & Dickson 1987). Next most widespread are *S. porrigentiformis* and *S. anglica*, both with much more coherent distributions centred on the South Wales limestone. Some of the more restricted distributions may have relic features, but to a great extent we are probably looking at rather recent patterns of bird dispersals (compare the patterns in *Rubus* of Weber (1987)) from centres of origin concentrated in three main areas, the Avon Gorge and Wye Valley, the Mynyd Llangattock area, and the Exmoor coast. From the peroxidase data, it is tempting to speculate that *S. porrigentiformis* was involved in the origin of *S. anglica*, *S. leyana*, *S. minima*, *S. bristoliensis* (Sell 1989) and other apomictic populations within its area (but excluding *S. leptophylla* and the North Devon apomicts); farther north, *S. rupicola* was probably the *S. aria*-group parent of *S. arranensis* and *S. pseudofennica* (Proctor *et al.* 1989). However, the inheritance of peroxidases in *Sorbus* is unknown, and likely to be complex (Gottlieb 1981), so these are no more than tentative conjectures which should stimulate search for other evidence.

It was Linnaeus's precept that the first step in understanding is to know the entities one is dealing with. However, the interest of *Sorbus* only begins with the delimitation and enumeration of apomictic microspecies. A far more interesting challenge is to understand how an apomictic group

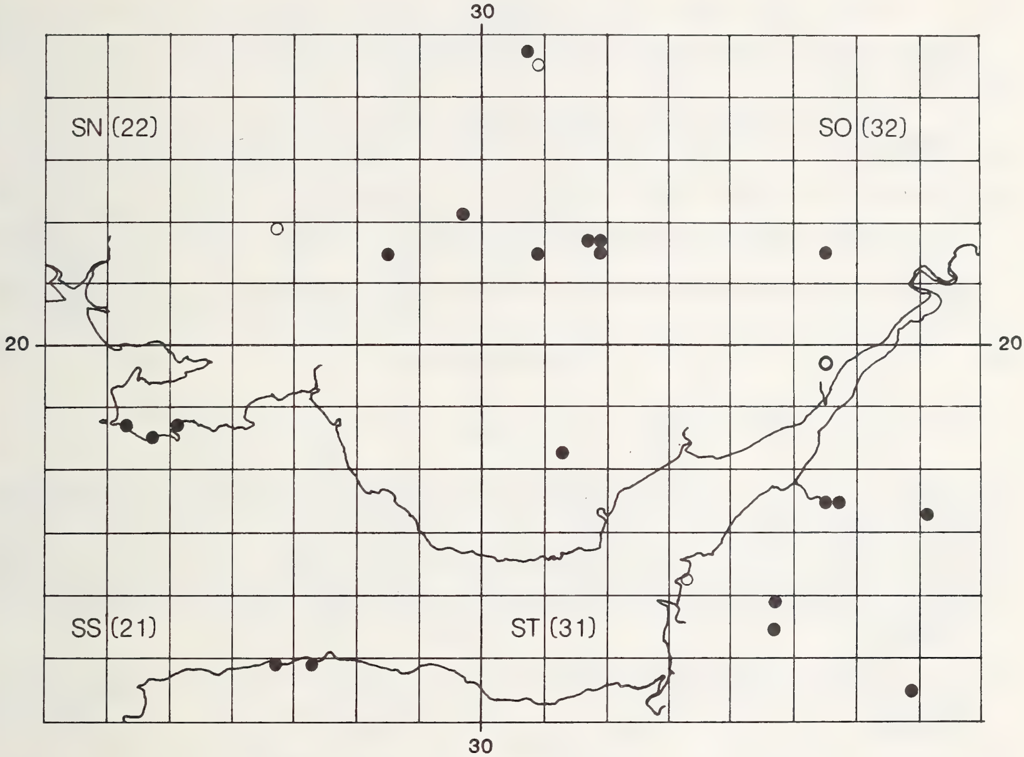

FIGURE 7. Distribution of *S. porrigentiformis* E. F. Warb. in 2-km squares (tetrads) of the National Grid. ● peroxidase phenotype (a); ○ tetrads from which we have seen material which on morphological characters appears certainly to be this type. **O** shows the location of the holotype specimen. Outside the area of this map, *S. porrigentiformis* confirmed as peroxidase phenotype (a) occurs in v.c. 3 in tetrads SY82.70, 92.62 and 92.64.

of this kind came into being, under what selection pressures, and how it functions over an extended span of time (Gustafsson 1947; Clausen 1954; Asker 1979). In this quest, fast-growing herbaceous plants (e.g. *Taraxacum* (Richards 1970a, b, 1973; Ford 1981)) and the long-lived populations of *Sorbus* offer complementary opportunities. In the latter genus, many questions of cytogenetics, population biology and ecology invite investigation, both in the apomictic populations of South Wales and South-west England, and in the mixed sexual and apomictic populations of the Wye Valley, Avon Gorge and Mendip which may well provide models for the kind of situation in which many of our present-day *Sorbus* apomicts originated.

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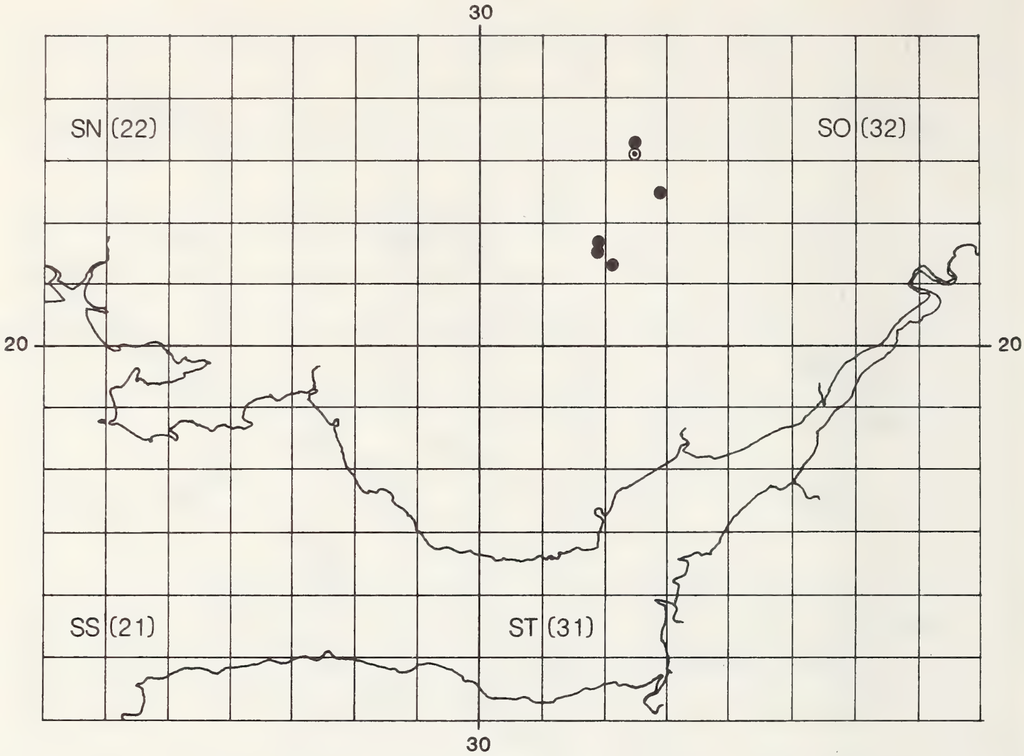

FIGURE 8. *S. porrigentiformis* sensu lato. Distribution of peroxidase phenotype (b) ('large-leaved *porrigentiformis*') in 2-km squares (tetrads) of the National Grid. ⊙ population at Taren-yr-Esgob.

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APPENDIX

The table below gives the C.I.E. coordinates of the shades from the *R.H.S. Colour Chart* used in matching fruit colours for Table 1, and the corresponding colour names from the earlier *Horticultural Colour Chart* (British Colour Council 1938). The first two figures of the C.I.E. coordinates define the chromaticity (hue and saturation) of the colour on a modified colour triangle; the third coordinate measures percentage reflection. Colours 28A–33A appear in the ‘orange-red group’ and colours 44A–53A in the ‘red group’ of the *R.H.S. Colour Chart*; 45A is a nearly pure red. For further explanation see Royal Horticultural Society (1966).

Number in R.H.S. Colour Chart	Colour name	C.I.E. coordinates x	y	Reflection factor (%)
28A	Persimmon Orange	0·547	0·391	45·5
32A	Indian Orange	0·561	0·370	27·6
33A	Capsicum Red	0·567	0·355	23·6
44A	[unnamed]	0·592	0·339	14·6
45A	Guardsman Red	0·593	0·315	11·9
46A	Currant Red	0·546	0·310	9·4
53A	Cardinal Red	0·522	0·298	8·3

Short Notes

OROBANCHE ALBA STEPH. EX WILLD. IN FIFE (V.C. 85)

Comment is necessary on "An account of *Orobanche* L. in Britain and Ireland" by Rumsey & Jury (1991), particularly on the section dealing with *O. alba* Steph. ex Willd. Here, the authors state that "it is now believed absent from the east coast of Britain" and lament its disappearance from Fife. I may have been the source of this belief, as in Ballantyne (1970) I said – rashly as it turns out – that the species was extinct in all its former v.c. 85 stations.

Happily this is not the case. In view of the confusion, it is as well to document the plant's localities in Fife. These are all on the north shore of the Firth of Forth, from west to east:–

GR NT1.8: East of St David's, 1820 (**E**); Cliffs below St David's, "fine specimens" (Graham 1840); 1969, J. Carlyle (pers. comm.). This locality is a small rocky bay with cliffs of 15–20 m between Inverkeithing and Dalgety Bay new town. I did not see *O. alba* on a visit on 3 August 1979 but as I did not search the area thoroughly, it may well still be extant.

GR NT2.8: (a) Sibbald (1684) stated that he found "*Orobanche major* . . . Broomrape upon the Buck [back] of Bruntisland"; in 1710 he rephrased this comment to read: "I found it below a rising ground upon the north side of the town of Bruntisland" (Sibbald 1803). (The earlier description is repeated by several authors, e.g. Greville (1824).) Both Sibbald's localities almost certainly refer to an area near to or on Burntisland Binn, a low hill some 200 m high overlooking the town. Over two centuries elapsed before the next record from here – a specimen in **E** dated 1906 says "Burntisland"; more specifically, a year later another observer stated "near the Binn, Burntisland, July 1907 (J. Anderson) and later, W. E. Evans" (in an annotated copy of Balfour & Sadler (1871)). There seems to be no further records from this site.

(b) A separate locality from (a) appears to be c.2–2·5 km to its east, between Burntisland and Kinghorn. This is variously given as follows:– near Pettycur, 1837, **KNS** (Young 1936); ". . . walked to hills east of Burntisland, . . . picked *Orobanche rubra*", 1854 (Balfour, 1902); near Kinghorn, 1892 (**STA**); Kinghorn, 1904/07 (**E**); "on broken ground between Kinghorn and Burntisland", 1907 (**E**). There are no further records from this area, which is now occupied by a large caravan site, although neighbouring cliffs (with difficult access) may still provide a haven.

(c) Perhaps the best known site is on top of a grassy cliff at Abden near the old Kinghorn Poorhouse, about half-way between Kinghorn and Kirkcaldy; this is usually referred to as near Seafield Tower, which is some 400 m to the north. The first mention is in 1809 (Maughan, 1811 and in **E**) and there are records at regular intervals since, mainly in **E** and **BM**, to 1903; by this time, it appeared to be almost extirpated, as described by Blackstock, a local naturalist. Commenting on the "rooting-out" of Fife's rare plants, Blackstock (1895) continued "Fifteen years ago, *Orobanche rubra* [etc.] where plentiful in well-defined stations along the Fife coast. Five years ago, I counted twenty good specimens of the Broomrape at its station near Kinghorn . . . Last year I saw two plants – this year [1893] I failed to discover any". Ten years later, in 1903, another local botanist said of the same site: ". . . if fortune specially favours us, we may gather a single specimen of the rarest plant in Fife, the red Broomrape" (Young 1903). It was these observations that led me to believe that the species had disappeared about the turn of the century. However, in 1971 J. E. Lousley (pers. comm.) wrote to me to say that he had found the plant on 29 July 1938 (specimen in **RNG**). I again searched for it, as I had done in the 1960s, without success; then, late in 1985 I was told it had been seen during that summer, and on 23 July 1986 I came across three stunted stems. I have not had the opportunity of returning since.

GR NT2.9: An open circle appears on the map of *O. alba* provided by Rumsey & Jury (1991) for this square but there is none in the *Atlas* (Perring & Walters 1962) and I know of no locality. This record is presumably based on the specimens collected by W. McIvor from "Kirkcaldy" (**MANCH**, 1847; **STA**, undated). Nominally this is in this square but the actual station is almost certainly Abden (above).

GR NO4.0: In the *New Statistical Account* (1845) for the parish of Kilconquhar the compiler (the local minister) in 1837 listed several plants from "under Kincraig Hill, on rocks", among them *O. rubra*. While this site is quite suitable, there is no other record from a locality which became well explored. In particular, Charles Howie, who lived not far away and who botanized in east Fife from c. 1834–84, does not mention the species from here. Additionally the minister's botanical knowledge must be questioned as he includes, from elsewhere in the parish, such improbable species as *Silene acaulis*, *Azalea procumbens* and *Adiantum capillus-veneris*! The record in Wood (1862/87) is based on the *N.S.A.*, as is the "Elie" of Sonntag (1894). It seems best to discount this locality.

To summarize, *O. alba* has been definitely recorded in four separate localities in v.c. 85. In two of these it is probably extinct; in the other two, it seems to be surviving, although in small numbers. It needs to be refound in the St David's station to establish its status there, while the Abden site requires to be monitored regularly because of the very small size of the population there.

I am grateful to D. R. McKean and A. Angus for checking specimens in **E** and **STA** respectively.

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RE-ESTABLISHMENT OF A DISCARDED NAME IN *CREPIS* L. (ASTERACEAE)

While reviewing Linnaean names associated with temperate eastern North American species of *Hieracium* and *Crepis* I chanced upon *Crepis vesicaria* L. subsp. *haenseleri* (Boiss. ex DC.) P. D. Sell (1976), a name in current use (e.g. Clapham, Tutin & Moore 1987). The name is no longer correct because of modifications made in Art. 57 of the 1983 Sydney *Code* (cf. Reveal 1983a) conferring priority and transferability to autonyms, a concept supported by Sell when he reluctantly proposed this combination. Accordingly, the following change is mandated.

Crepis vesicaria L. subsp. *taraxacifolia* (Thuill.) Thell. in Schinz & R. Keller, *Fl. Schweiz* ed. 3, **2**: 361 (1914), autonym priority established by *C. taraxacifolia* subsp. *haenseleri* (Boiss. ex. DC.) Nyman, *Consp.* 459 (1879).

Crepis taraxacifolia Thuill., *Fl. Env. Paris* ed. 2, 409 (1799).

Barkhausia haenseleri Boiss. ex DC., *Prodr.* **7**: 153 (1838).

C. vesicaria subsp. *haenseleri* (Boiss. ex DC.) P. D. Sell in *Bot. J. Linn. Soc.* **71**: 254 (1976).

C. vesicaria var. *taraxacifolia* (Thuill.) B. Boivin in *Naturaliste Canad.* **94**: 523 (1967).

It is possible that var. *taraxacifolia* is not the correct name for the taxon at this rank. Until there is a catalogue of all infraspecific names for Old World plants (Reveal 1983b) it will be difficult to ascertain autonymic synonymy as required by the *Code*.

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Book Reviews

Plant form. An illustrated guide to flowering plant morphology. A. D. Bell. Pp. xiii+341, with numerous colour photographs and line drawings. Oxford University Press, Oxford. 1991. Price £50 hardback (ISBN 0–19–854279–8); £25 paperback (ISBN 0–19–854219–4).

This book is a mine of information on morphological terms, many of them not well known, at a time when morphology is seldom taught in detail. There is a good index and an excellent cross-referencing system, which, however, makes the book harder to read right through.

The author states that he has tried to make the book attractive, "the better to woo the budding botanist and the curious amateur plantsman". He has certainly succeeded in his primary aim. The book is laid out in such a way that a topic is dealt with in one or more double page spreads. Usually on the left there is a colour photograph and descriptive paragraphs: on the right-hand page are excellent line drawings by Alan Bryan, relating to the same topic. This results in a strangely shaped book, wider than it is long. For the most part the colour photographs are excellent, although in my copy, at least, a few were over-exposed (Figs 62b, 74, 170 and especially 134). In many cases they could have been made more useful, especially to the novice, by the use of arrows or labels. How will the "budding botanist" know, for example, that *Epiphyllum* in Fig. 294 is the narrow green plant growing up the tree trunk, and not the much more obvious tree itself? In my opinion, it would also be helpful to have rather more detailed legends to the line drawings, so that they can be understood without frequent reference to the text (consider, for example, Fig. 73). Teaching opportunities have been lost in these ways. A good feature of the book is the provision of examples from all over the world, often unusual or little known plants.

The second part of the book deals with "Constructional organization", especially the architecture of tropical trees. Although this section is also interesting, I am not entirely convinced that the two parts of the book successfully complement one another.

The author emphasizes throughout that, in order to understand the adult morphology, it may be necessary to study development; but it is on developmental topics that the book is weakest. It is unfortunate, also, that the dynamic aspects of phyllotaxis receive little emphasis, and that the fractional method of description has been perpetuated.

Although there are a few curious placings – *Cyclamen* sits oddly with root tubers, for example, and haustoria under root morphology – there seem to be few errors. There are also few typographical errors, although the legend to Fig. 205 includes a substantial part of the legend to Fig. 239. The term membraneous is used instead of membranous, and principle instead of principal.

This is a beautifully produced book containing a wealth of information on plant morphology which it is important should not be lost. It is not entirely clear, however, who its principal readers will be. Few students of plant science to-day, however regrettably, will be able to spend the time required to master the whole book (or have the funds to buy their own copy). On the other hand, if the book is to be used as an illustrated dictionary, as the author suggests, it fulfils its purpose very well. Anyone who has consulted Willis (*A Dictionary of the flowering plants and ferns*, 1966) or its more modern counterparts will find this book extremely useful, as will those who need to describe plants.

E. G. Cutter

A colour guide to rare wild flowers. J. Fisher. Pp. 364. Constable, London. 1991. Price £12.95 hardback (ISBN 0–09–470780–4); £11.95 paperback (ISBN 0–09–469190–8).

British and Irish botanists are well served, too well served, with illustrated field guides. Having recently reviewed our popular field botanical literature (*British Wildlife* **2**: 214–218, 1991), and concluded that a substantial body of it is superfluous, my first reaction to another guide was predictably jaundiced. Nevertheless, the publishers appear to have found a small niche in the market, and have produced a neat and cheap volume. Some 150 species are featured, grouped by seven regions, e.g. Home Counties, Isles of Scilly, that are rich in rarer species. Each text entry consists of an informal description of the appearance and habitat of the plant opposite a full-page photograph. A miniature map of the region included under each species is of no use at all, other than a reminder that one is perhaps searching in the Home Counties for *Melittis melissophyllum*, which might anyway be better sought in Cornwall – possibly the publishers were unaware of the *Atlas of the British Flora*? The photographs vary in quality and many do not come up to the standard of those in recent field guides. The text has a freshness of style, however, which conveys that the author is an enthusiast, is familiar with the literature and recent research, and knows his plants in the field.

Nevertheless, the contents tested even my robust attitude (pro-picking flowers, hunting, shooting, etc.) to conservation. The title says it all: the book tells the naturalist, reputable or not, where to find some of our rarest wild flowers. There will be those who feel that the book thus provides a service, but this argument has the same suspect basis as that preached by those who market illustrations of the unclothed human form. I fear that this guide will indeed fall 'into the wrong hands'; nor is seeking rarities as an end in itself a healthy intellectual exercise for the botanist.

Several text entries give detailed instructions as to how to reach localities for very rare plants, including precise road directions and, more disturbingly, six-figure grid references. Fortunately the concept of rarity employed here seems to be based on unfamiliarity (the book having a distinctly south-eastern bias), and a good many of the species included are not particularly threatened. *Leucojum aestivum*, for instance, flourishes in the suburbs of Reading, and most of the species included in the section on Scilly are merely locally common weeds. One could include within this category the native Scillonian rarity, *Ornithopus pinnatus*, a denizen of the celebrated Tresco Abbey Gardens' rockery. Nor will anybody who has seen *Oxalis pes-caprae* colouring Cretan olive groves a sickly yellow in spring worry unduly about its possible fate at the remotest extremity of its range. However, the locations of other species should never have been included, although mercifully the author is circumspect about some of the choicer rarities.

The information divulged is of a sort best kept within notebooks and amongst friends (see Obituary of John Codrington, p. 53). The book ends with a list of addresses and telephone numbers of Wildlife Trusts, and a note on the dust cover suggests that they be approached for permission and information, including the state of the season. I suspect that these bodies, with often limited administrative resources, will be less than pleased to receive a deluge of enquiries from rarity hunters armed with what ought to be confidential data! From my own experiences on excursions, I know only too well that a minority of botanists *do* lack self-control and *will* dig up plants for their gardens. Furthermore, the rising popularity and fashionability of horticulture, not least its current fashion for 'wild flowers', means that rich pickings are to be had from selling rare plants – and, as with antiques, some sources of supply are more dubious than others.

J. R. AKEROYD

The families and genera of flowering plants. Edited by K. Kubitzki. Vol. 1. *The ferns and gymnosperms*. Edited by K. U. Kramer & P. S. Green. Pp. 430 with 216 figures. Springer Verlag, Berlin. 1990. Price DM298 (ISBN 3–540–51794–4).

This well produced volume is the first in a proposed series covering the vascular plants. This ambitious project is competently started, well produced, and written and edited by a selected group of international experts in the different fields. The first volume of the series covers the ferns and fern allies (edited by K. U. Kramer) and the gymnosperms (edited by P. S. Green).

The ferns are ably written by a recognized group of experts in the different families. As with all such projects there is an unfortunate limitation in discussions caused presumably by restrictions in length. Most of the articles provide an excellent review of the families and genera although, at least at the Royal Botanic Gardens, Kew, not all the family and generic delimitations will be followed. The detailed studies of Holttum on the Thelypteridaceae, which resulted in the recognition of many clearly defined genera are not followed, the species being placed in a restricted number of genera rather than the more numerous genera of Holttum which indicate the relationships within the family.

Classification of the ferns at the level of the family is still in dispute. At Kew we will be following the families as listed by Brummitt. Thus the Pteridaceae will be treated in several families: Parkeriaceae, Adiantaceae and Pteridaceae. In addition the genus *Nephrolepis* will continue to be treated within the family Oleandraceae rather than in the monotypic family Nephrolepidaceae. Generic limits outlined for the Polypodiaceae are not accepted and rather than the very broad concepts of *Aglaomorpha* we will continue to accept its related genera, *Thysanosoria*, *Merinthosorus*, etc. which were studied by Roos. Indeed at both generic and family levels little stability in the application of names can be expected. The limits used in this book are not necessarily widely accepted.

Probably one of the most difficult aspects of the book is the decision to arrange the families alphabetically. It is unfortunate that the families were not arranged according to their relationships, particularly as family limits are still uncertain. This approach will cause major problems within the dicotyledons.

The detailed treatment of the recognized genera with the references specific to each family will, despite differences in generic delimitation, provide an indispensible reference book to the student of the pteridophytes. It is difficult to understand why some chapters, such as Conservation, were included in the section on ferns particularly with the limitations in space. The author of this section is a recognized expert in conservation of pteridophytes and the chapter in no way reflects either his knowledge or the available information.

The gymnosperms were the work of a single author, C. N. Page from Edinburgh. The treatment provides an up-to-date review of the families and genera of the gymnosperms and the subdivision of the Podocarpaceae is widely, if not universally, accepted. The high standards of the pteridophyte section are equalled in the section on gymnosperms.

The series on vascular plants starting with this first volume will provide an indispensible reference which must find its place in every reference library. It is hoped that the treatments at family level will be organized according to the relationships between the families as this will greatly increase the use of the volumes to the student of botany. The cost of these volumes will unfortunately restrict their availability in the libraries of the developing world where they could be extensively used as a reference for teaching University courses. This volume sets a high standard for the remainder of the series and will undoubtedly be a classic of this decade. A low priced edition for the developing world would be a great service to taxonomy.

R. J. Johns

Flora of eastern Saudi Arabia. J. P. Mandaville. Pp. x+482; 268 colour plates. Kegan Paul International, London. 1990. Price £95 (ISBN 0–7103–0371–8).

This exemplary regional Flora fills a notable gap in the Arabian floristic literature. The author, an American employed in the oil industry, has spent the past 25 years exploring the Eastern Province of Saudi Arabia and has also made a major contribution to our knowledge of the flora of Oman. Although the area covered is not rich in species, nor for that matter in families (73 are recognized in the *Flora*), there were many thorny taxonomic problems to be confronted in preparing this first critical treatment of an area where the Saharo-Arabian element of the flora intermingles with Mediterranean and subtropical elements.

The book starts with a short history of botanical investigations of the Province; several notable travel writers are among those mentioned, including Harold St John Philby, Bertram Thomas and Wilfred Thesiger. The geography and climate of the area are described, and a significant extension of subtropical (Sudanian) vegetation into central Arabia is highlighted in the chapter on phytogeography. The region's palaeo-environments are also described, and the introduction ends with a short section on vegetation.

The Flora proper is set out in the order of Stebbins' sequence of 1974, which is close to that of

Cronquist. Families, genera and species are keyed and described, and detailed distribution summaries are augmented by citations of the author's and other specimens. Vernacular names, collected by the author in the field, are cited when available. His scholarly approach to etymology is coupled with terse observations on economic uses; under *Deverra triradiata*, for instance, he notes that "Many Bedouin herdsmen note the camel's particular fondness for this aromatic shrub."

Selected species, such as three of the four *Stipagrostis*, are provided with dot distribution maps, and there are 268 colour photographs, most of very high quality, which should broaden the sales appeal of the book. A glossary of botanical terms, a gazetteer of geographic names cited in the text, an eight-page bibliography, and two indexes of vernacular names (one in Arabic order, the other in transliteration) precede the general index. The choice of a close-up of *Aegilops kotschyi* to illustrate the dust jacket is a bold one, yet it epitomises a 'desert plant' and also represents the area's largest family, the Gramineae.

The author's notes provide some original insights into the many taxonomic problems of the flora. They are invariably helpful and perceptive, displaying a profound field knowledge of the Arabian flora as well as setting out pointers to the need for further work. His extremely tactful phraseology when referring to Migahid & Hammouda's *Flora of Saudi Arabia* (2nd ed., 1978) as being "designed to be Kingdom-wide in scope . . . although the basis for its attribution of taxa to the Eastern Province was somewhat unsure" will hardly offend anyone. But in practice Mandaville's *Flora* will be of far greater value to users outside the Eastern Province, as I have found when working on collections from the United Arab Emirates, and it will be of great relevance throughout the peninsula. The hopes expressed in the Preface that the book may "assist to some extent in the development and conservation of natural resources in these lands which have been my home for 40 years" deserve to be fulfilled. Saudi Arabia now has a Flora, as well as a flora, of which to be proud.

J. R. EDMONDSON

The Cornish flora supplement 1981–1990. L. J. Margetts & K. L. Spurgin. Pp. vi+119, with frontispiece line drawing and endpaper map. The Trendrine Press, Zennor, St Ives, Cornwall. 1991. Price £14 (ISBN 0–9512562–2–X).

In Margetts & David's *A review of the Cornish flora 1980*, one of the authors forecast that "further investigations would proceed vigorously" but he would not have foreseen that enough records would accumulate within the next ten years to justify the publication of a *Supplement*. Knowledge of the Cornish flora has been greatly increased by individual recorders and various surveys. These include the Lizard project directed by Dr L. C. Frost of Bristol University, the monitoring scheme and meetings of the Botanical Society of the British Isles, and mapping on a 1-km square basis in S. E. Cornwall by the Caradon Field and Natural History Club. Not only have many areas been studied in greater detail since the *Review* but more attention has been given to introduced species ranging from aliens to garden outcasts.

The arrangement of families, genera and of the species (with a few exceptions) is the same as in the *Review*, apart from the garden escapes and casuals which were listed at the end. In the *Supplement* these are included in the main list. As in the *Review*, localities for the less common species are listed under the number of the appropriate 10-km square but species that are common or frequent and widespread were not treated in detail there and are not referred to in the *Supplement*. In general the nomenclature, English names and distribution follow the *Review* closely, making it a pleasure to use the two volumes side by side.

The *Supplement* is strongly bound, well laid out and clearly printed with the minimum of typographical errors. Improvements over the *Review* include the greater distinction between the generic name and its authority, and the placing of the Dandy (or other) number after rather than before the specific name. The use of bold type-face for the word 'introduced' in place of a sign, and for the vice-county 'West' and 'East' and for 'Scilly' make the text much easier to use. These three words are succeeded rather than preceded by the star used to indicate a new vice-county or Scilly record.

The authors have kept up with contemporary studies of various genera and mapping of critical species, for example in *Rosa*, *Taraxacum* and *Rubus*. The last-named genus includes the appropriately named *R. metallorum* L. J. Margetts, which is frequent in the old metalliferous mining areas in W. Cornwall. A description and Latin diagnosis of this new species is given in the appendix.

The large amount of information in this *Supplement* includes the up-dating of some records, reports of over 180 new vice-county records (including introductions) and of a number of exciting discoveries. No one who has a copy of the *Review* can afford to be without this excellent *Supplement*. It should also enhance sales of the *Review*, which is still available (see *Watsonia* **14**: 293–294, 1983).

J. A. Paton

Flora of the Outer Hebrides. R. J. Pankhurst & J. M. Mullin. Pp. 171, with 6 maps, 3 transect outlines and 4 half-tones. Natural History Museum, London. Price £19.95 (ISBN 0–565–01121–9).

This is a provocative Flora, being something less and something more than it pretends to be. In appearance and content it is much of what we have come to expect in a modern county Flora. The cover is immediately appealing. There are introductory chapters by specialists on geography, geology, geomorphology and soils, climate and vegetation, floristic and vegetational history, vegetation, botanical history and plant lore of the Outer Hebrides. In addition there is an index of place names with six-figure grid references, the bibliography is cross referenced with particular islands, and there are lists of S.S.S.I.s and N.N.R.s and of collectors.

The flora list is arranged in two column format which makes it compact and easy to scan though the absence of an index of genera may be a continuing aggravation to users for whom plant classification is not a daily routine. There are excellent keys to *Euphrasia*, *Rubus*, *Hieracium* and *Taraxacum* which should tempt field botanists to plunge deeper into these troubled but well charted waters and promote more intelligent collecting. The use of English and Gaelic names recognizes a cultural dimension to local botany and the importance of vernacular names in education and conservation. Ancient links with Ireland are seen in our mutual celebration of Cu Chulainn, Patrick and Colm Cille in the Gaelic names. Compilers of the standard list of Irish plant names used in the *Census Catalogue of the flora of Ireland* looked at times to Dwelly and Cameron for inspiration and the compilers of the present list of Gaelic names have found inspiration in Irish examples, though the comprehensive list in the second edition of the *Census Catalogue* was apparently not available in time. While both compilations might have benefitted from closer co-operation, the Gaelic names selected by Clark and MacDonald will go a long way towards the production of a standard list of Gaelic names for plants. The Gaelic Books Council assisted with the expenses of the *Flora*. Molaim an saothar agus an taca. [I praise the labour and the support – Ed.]

There are few typographical or editorial errors though reference to a *Salicornia perennis* community on p. 39 may cause some confusion.

The authors had to deal with an unusually high number of unsatisfactory records including unsubstantiated literature records, field records not refound, student hoaxes and specimens of doubtful provenance or identification. In this matter they have adopted the role of reporters rather than commentators allowing themselves only expressions of mild scepticism or faint hope that improbable records might be confirmed. Outright dismissal is delivered at times in the words of third parties, as A. J. Wilmott's, "I don't believe it", on hearing a report of *Cerastium arcticum*. Users of the *Flora* will need to read the chapter on the history of recording and the introduction to *Potamogeton* to get a flavour of the rivalries and indiscretions which hampered progress with the Outer Hebrides flora for decades.

It would have been difficult to select from among the unconfirmed records all those which ought to be disregarded and consigned to an appendix of errors; the baby might have been thrown out with the bath water. As it is, the flora list is unsatisfactory. Further work on the confirmation or otherwise of the doubtful records is needed. A conservative view ought to be taken of what is probable or even possible in the islands.

The authors have acknowledged the considerable work done by their predecessors, notably

Professor J. W. Heslop-Harrison, Miss M. S. Campbell and A. J. Wilmott. It is their wish that the book should form a basis for a future, more detailed and comprehensive Flora. Meanwhile we are indebted to the authors and their team of workers and writers and to the Natural History Museum for an important and long overdue Flora of these fascinating islands.

D. Synnott

Crucifers of Great Britain and Ireland. B.S.B.I. Handbook No. 6. T. C. G. Rich. Pp. 336. Botanical Society of the British Isles, London. 1991. Price £10 (ISBN 0–901158–20–8).

This latest of the B.S.B.I.s monographic handbooks is a worthy addition to an indispensible and acclaimed series. *Crucifers*, i.e. the family Cruciferae or Brassicaceae, covers "the 138 species most likely to be found in the field" in Britain and Ireland, and sets a high standard for future titles and revisions of earlier handbooks. Written with a blend of diligence and enthusiasm, which just occasionally merges into whimsy, it is a more substantial volume than the others, but retains a neat, compact feel in the hand. Although Tim Rich is now among our Society's more familiar figures, the B.S.B.I. was brave to commission one of its then younger members to write a handbook to this large taxonomic group. Nevertheless, the risk paid off handsomely, and nobody doubts the wisdom of the Publications Committee's decision. *Crucifers* is a most useful contribution to the literature on this family, and will be of value to all European as well as to British and Irish botanists.

The descriptions are thorough and based for the most part on living material, and under each species there are substantial observations on taxonomy, variation, ecology and, where data are available, biosystematics. A 10-page bibliography at the end reflects the author's broad study of the family. Introductory sections on taxonomy and identification are for the most part excellent. The keys to genera and species are clear and should not be too hard to follow. The very first key directs the reader to sections A–H of the main key, thus avoiding a lengthy crawl through the whole key. The main key is embellished with small line drawings of morphological features, something that I would not normally favour, but here they do not clutter and help to explain terminology to an unfamiliar reader. It is a feature that will be popular with the Field Studies Council and others who teach groups of students. Generic keys follow and there is an informal synoptic key to provide a short cut and aide-memoire. I should have liked to see more in the introductory section on the economic aspects of this important family that provides such a significant proportion of the vegetable crops, salads and arable weeds of Europe.

The coverage is thorough, with the inclusion of all native and established adventive species, together with several persistent casuals. This adds greatly to the value of the book, as it is likely that certain species will become more widespread, not least as a result of the consequences to trade of a post-1992 E.C. free market and increased contact with eastern Europe. Recent years have seen a considerable expansion of the range of *Hirschfeldia incana*, for example, in both Britain and Ireland, especially in London and Dublin where it is now rather common. Indeed, Tim Rich was the first to report its occurrence in Dublin (*Ir. Nat. J.* **22**: 531–2, 1988), where too many of us had dismissed it as *Brassica nigra*. Had this present work been available, we might have been encouraged to note the seeds in the beak of the fruit! Conversely, *Camelina sativa* has decreased markedly in Britain and Ireland during this century with the decline of the flax fields which were its characteristic habitat. However, the revival of flax, or rather linseed, cultivation in Norfolk and elsewhere, together with other new crops, may perhaps lead to an increase in the frequency of this and other crucifers.

For two critical genera, the author has called on the services of other specialists. A highlight of the book is the account of *Rorippa*, including hybrids, written jointly with B. Jonsell. More controversial is the account of *Cochlearia*, by K. H. Dalby, which takes a distinctly narrow view of specific limits, albeit one closer to the view of some continental workers. Two other departures from convention, at least from *Flora Europaea* (including the as yet unpublished revision of Volume 1), are the inclusion of *Cardaria* in *Lepidium*, with the treatment of the two European subspecies of *L. draba* at specific rank, and the inclusion of *Cardaminopsis petraea* within *Arabis*. These small matters should not upset too many botanists; synonymy is nothing new in Cruciferae, a family of economic importance that has thus been over-classified and now has too many genera!

The general appearance of the book, alas, falls down somewhat. The overall standard of the copious line drawings suffers from their being the work of a number of artists, as they vary in quality as well as style. The use of a single artist would have ensured a more consistent, professional-looking product. This ought to be borne in mind for future handbooks, since they are a flagship publication of our Society. Although the fact that the artists have provided their services free is to be applauded and the great majority of the drawings are of a high standard, the end-product may support accusations from some quarters that the B.S.B.I. is too often amateurish in its approach. The author has obviously bravely coordinated the efforts of the various artists, making sure for example that floral parts were consistently illustrated. The use of 10-km dot distribution maps has greatly enhanced the value of the later handbooks, although in this case there are rather too many maps – they are surely not necessary for rarer species – and sometimes too many symbols have been used for clarity. The numbering of the maps, based on that used for species in the text, is confusing. In many cases, I should have preferred a more detailed geographical description in the text itself.

Crucifers of Great Britain and Ireland is an essential book for the field botanist and should encourage more of us to tackle them, especially the despised 'yellow crucifers'. It would be good if this handbook were to reach a wider public, both as a standard reference and as publicity for the B.S.B.I., but the Society does maintain a rather cryptic publication policy.

J. R. AKEROYD

British Plant Communities. Vol. 1: *Woodlands and scrub*. Edited by J. S. Rodwell. Pp. x+395, with 25 line drawings and 25 floristic tables with accompanying distribution maps. Cambridge University Press, Cambridge. 1991. Price £70 (ISBN 0–521–23558–8).

With this book the editor presents us the first volume of a planned 5-volume series. For the authors it is the most difficult volume, since here the principles and methods must be laid out. Moreover, it also encompasses the most difficult of the plant communities, the woodlands. Already at a first brief look, it is apparent that it is scientifically a complete success, and that it is also an important work for plant sociology. That it is being reviewed by a Continental European plant sociologist indicates that it also has great value extending well beyond the British Isles. Indeed, it fills a painfully felt gap for us. Descriptive vegetation science depends in the long run on regional comparison, and until now such comparisons were difficult, if not impossible. To be sure, for Ireland and Scotland there were several individual surveys available (viz. White & Doyle, McVean & Ratcliffe, Birse), but for England and Wales, despite a wealth of synecologically and syndynamically valuable studies, a comprehensive systematic review of vegetation types was lacking. In addition, the organization of such a magnum opus is of interest, since *only* 15 years have passed since the beginning of the actual field work – a short time for an enterprise based in an inductive way on circa 35,000 vegetation relevés!

This undertaking received its initial impulse from the urgent need of nature conservation for a systematic overview of the objects to be protected, valid on a large scale and based on uniform standardized methods. Hence there was first of all a need for exactly described plant communities (vegetation types), which at the same time form the biotopes for animals. Thus it is understandable that the old discussions of methods far removed from actual practice did not break out again, rather one proceeded pragmatically – the success of the result shows that this was good. Although four universities took part, it was possible quickly to agree upon a procedure and that despite different evaluation methods, a self-consistent picture emerged. Dr J. S. Rodwell was primarily responsible for this course of events. (Here I would have liked to have learned more about the methods and techniques of the individual research groups involved.) In any case, one strived more for ecologically valid statements than for difficult mathematical algorithms – much as on the Continent. The British modus operandi (can one say: the modern British school?) has many features in common with this Continental school, the Braun-Blanquet concept, which today has gained worldwide acceptance. Indeed, certain passages could be incorporated in a Continental European textbook: common principles are for example taking into account *all* species, according to their frequency of occurrence, the strict uniformity of relevé plots and last, but not least, the crucial criterion for ordering called 'frequency and abundance', which evidently corresponds quite well to the term 'Treue' of the Braun-Blanquet school. Even though no formal hierarchy was aimed for, as it turns out three categories have been introduced and proved useful: community, sub-community and variant. The parallel to associations is of course obvious. The authors then also draw parallels between groups of communities and the Continental 'Verbände'. One could now wish further to have a general survey of woodlands in the form of a table of 'Stetigkeit' or degree of presence (as we say instead of frequency).

All together, 25 communities have been described, which in turn are placed into six principal groups, the largest one being the Mixed deciduous and Oak-Birch woodlands. The greatest part of the book is dedicated to the presentation of the communities and their subunits. This is done in a consistent way throughout, in the sequence: Synonyms – Constant species (i.e. those of high degree of presence) – Rare species – Physiognomy – Sub-communities – Habitat – Zonation and succession – Distribution (inside Britain) with dot-distribution map – Affinities (also with the Continent) – Floristic table (with degree of presence and abundance). A list of literature references of around 400 items closes this work, an effort which lays out the basic aspects of the vegetation in a most exemplary way, while offering a wealth of detailed information as well.

We congratulate our British colleagues, students, nature conservationists and floristically interested active amateurs on this foundation for the plant sociology of the British Isles!

O. Wilmanns

The Orchids of Suffolk: an Atlas and History. M. Sandford. Pp. 123. Suffolk Naturalists Society, Ipswich. 1991. Price £15 (ISBN 0–9508154–3–8).

Like its companion *The Butterflies of Suffolk* this is a well-produced, readable, well-illustrated and informative book. Its 123 pages cover the 32 species that have been recorded from the county, only twelve of which are now present in anything like reasonable numbers. The book also covers eight hybrids. But the book is much more than just species accounts, for there are also interesting chapters on ecology, variation, habitats, soil regions, conservation, the Suffolk Orchid Survey, and a fascinating contributed chapter by Francis Simpson on "Suffolk orchids – half a century of change" which gives us one man's historical perspective and brings out the joys of botanizing.

But it is the catalogue of species that most readers will use most and which occupied more than half the book. The accounts have detailed information on the discovery and subsequent fortunes of each species, along with ecological information, taxonomic problems, variations, as well as anecdotal snippets from older publications. The conservation status is discussed but, here and in the general chapter, the reader is faced more by a catalogue of woes rather than with ideas for the future. Even allowing for some of the more intractable problems, more could have been done to lay out the practical steps that could be taken to ensure that yet more local extinctions do not occur. Related to this, it would have served the local and wider botanical community well if a list of needed research had been included, perhaps with some idea of priority. How many more populations will disappear because we failed to understand what simple management actions were required to save them?

The reference list is complete, but the list of useful addresses is remarkable for its omission of the Nature Conservancy Council (now English Nature) and its regional offices.

It is certain that this book will encourage increased local interest in and concern for this fascinating group, and it is hoped that this will in future be reflected in improvements in their status.

A. J. Whitten & L. Farrell

Recovery; a proposed programme for Britain's protected species. A. J. Whitten. Nature Conservancy Council, C.S.D. Report, No. 1098. Peterborough. 1990.

The bulk of this work is a compilation of proposals for active conservation to ensure the continued survival in the wild in Britain of each of our endangered species, and it is a mine of information about these species. For each of the 217 or so species treated, information is given on their distribution, ecology, reasons for rarity and suggested management which could increase their frequency to such an extent that the species would no longer be endangered. Each account ends with costings for the parts of each proposal; site management, translocations, enforcement, research and the monitoring which will be required over the next 15 years. The total budget required to carry out all these proposals is around £800,000 over the 15 years, at 1991 prices.

In addition to the individual species accounts, the introductory 27 pages and a series of appendices (72 pages) discuss the rationale behind the proposals and arrange the species of each category (plants, bats, Lepidoptera, etc.) in order of degree of threat, recovery potential and the budget required. English, Welsh and Scottish plants are considered separately and separate lists are also given for each habitat.

It is interesting to see how little is known about most of our native rare plants (and the majority of our common ones as well), so I strongly support Dr Whitten's appeal for more autecological studies. For most species we don't even know whether they are usually self-compatible or self-incompatible and only rarely are the conditions required for seedling establishment known. Many species appear to require disturbance and therefore active management to provide the open habitats required for seedling establishment (e.g. *Stachys alpina*, *S. germanica*, *Teucrium botrys*, *Damasonium alisma*, etc.), such disturbances naturally having been provided by large mammals, perhaps especially wild boar, a species eliminated from Britain by Man.

Gardeners may not be as surprised as Dr Whitten that some species which grow poorly in the wild grow vigorously in cultivation when they are adequately watered and competition is removed (see comment under *Carex depauperata*). Relieved from competition, many species of poor competitive ability (e.g. *Equisetum arvense*, *Poa annua*) can thrive and grow all too well.

Through pointing out the gaps in our knowledge this book should stimulate many research projects in addition to the conservation work proposed. How many of the proposals will be implemented is rather uncertain in the present political and financial climate, but it is reassuring to note that, though species-centred, the significance of habitat conservation is stressed, 'honeypots' with many rarities and great species diversity being mentioned as of particular importance.

The positive approach proposed in this work may not appeal to those who prefer 'laisser-faire' conservation, but Man has already done so much damage that many habitats and populations will never recover without active intervention. We may think the situation bad in overcrowded Britain, but it is much worse elsewhere, especially in relic communities and islands (e.g. New Zealand, see *New Scientist*, 20th April 1991). While conserving Britain's habitats, fauna and flora we must never forget our responsibility as a rich country to the rest of the world and remember that if Britain were to be wiped off the face of the Earth very few clearly distinct species would become extinct and it would make very little difference to the biodiversity of the Earth. This book is a model for similar projects throughout the world and it clearly demonstrates the value in Britain of the specialist societies and County naturalists' trusts.

With many people having been involved in the compilation, errors are bound to have crept in. On page 280 the Natterjack Toad is referred to as a "lizard". *Arabis alpina* is described as annual, though all Floras and experience show it to be perennial, and there is no mention of the fact that *Cotoneaster integerrimus* is apomictic, a major consideration when deciding how it should be propagated as it grows in the presence of other *Cotoneaster* species and is difficult to root from cuttings. These, however, are very minor criticisms. It is perhaps a pity that bryophytes are not covered as some primarily western oceanic and montane species and habitats are probably of greater world significance than any of the British populations of vascular plant or animal species dealt with here. A follow-up work on bryophytes and lichens would be welcome, though recovery would depend almost wholly on habitat management, as we have not yet developed the knowledge and skills to cultivate them.

H. A. McAllister

Obituaries

JOHN ALFRED CODRINGTON
(1898—1991)

The varied aspects of that endearing character, Lt-Col. John Codrington, have been well set out in obituaries in *The Times* and *The Daily Telegraph* of 23 April, *The Independent* of 3 May, and *The Rutland Times*, supplemented by further notices in *The Times*. These cover his extraordinary career, but hardly mention his life-long absorption in plants.

He painted four remarkable sets of flowers, dated 1905, 1905, Spring 1906 and Summer 1906, 19 in all, when he was 6 and 7. In July 1908, aged 9, he was given a nicely bound copy of the Rev. C. A. Johns' *Flowers of the Field*, and he was growing alpines when still young. The interest never left him, and was kept up even during his 20 years with his father's regiment, the Coldstream Guards. In 1920, when quartered at Wimbledon, he noted *Potentilla norvegica*. He sent a long letter from Salzburg to the *Wild Flower Magazine* dated September 1922, recording several plants; and another from Constantinople in June 1923.

He wrote a beautifully clear set of "botanical maps and directions" for over 300 scarce and rare plants in England and Scotland, labelled "confidential", with an index. An O.S. map is noted for each and the grid reference. Most are dated 1953, but they extend from 1951 until 1969. Some dozen are marked "most secret", and as many "secret", but not all will still be valid, e.g. for *Agrostemma githago*. This set has been gifted to the Botany Library of the Natural History Museum, London.

He kept up his painting all his life, almost all of landscape or gardens, including garden designs – his first essay in design was a knot garden at Rockingham Castle in 1916, which still survives. The only later painting of a flower I have seen is of *Cypripedium calceolus* in 1957, which is with his directions for finding that species, and is frankly a poor depiction. In all, something between 2,000 and 4,000 of his paintings survive.

The Royal Horticultural Society awarded him its Veitch Memorial Medal in gold in 1989, "living proof that the finest gardeners never age" as the President put it. There is a good account of him in *The Garden* for November 1987.

I first met him soon after the last war, and we had kept in regular touch ever since, including on the tours of the International Dendrology Society, of which he was a faithful member. At both the houses he eventually lived in, in Pimlico and Rutland, he grew remarkable plants. The Ranelagh Cottage house reverts to the Grosvenor Estate, which will try to get a suitable tenant for the garden. What happens to Stone Cottage, at Hambleton, Rutland, is currently uncertain. Its garden he described in *The Englishman's Garden* of 1982, and in *The Garden* for November 1988.

He worked with Sir Alexander Korda for some years after the war (with Merle Oberon too) at London Films. On one occasion he noticed on a film set that the flowers were wrong for the time of year the action was taking place. Sir Alexander bet him that no-one would complain, and no-one did. Among the plants that interested him most and he distributed widely were *Bupleurum falcatum* from Essex stock, which seeded freely in his chalky garden, *Smyrnium perfoliatum*, Bowles' Golden Grass *Milium effusum* 'Aureum', and white-flowered Herb Robert (*Geranium robertianum*). He grew many native and naturalized plants in his "mad wild jungle" (as he put it) at Hambleton, *Sisymbrium strictissimum* doing particularly well; and there were others he had collected from exotic places. He took seed of a cypress from the Holy Land in 1922, two of the progeny being still in the churchyard at Oakham and others in that at Preston, nearby, all family territory.

His name will be found as having made contributions to publications such as *The Hand List of the Plants of the London Area* of 1951, *The Atlas of the British Flora* of 1962 and the *Flora of Essex* of 1974. He was the unquenchable enthusiast, pestering me to go and see how the London Rocket (*Sisymbrium irio*) was on Tower Hill (which he had seen during 1951–6 at least) until a year or so before he died.

Apart from the accounts already mentioned, I know of nothing that he put into print about plants, except occasional letters to *Country Life*. This is sad, because he had travelled the world endlessly and saw much, and had written a manuscript autobiography. I think that he did not consider himself a botanist, but was just a devoted, clubbable plantsman, with a wealth of stories. But what a plantsman!

D. McClintock

NORAH DAWSON
(1913—1991)

Norah Dawson, B.S.B.I. Recorder for County Armagh, died on 4 March 1991. A daughter of Armagh, the 'City of Saints and Scholars', Norah was one of the most modest and yet competent of amateur botanists. A history graduate of The Queen's University of Belfast, she trained as a librarian, and spent her working life in the employment of Armagh County Council, where she was for many years the County Librarian.

Norah's interest in botany developed through the Armagh Field Naturalists' Society, of which she became one of the founder members in 1952. At first, the Society was a small band of enthusiastic novices. Norah, because of difficulties with her sight, preferred to concentrate on plants, whereas birds absorbed most of the attention of other members. Perhaps rather unusually for her time, she had studied German rather than Latin at school, but nevertheless soon mastered the use of Latin names for plants.

With encouragement from the late Pat Kertland, Norah became interested in recording plant distribution during the years leading up to the publication of the B.S.B.I.'s *Atlas*. Later, during the 1960s, the Armagh Field Naturalists along with the Belfast Naturalists' Field Club began a project to record the Co. Armagh flora in 5-km squares, and Norah became the stalwart of this project.

On her retirement, she took on the honorary secretary's post in the Field Naturalists' Society, a role she carried out with singular efficiency and good humour for several years. As the Society's chairman and a near neighbour, I came to know Norah and her constant companion Burren well at this time. Burren, a red setter, was ironically not named after the botanists' Mecca in western Ireland, but after a little-known townland of that name in Co. Down. In fact, Burren became known under another name to my family rather earlier than Norah, on account of the memorable sight of him emerging from another neighbour's back door and careering across the unfenced back gardens of our recently built estate with a string of sausages hanging from his jaws. Burren was temporarily known as 'The Sausage Stealer'; quite unfairly as it turned out, as we later discovered that the neighbour in question was a butcher with a surplus of out-of-date sausages.

The early years of her retirement were the time when Norah was at her most botanically active, most days in summer being spent recording along the by-ways of the County, and also further afield in Ireland, both on her own or with the Irish Biogeographical Society. As befitted a professional librarian, her plant records were kept in a magnificent state of order, and she also kept meticulous notes on butterflies in Co. Armagh. Her role as a B.S.B.I. Recorder was largely one of collating her own records, the county at that time being sparsely populated by resident botanists and seldom visited by outside ones.

A modest and unassuming person, Norah could always be relied on to do anything she undertook in a thorough and reliable way. She always felt that a little more work was needed before the records for her county would be in a fit state for publication. It was a great shame, therefore, that health problems led to premature decline in her recording activities and, as the major contributor to the stock of botanical records in Co. Armagh, that she did not live to see them through to publication in a County Flora.

J. S. Faulkner

JOHN GEORGE DONY
(1899—1991)

John Dony M.B.E., B.Sc., Ph.D., Hon. F.L.S., who died in Luton on 24 March 1991, was one of the best-known British field botanists of this century. He was essentially interested in the distribution, ecology and features which were susceptible to statistical analysis rather than the systematics of plants. His *Flora of Bedfordshire* was widely recognized as a model of how such things should be done and truly, as the late Sir E. J. Salisbury said, "takes a worthy place amongst its predecessors and contemporaries", and so does its author amongst his. His efforts for conservation in the county in which he was born and died were sustained and successful, resulting in a well-merited M.B.E. in 1983.

John was born in Luton on 8 August 1899 in Court Road by the parish church in a road of typical mid-Victorian terraced houses, now totally destroyed. A great fondness for the church, indeed a magnificent building, remained with John throughout his life, although he had no time for religious doctrine. His father, an engineer, was a well-known Sunday School teacher and a very active member of the Chase Street Mission, Luton from 1901 until its closure in the early 1940s. His great-grandfather was a Cornish tin miner who changed the name from Doney. His mother's family were local and mainly connected with the hat industry. His grandfather was a founder member of the Luton Industrial Co-operative Society in 1883, and John himself was an ardent Fabian. His education at Surrey Street School, like that of so many of his contemporaries, was restricted to elementary school (but from what I know of its products it must have been immeasurably superior to that of the present day). In 1913 he became an apprentice at Hayward Tyler, an engineering firm renowned for their hydraulic pumps, where he worked on the bench. He stayed in the firm until 1920, his service there broken by World War I, when he joined the Royal Navy Volunteer Reserve from June to December 1918, although he did not see active service. From 1920 to 1922 John worked as a draughtsman in London and Cardiff but then after matriculating at London University in 1922 became an uncertificated school teacher. His working in Cardiff probably explains his support of Glamorgan County Cricket Club. A suggestion that his first teaching post was in Cardiff appears to be inaccurate as there is no other mention of this, and his first school post was at Norton Road School, Leagrave. He obtained an Acting Teachers' Certificate in 1924, the last time a teacher could become qualified without going to college. He moved to Queen's Square School from 1925 until 1931, then to a school in Kentish Town for nine years. Although he had attended W.E.A. evening classes in engineering, mathematics and Spanish years before, his attempts to better his lot now started in earnest. He attended the University Extension Class, 1931–32, in Economics at Toynbee Hall with W. Milne-Bailey as tutor, for whom he wrote a long essay on the hat industry which was shown to J. J. Mallon, the Warden of Toynbee Hall, and Barbara (later Baroness) Wootton, both of whom encouraged him to continue. He enrolled as a student of the London School of Economics, working in the evenings until he gained his B.Sc. in 1936. He had married another teacher in the 1920s but this marriage was dissolved in 1931.

The beginnings of the straw hat industry in Luton go back to visits by James I, whose mother Mary, Queen of Scots had brought over to Scotland some Lorraine straw-plaiters – or so the story used to go. Actually the industry may have had more local origins. However it started, it eventually dominated the town, which became a main centre in Europe for the trade. The extent of its importance is now inconceivable to a generation most of whom do not even own a hat. My own paternal grandfather, a Belgian hatter, came to Luton in the 1890s when it was the Mecca for hat-workers of all sorts. John had decided to work on and obtain a doctorate and the hat industry was an obvious choice of subject for a Lutonian and he gained a Ph.D. in 1941 for his thesis on its history and economics. To tell the truth he used modern pressurised interrogation techniques on the surviving hat firms of the day by bombarding them with innumerable queries and wanting to see their records. From his thesis he produced a book, *A history of the straw hat industry* (1942), which became accepted as the standard, if not the only, work on the subject. The industry rapidly declined until it became a fragment of the town's economy but John's desire to investigate this was never accomplished. His teaching career blossomed and after a short spell at the North Western Polytechnic, he became in 1941 History and Economics Master at Luton Modern (later Grammar) School and remained there until his retirement in 1964. There he was much loved and universally known by the nickname 'Doc'.

It is always rather difficult to pin down accurately the start of an interest, but John as a schoolboy belonged to The Band of Hope, a society for promoting temperance principles among the young (although John was not averse in later life to a modest drink in convivial company). This worthy body gave a series of books as prizes for an essay on "The evils of strong drink" and John, a winner, chose *The Works of Shakespeare* and J. Saunders' *Field Flowers of Bedfordshire*, the latter an austere work scarcely likely to inspire a youngster. When he was 15 he made a collection of insects and plants and received a commendation for the flowers. It is likely that Frederick Mander, (later Sir Frederick, General Secretary and President of the N.U.T. and Chairman of Bedfordshire County Council), keen on orchids and a teacher at Surrey Street School, encouraged him most of all to let his innate interest in natural history develop. Mander's name appears several times in the Orchidaceae in John's Flora. John's early interest in botany relaxed during the time he was obtaining qualifications but was rekindled in 1935 and developed considerably during the War years. Once he had resolved to write a new Flora of his county, a group of like-minded friends (particularly Horace Souster, perhaps his most constant companion) gathered together and an immense amount of field work was undertaken. How far this had advanced was evident from a very successful exhibition entitled "Wild Flowers in Bedfordshire" which was mounted at the Luton Museum some years before the Flora was published. The covering booklet for this was of course written by John and for many Lutonians it was the first intimation of the project. This sustained labour by John and many helpers culminated in his *Flora of Bedfordshire* in 1953, without doubt his finest work. This was a subscriber publication and was produced for the very modest sum of "42s nett". I was already an old Africa hand by then and received my copy in Nairobi together with a letter from John dated Christmas Day, 1953 (he wrote in a small but very legible hand which achieved maximum information per square inch of paper). Almost unbelievably the 1000 copies cost only £1271 to produce and an expected deficit of £600 was soon turned into a small profit. John was extremely sensitive about the reception of this work and he awaited comments eagerly. I think that they were without exception extremely favourable, as indeed they should have been – John had a natural bent for accuracy and his publications were accordingly much more polished than those of many a professional scientist. The 20 pages of historical introduction to Bedfordshire botany make fascinating reading, combining as they do John's twin interests of botany and local history. The geographical index is a feature I still constantly use. Today this 42 shilling book usually fetches about £18–25, which seems rather low bearing in mind inflation. It was reissued in 1978 in a much less pleasing format. John then moved on to writing the *Flora of Hertfordshire*, which was published in 1967 by the Hitchin Urban District Council, again with an introduction by Sir E. J. Salisbury. Although only 14 years later than the Bedfordshire Flora, the changes in book production gave it an altogether different look. There was also the novelty of 47 pages of tetrad dot maps. These two Floras show to a remarkable degree John's capability of marshalling an enormous amount of varied information and presenting it in an orderly form; this was perhaps his dominant characteristic; it is of course a prerequisite of a good historian.

John developed a deep interest in conservation but was not unreasonable. He recognized that progress, whatever we might individually think about it, was inevitable and did not make foolish demands. His well-reasoned pleas produced more success as a result. Perhaps all this was started as a result of a disgraceful act he witnessed as a youngster – the demise of Grass of Parnassus (*Parnassia palustris*) in Bedfordshire. The last population was uprooted in his presence by an amateur botanist who proudly gloated: "That is the last time anyone will find that here!". John mentions this in his *Flora of Bedfordshire* but did not hint that he witnessed it. Perhaps it is as well that I have forgotten the name of the perpetrator. The designation of Knocking Hoe, Pegsdon as a National Nature Reserve in 1958 was a major success for John.

Like many on the political Left, he seemed to actively enjoy being on committees and helping to found new societies; he did valuable work for a surprising number of them. Early on, his political affiliations developed (he had long warned of the dangers of fascism) and he became a local secretary of the Left Wing Book Club and a founder member of the Luton Branch of the Fabian Society. He became its chairman when it re-formed in 1967 after ten years of lack of public interest. He was Honorary Keeper of Botany at Luton Museum from 1935 until 1988 during which time he built up an admirable local herbarium and library; from 1955 he undertook the same duties at Hitchin Museum. Already a Member of the Wild Flower Society, he joined the Botanical Society of the British Isles (then the Botanical Exchange Club) in 1937 and after 1947 held office continually as, successively, a Council Member, its Honorary Field Secretary (later renamed Honorary Meetings Secretary) (1949–56), Honorary General Secretary (1956–64), a Vice-President (1965–66) and finally President in 1967–69. After this he was made an Honorary Member. He helped found the Bedfordshire and Huntingdonshire Naturalists' Trust in 1961 and was also a founder member in 1962 of the Hertfordshire and Middlesex Trust. He was almost a founder member of the Bedfordshire Natural History Society but missed the first meeting (I fear I used to gloat over this); he was, however, intimately associated with it for over 40 years and served as President in the early 1960s. He also served as President of the Hertfordshire Natural History Society and of the South Bedfordshire Association of National Trust Members. In 1954 he was elected a Fellow (Honoris Causa) of the Linnean Society of London. Other posts which he held were Chairman of the South Bedfordshire Preservation Society (which he helped form in 1948) and the presidency of the Luton Workers' Educational Association which he took over from Lord Hill ('The Radio Doctor') in 1977 and retained for ten years. Towards the end of the 1980s John relinquished his various duties and one of his last acts was to grace the opening of the John Dony Field Centre by the Mayor of Luton in October 1990.

He was extremely interested in alien plants, particularly those resulting from the use of wool shoddy; a remarkable number grew in Bedfordshire and in some places such as Flitwick railway sidings one could be forgiven for thinking one was in Australia rather than Britain.

Anxious that every record should be as accurate as possible, he gradually got to know all the botanists of his day, particularly the specialists on tricky groups. Many of them accompanied him on field trips. Whilst Edgar Milne-Redhead was stationed at Dunstable during World War II, a great friendship sprang up between them and they travelled by bicycle and train over much of the county collecting records. A particular friend was V. H. Chambers who died in 1984. He had begun a herbarium when only twelve years old and continued to list his records until 1931. Later he specialized in the Hymenoptera and became a recognized authority on certain groups. He collaborated with John and was in fact the stimulus which persuaded John to undertake the arduous task of writing a proper Flora. Vic had a car early on and they undertook numerous joint expeditions; Vic shared with me the almost total inability to ride a bicycle. Many young botanists owe much to John's encouragement. Peter Taylor and I were both protegés during the war and we both decided eventually to become professional botanists. Peter was very neat and tidy (like John) and did very much more to help John with recording and indeed wrote the Section on the Hepaticae in the *Flora of Bedfordshire*. I already had many zoological interests which interfered with botanical recording. My father viewed my interest in botany with dismay, particularly as I had a degree in physics, and was certain I would never get a job as a biologist (they were rare in those days) and it was John who showed it was a possibility, and in fact made it a respectable option. Without his help and introductions to other people, probably neither Peter nor I would have ended up at Kew. One of my main memories of him during the war years was the speed with which he walked despite his short stature – like a galleon in full sail bent into the wind – and this continued well into later life. In those early days transport was scarce and we had no car – a large part of most expeditions was done on foot which of course helped us to find more.

John got on well with others, whether peasants or aristocrats. During the gathering of records for the *Flora* he needed to examine the flora of many private and government properties. This was usually arranged in advance, nearly always without difficulty, but occasionally had to be done off the cuff, so to speak. He had a formula for this: when the door opened he would say "We are botanists" in much the same way as one might announce that one was the Governor of the Bank of England! Nearly always this resulted in permission being given – only occasionally was the reply the equivalent of 'get lost'! John had a quite authoritarian air about him which somewhat overawed the opposition.

A group of us often ended up in a pub (as often as not the *Speed the Plough* just north of Barton and actually mentioned by name on sheet 95 of the old one inch map) on our way back from a meeting in Bedford for a modest drink. He ate very frugally, often only an apple for lunch during a field trip; which fruit he was proud of being able to split into two pieces by a deft twist of the hand.

Although as a schoolboy he disdained history, a W.E.A. evening course on economic history he attended in 1917–18 kindled a strong interest – so much so that history ultimately became his bread and butter. He became particularly fascinated by local history, about which he gained an encyclopaedic knowledge. It is an interesting coincidence that the road of his birth long ago formed part of the estates of Sir John Rotherham, one of the oldest parts of Luton. He was part author of *The Story of Luton* (1964) (reprinted 1966 and 1975) and wrote many other historical papers besides. John's total output of articles was quite considerable, many being in the *Bedfordshire Magazine* and *The Bedfordshire Naturalist*, also *Watsonia* and its predecessors. He was an excellent writer of obituaries.

In 1971 he joined the élite band of amateur naturalists to have received the Bloomer Award of the Linnean Society (H. H. Bloomer, 1866–1960, was himself an amateur who mainly studied bivalve molluscs). John married for a second time in 1962, Christina Mayne Goodman, a keen Birmingham botanist and former England hockey international, who proved the perfect companion. Most of John's work after this date was in the nature of a joint effort. He is survived by her and a son by his previous marriage. Undoubtedly the secret of John's success was hard work and determination coupled with enthusiasm and orderly methods, all in fact attributes of the Victorians, one of whom he could just claim to be. He could certainly have been a successful politician and probably a business man but he chose to become a schoolmaster don who will long be remembered for his attainments.

PUBLICATIONS OF J. G. DONY*

MAJOR WORKS

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*Compiled mainly from a list produced by himself. It excludes detailed elaboration of recorder's reports. Some very short notes, exhibition reports, etc. are also omitted.

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1976 *Bedfordshire Plant Atlas*. Luton.
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? *The classification and assessment of mires in Bedfordshire*. British Ecological Society.

*There appear to be two separate items involved. I have a copy of a white undated 16-page pamphlet with a photograph of *Alisma* on the front cover; C. Boon has a green pamphlet dated 1948 with a similar photograph but with 20 pages.

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B. VERDCOURT

JOHN DONY, HISTORIAN AND TEACHER

John Dony was a most remarkable man with limitless interests and boundless energy. He was a true self-made man – he left school at 14, completed an engineering apprenticeship, and then, without any full-time attention to study, qualified as a teacher, earned a respectable degree in Economics, and then secured a Doctorate. The record does not end there for, and this is well documented in the bibliography above, there is a prodigious list of publications devoted to his two academic loves of Botany and History.

Although he was a prolific historian, I would think that his national reputation is greater in Botany and that may be because much of his historical work focusses on Luton. However, even a parochial interest must not be dismissed for what he produced is of considerable value and not just to local people.

John was best known for his work on the Straw Hat industry (the subject of his Ph.D. thesis) which was originally inspired more by the issues of labour relations than by the product itself. This work grew out of an essay on trade unions and the hat industry first composed in 1931 for his Economics tutor. Much encouraged by J. J. Mallon and Barbara Wootton, the subject was later to be enlarged and developed into his doctoral thesis. John had no direct connection with the hat industry but, as it was an important and lively economic activity in Luton, it offered a ready and accessible research topic.

In concert with two others (Dyer and Stygall) he produced the definitive local history under the title *The Story of Luton*. As a schoolboy it is known that he had little taste for history but his enthusiasm was kindled by a W.E.A. class and he took to the subject with a passion, and it was that very passion that made him an effective and entertaining teacher, for he made history challenging, alive, and, importantly, relevant.

John was very much a son of Luton and he came from a well-known local family which lived almost in the centre of the town. John's grandfather supported the Co-operative cause and was a founder-member of the Luton Industrial Co-operative Society. John's share number, which he inherited via an uncle, was 2. He was thus 'related' to the development of what was once a significant social movement.

We were fortunate at Luton Grammar School to have been taught by scholars, but most were drawn from relatively comfortable middle class backgrounds. John was not of that mould. Although he was a success, he had had to struggle to be so. He was his own man and he brought to his many activities a very marked sense of reality doubtless drawn from his experiences. For a man otherwise destined for the machine-shop John won his place in the pantheon of great teachers. He was a man who bore his achievements modestly and without display; he gave much of himself and was always a ready friend and counsellor. His like is rare enough and it is an honour to be one of his 'old Boys'.

M. Butcher

JOHN DONY AT THE LUTON MUSEUM

When I started work at Luton Museum as assistant to the curator in 1938 we were the only full-time curatorial staff, but we had an Hon. Keeper of Botany, John Dony. On Saturday mornings and in the school holidays he darted about the museum, working on the herbarium with a great sense of purpose. He remained Hon. Keeper of Botany for the next 50 years. No museum can have had more valuable and devoted service than he gave to Luton. He appeared only at these times because he was teaching in Kentish Town and also working for a Ph.D. in Economics, having taken his first degree two years before, by evening study after a full day's teaching. He gained his doctorate for his thesis on the straw hat industry in 1941. In the same year he took a post at Luton Grammar School, teaching history and economics, and remained there until he retired, as Head of History, in 1964.

He was born, brought up and educated in Luton; worked in his teens as an apprentice engineer there until 1920; and began his teaching career, first in Luton and then in Kentish Town (but still living in Luton). His chosen study, the straw hat industry, was not just a subject for a thesis. He had grown up in a town which had been shaped by this industry, which took from it its urban pattern, its social nuances. It was the social and economic complexities of the industry which fascinated him. His studies in local history and politics were never those of an academic specialist, but, as in his botanical work, were 'habitat studies'.

His historical writings are mostly about Luton: *A History of the Straw Hat Industry* (1942); *The Story of Luton* (1964); *A History of Education in Luton* (1970), enriched by his own experience as pupil and teacher there in the early years of this century; and *The 1919 Peace Riots in Luton* (1978), in a volume presented to another Bedfordshire historian, Joyce Godber. Again he wrote from first hand knowledge, a mildly participating witness of this tragi-comedy of local politics, in an essay which shows how well he understood the character of the town he had lived in, worked in and served all his life.

A. Buck

JOHN DONY AND THE B.S.B.I.

John Dony's influence on the Society's development was second only to that of Ted Lousley in the early post-War years. Throughout those two formative decades, the 1950s and 1960s, he was continually in office: initially as the first-ever Field Secretary; in due course, for eight years, as General Secretary; and ultimately as the third amateur to fill the Presidential chair in the new post-War amateur/professional alternation. While, unlike Lousley, his involvement in the Society's affairs never extended to administering its finances and he was content to leave the publications side of its activities to others, the nine years he devoted to organizing and overseeing its annual meetings programme – a much more onerous responsibility than is generally appreciated – proved an excellent preparation for running the Society as a whole, so that when Lousley stepped down as General Secretary in 1956 no succession to that office can ever have seemed so natural and appropriate.

Though very different personalities, the two of them worked together in harmony, united by a common commitment to efficiency and shared battle scars from the endless in-fighting that had characterized the régime that preceded theirs. John in particular never forgot or forgave, to the end of his days, the airy casualness with which the supposed joint organizer had left him to cope alone, almost at the last minute, with the arrangements for the all-important 1950 Conference at which the *Atlas of the British Flora* had its original, carefully stage-managed conception. Nothing of the kind ever happened again once the Society's meetings programme was entrusted to his hands alone. In a very short time, indeed, the atmosphere was transformed: the conflicts and cantankerousness for which some of the first post-War field meetings were notorious at once became a thing of the past, as John brought to these occasions his chuckling sociability, his supreme meticulousness and his unending tact. They were qualities from which the Society was to benefit more generally in his subsequent spell as General Secretary and which rendered the team who served with him in those years a memorably happy and smoothly-functioning one.

The meticulousness which he brought to the Society's administration was the hallmark of his personal botanical work too. Delighting in precision, with that tiny, figure-like handwriting characteristic of the mathematically inclined, he loved nothing more than working carefully-delimited areas with steadily increasing intensiveness. Deeply rooted in his home town of Luton and surrounding countryside, he had the compiling of local Floras as his manifest botanical destiny. And not just their compiling: his training in economics additionally gave him a taste for just those aspects from which local Flora-writers typically tend to shrink, and he would spare no trouble in working out costings and gauging market potential, matters on which he became the acknowledged national expert and was ever-pleased to be asked for advice by fellow authors. It irked him greatly that the handsome profit that the first of his Floras had unexpectedly made all went into the coffers of its local government sponsor, yielding him no personal benefit financially in return for all the effort he had put in, not least in earlier raising the money that had made publication feasible; and he was determined ever afterwards to assume the risk of publication himself, convinced by that first experience that works of this type were sound commercial propositions provided the production and marketing received the careful attention they deserved. Not everyone felt able to share his optimism on that score, which assumed an input of time and labour which few if any others were likely to be prepared to contemplate (it extended, for example, to acting as your own publisher's representative and hawking copies in person to every bookshop in the county); but he was a lasting force for good in making Flora-writers think more carefully and constructively about the stages that must come after the accumulating of the records. The series of habitat studies which formed a major and novel feature of the first of his Floras has had many copiers, while his switch from the traditional octavo format to a quarto one for the succeeding *Flora of Hertfordshire*, to accommodate the printing of the systematic list in double columns, which he perceived as dictated by cost-cutting logic, was so much admired by K. G. Messenger that he modelled his *Flora of Rutland* exactly upon it.

Above all, John was identified with tetrad-mapping. If not quite the first to employ this method (E. S. Edees anticipated him by just one year), he was certainly to the fore in exploiting it and in promoting its adoption generally. The work that he undertook in this direction for his Hertfordshire and Bedfordshire plant atlases so fascinated him that he even talked for a time of going to live in Co. Carlow on his retirement and submitting that underexplored, similarly-sized county to the same exhaustive treatment. If that was to remain but a pipe-dream, it was happily a different story with his gradually-developing wish to research more deeply into the classically Watsonian question of the number of plant species to be expected in an average stretch of ground – the subject of an impressive paper that he contributed to *Watsonia* in 1963, in which his early statistical training came into its own. A grant secured from the Natural Environment Research Council (a signal achievement in itself) not only made that possible, but also largely allayed the financial anxieties that had began to prey upon him as his time to retire approached.

Captivated by grid-square mapping and cursed with a home territory in which the administrative boundaries had been subject to numerous and substantial changes, John became a dedicated opponent of the long-standing vice-county system, repeatedly drawing attention to its drawbacks at conferences and in informal discussion. Eventually he took the opportunity of his Presidential Address in 1968 to advocate its wholesale abandonment and the adoption of 50–kilometre squares as the Society's unit for recording in its stead. No one could have put the case better, and he was undoubtedly more disappointed than he ever let on that his arguments failed to win enough converts to bring about that change.

It was probably the only major disappointment in a notably productive botanical life, in which he raised to a new high level of achievement the long and proud tradition in these islands of producing local Floras. It is as a local Flora-writer that he would surely wish to be remembered above all and the capacity in which his contributions are most obvious and likely to prove most enduring. But the B.S.B.I. more generally has cause to mourn the passing of a man who left his own very special mark on it, in the course of the many years in which he served it with singular selflessness, endearing himself to all of us who had the good fortune to know him.

D. E. Allen

MARY PATRICIA HAPPER KERTLAND
(1902—1991)

Miss Pat Kertland had an enlightened upbringing and education which was Edwardian in the best sense. In her youth she travelled widely, including a trip to the Far East, went up to her local university and earned a higher degree. Her M.Sc. thesis, entitled "The ecology of Divis", was written while she was Hugh Wisnom Scholar at the University and formed the basis of a major paper in *J. Ecol.* **16**: 301–322 (1928).

She was blessed with the ability to use 'family money' without ostentation and was able to live much of her life in the way she wished, without the absolute requirement to hold the highest possible salaried post, though by training and intellect she would have had little difficulty in securing a senior position in any University.

She worked in the Botany Department of The Queen's University of Belfast, in which she had been a student, from 1929 to 1937 as Honorary Herbarium Assistant, as Demonstrator in Botany from 1937 to 1945 and as Curator of the Herbarium from 1945 to 1967. Within these few lines is encompassed a vast amount of work both personal and in the inspiration of generations of students, for although the Department was never large, it produced a number of outstanding botanists over the years on all of whom she had an influence; B. E. S. Gunning, M. Morrison and J. S. Pate immediately coming to mind. She was a colleague of Professor James Small and his successors Jack Heslop-Harrison and Eric Simon. The Herbarium collection was greatly enhanced and completely reorganized during her Curatorship. Her last great task was to oversee its transfer to the Ulster Museum (**BEL**) in the spring of 1968, though, technically, she had retired in the autumn of 1967. Her taxonomic work was meticulous and through it she got to know a large group of experts across the world.

From 1951, she was formally involved with the *Irish Naturalists' Journal*; at first as Assistant Editor with A. W. Stelfox for two years, then as Editor until 1976, when Mrs Elizabeth Platts succeeded her. After her retirement she continued to give both of her time and material resources and remained on the management committee until her death. A short appreciation of her period as Editor appeared in *Ir. Nat. J.* **19**: 1–2 (1977) and, with it, a reproduction of the pencil portrait created in 1973 by Raymond Piper which shows her in repose.

Through the Belfast Naturalists' Field Club she reached a wide audience as excursion leader and lecturer. Through the B.S.B.I. she became known to a wide spectrum of botanists and was unfailing in her assistance to members, at least to those of whom she approved, in the discovery, or rediscovery, of rare species across Ireland.

The *Irish Naturalists' Journal* fitted well into Pat Kertland's persona: it gave her the opportunity to do good by stealth. As Editor she encouraged the amateur naturalist in every way possible, often taking the barest bones of a scientific note and converting it to an acceptable technical standard. One recent project dear to her heart was the creation and publication of the *Flora of Lough Neagh* by John Harron (1986). This book, dedicated to her, reflects the encouragement of others and the drive which epitomised her life. She recognized the value of the data, and associated record specimens, which the author was collecting and, over a long period, catalysed a team to help him convert this raw material into the finished product.

I was privileged to be one of Pat Kertland's students in the early 1950s at a time when she took on extra duties after Dr Mary Lynn's early retirement due to unstable health (though happily she is still with us today). I can vouch for her ability as a lecturer, though, on field trips, her propensity to take both hands off the steering wheel to point out features of interest was disconcerting, to say the least.

In recent years ill-health struck cruelly; firstly increasing deafness and then sudden total blindness. This did not break her spirit: she moved to a nursing home, organized readers and continued to make her distinctive contribution to life.

I can do no better than end with a quotation from the Address by the Rev. Dr David Lapsley given at her funeral in late February 1991: "Most of all she is held in deep respect and affection because of her interest in people. She was a source of encouragement to others, this honest woman, with a manner that could be formidable and brusque. She appeared not to suffer fools gladly, but her words and deeds were constantly flavoured by kindness and generosity."

W. D. Linton

EVAN ROBERTS
(1906—1991)

When Evan Roberts died on 15 May 1991, at the age of 84, Wales lost one of her most outstanding field botanists of this century, a man whose special interest was the distribution and ecology of the arctic-alpine plants of Snowdonia and who became the acknowledged authority on them.

He was born in Capel Curig, the little village in which he was to spend the whole of his life. Even when he married, he went to live only a mile away, and following the death of his wife, Mabel, in 1969, moved back to the house where he was born, to spend his latter years with one of his sons.

On leaving the village school at 14, he found employment at the local slate quarry and worked there almost continuously until it closed in 1953. The work was hard, often dangerous, and poorly paid. It was these circumstances which eventually drove Evan on to the course which was to give his life a new dimension and himself so much pleasure and satisfaction. For, having married when he was 23, the increasing needs of his young family forced him to give up his treasured motor-cycle and consequently spend more time on the hills around Capel Curig.

As he was fond of recalling, one Saturday afternoon during this period proved particularly fateful. He took the path up Moel Siabod, the hill immediately behind his home, and, just before reaching the summit, came across a plant with beautiful purple flowers which he had never seen before. It was only after several inquiries that he found its name: the plant which had captured his imagination was *Saxifraga oppositifolia*. For him it proved to be the key to a new world and from then on Evan spent much of his spare time searching for it on other hills around Capel Curig. He got hold of a copy of J. E. Griffith's *Flora of Anglesey and Carnarvonshire* and thereafter searched for other arctic-alpine plants such as *Lloydia serotina*, *Polygonum viviparum* and many others.

A chance meeting with E. Price Evans, the notable ecologist, gained Evan a friend who had considerable influence on him. For Price Evans urged him to keep a full list of all the plants he found, with details of their locality, altitude, aspect and the nature of the local rock. Thus began the most thorough and systematic account ever made of Snowdonia's arctic-alpine plants and all that grew with them. Years of careful and laborious work went into the survey, so that at its completion the plant life of this area was better known than it had ever been before. Rare plants thought to be extinct were rediscovered; others were found in new localities where they were formerly unknown, such as, for instance, his discovery of *Dryas octopetala* on the remote cliffs of Creigiau Gleision, 8 km from its previously known site above Cwm Idwal. When he took Price Evans there to see it some time later, they found *Carex capillaris* near by, a new record for Wales and an interesting addition to the mountain flora of Snowdonia. Happily, both plants still survive in this remote spot, where they may be seen together with *Saxifraga oppositifolia*, *Polystichum lonchitis* and many other species found here by Evan.

In addition to his dedication and enthusiasm (and in spite of a defect in one eye) Evan was well qualified for the work he undertook – he was hardy and a skilful climber. During World War II he assisted in training Commando units in the techniques of rock-climbing. It was therefore no surprise that when the Nature Conservancy acquired Cwm Idwal as its first National Nature Reserve in Wales, in 1954, Evan was appointed to be its Warden. He was later promoted to be the Chief Warden in North Wales, a position he held until his retirement.

In this new post his unfailing good nature, unruffled manner and natural courtesy, especially when dealing with those who sometimes transgressed the code of conservation in the Reserves, made him universally respected. His generosity and readiness to share his knowledge of the mountains and their flora with all who sought his help, made him many friends over the years. His services were in great demand to lead parties of students and others around the Reserves and, indeed, anywhere in Snowdonia. The illustrated lectures he gave during the winter months (both in his native Welsh and in English) became very popular and did much to further an understanding of the conservation movement among the general public in North Wales.

Evan's concern for conservation was apparent long before he joined the staff of the Nature Conservancy. I recall his deep disappointment when a small bog near Capel Curig, in which, in 1946, he had found *Hammarbya paludosa*, was destroyed by forestry operations a few years later, in spite of his appeal for its preservation. But I have happy memories, too, of many botanical excursions with him on fine summer days to Cwm Glas and Clogwyn y Garnedd, where he could show me most of the rare plants as unerringly as if they were in his own back garden; and of one occasion when he took me to a rock crevice high up on Snowdon to see the very rare *Woodsia alpina*. To be with him for a day on the mountains was an inspiration, for he knew Snowdonia, its cliffs and crags, gullies and ledges like the palm of his hand.

Although he published very little, his detailed records were made available to the Nature Conservancy. Copies of them have also been deposited in the Library of the National Museum of Wales in Cardiff.

The value of his work on the mountain flora of Snowdonia was recognized by the University of Wales, in 1956, when it awarded him the richly deserved honorary degree of M.Sc. He was later to receive the M.B.E. for his services to conservation over a long period, often beyond the call of his official duties. He was, indeed, a remarkable man and his loss is irreplaceable. He will be remembered with affection and gratitude by those who knew him.

We extend our deep sympathy to his three sons and their families in their bereavement.

R. H. Roberts

Report

ANNUAL GENERAL MEETING, 4 MAY 1991

The Annual General Meeting of the Society was held at the Merseyside Maritime Museum, Liverpool, at the invitation of the National Museums and Galleries on Merseyside, at 11.15. 95 members were present and Mr J. Ounsted, Vice-President, took the Chair.

Apologies for absence were read and Minutes of the 1990 Annual General Meeting, as published in *Watsonia* **18**: 331–332 (1991), were approved and signed by the Chairman.

REPORT OF COUNCIL

The adoption of this report, which had been circulated to members, was proposed from the Chair, seconded by Dr E. C. Nelson and accepted nem con.

TREASURER'S REPORT AND ACCOUNTS

The Hon. Treasurer, proposing the adoption of his Report and Accounts, offered to explain any points. Dr T. C. G. Rich asked for clarification of the terms of covenant of subscriptions. Mr Walpole replied that the covenants must be for a minimum of four years. The adoption of the Report was seconded by Mr R. G. Ellis and Dr P. Macpherson, who coupled this with a vote of thanks to the Treasurer. This was carried unanimously with applause.

SUBSCRIPTION INCREASES FROM JANUARY 1992

Following the general rise in costs, particularly of postage, Council had proposed the following rates from 1992:

Ordinary	£12.50 to £15.00
Family	£1.00 to £2.00
Junior	£5.00 to £6.00
Senior	£7.50 to £9.00
Institutional	£12.50 to £15.00

The Hon. General Secretary noted that there had been no increase in subscriptions since 1986. Mrs M. Lindop, relaying a query from a member unable to be present, asked for clarification of the Senior rate. The Hon. General Secretary read the definition as in B.S.B.I. Rule 24: "Persons over 60 who have been members of the Society for at least 10 years and who are no longer in full time employment may elect to pay an annual reduced subscription at such rate as from time to time shall be decided by Council". It was agreed to republish this rule in *B.S.B.I. News* for the information of members. The adoption of the new rates was proposed by the Hon. Treasurer, seconded by Mrs A. Lee, and carried with none against.

ELECTION OF PRESIDENT

The election of Dr P. Macpherson F.R.C.P., F.R.C.R., F.L.S., as nominated by Council, was proposed from the Chair and carried unanimously with acclamation. Dr Macpherson was then welcomed and took the Chair. Thanking Mr Ounsted, he also thanked members for his election, saying that this leap to President had in no way been anticipated, but that he was humbly and deeply appreciative. The President then called on Dr J. R. Akeroyd to thank the retiring President, Professor D. A. Webb Sc.D., F.M.L.S., who was unfortunately unable to be present at the meeting.

Dr Akeroyd, recalling that he and Professor Webb had shared the same biology teacher at Charterhouse, the late Percy 'Cheese' Chapman, reminded us that Professor Webb was first a marine biologist, whose research over the years had ranged from the blood pigments of sea-squirts to *Saxifraga*. Professor Webb, who had been one of the driving forces of *Flora Europaea* and had dominated Irish botany since the death of Praeger, had been an active President of this Society, frequently making the long journey to attend meetings and supporting all the B.S.B.I. activities during his term of office. He thanked Professor Webb on behalf of the Society and this was acclaimed with applause.

ELECTION OF VICE-PRESIDENTS

The election of Mr P. S. Green, Dr G. Halliday and Mr A. C. Jermy, as nominated by Council, was proposed by Dr R. J. Pankhurst, seconded by Mr R. M. Burton and carried unanimously.

RE-ELECTION OF HON. GENERAL SECRETARY AND HON. TREASURER

Proposing the re-election of Mrs M. Briggs, the President recalled that, when invited to accept nomination for President, he had asked if a medical certificate ensuring the good health of the Hon. Secretary was available. He particularly thanked the Hon. Secretary for the Annual Report of Council and this year for the first of a new series of the *Year Book* which had been widely acclaimed by members. Proposing the re-election of Mr Walpole, the President adding to his earlier vote of thanks, referred to the considerable workload of the Treasurer for the Society. The elections were formally seconded by Mrs A. Lee and Mr R. G. Ellis and carried unanimously with applause.

ELECTION OF COUNCIL MEMBERS

In accordance with Rule 10, nominations had been received for Dr J. R. Akeroyd, Mr J. M. Montgomery and Dr T. C. G. Rich. Their election was proposed by Mr R. G. Ellis, seconded by Dr R. J. Pankhurst and passed unanimously.

MINOR AMENDMENTS OF THE RULES OF THE SOCIETY

Some changes in the wording of eight of the Society's Rules, to incorporate changes of Rules approved by Annual General Meetings since 1968, and to consolidate the wording, had been discussed and approved by Council. Copies of the amended Rules were available at the meeting, and had been offered to members by post beforehand on request. The amendments were accepted without comment.

ELECTION OF HONORARY MEMBERS

Mr R. G. Ellis, proposing Mr M. Walpole F.C.A., F.L.S., spoke of him as a keen supporter of conservation and active member of his local Wildlife Trust, and as a botanical book collector with the finest private collection in this country. For the Society Mr Walpole was a decisive Chairman of the Publications Committee, and, most significantly, as Hon. Treasurer he has efficiently handled B.S.B.I. finances for 20 years.

Proposing Mr A. O. Chater, Mr Walpole noted that some societies awarded medals to individual members as a token of appreciation of distinction in service to the society. Mr Chater, a competent Secretary of the Publications Committee for nine years, was co-author of *Sedges of the British Isles* and had also been very involved in the publication of five other titles in this series of B.S.B.I.

Handbooks. His general botanical advice has been valued by the officers and members alike, and as a *Carex* Referee and the Specialist on Nomenclature his adjudications are generously offered and highly respected.

Before the meeting neither recipient knew that they had been nominated by Council; both were unanimously elected with warm applause.

RE-ELECTION OF HONORARY AUDITORS

The Hon. Treasurer, in proposing the re-election of Grant Thornton, West Walk, Leicester, referred to the honour for the Society to present their Accounts over the name of these distinguished Auditors. Their re-election was passed unanimously, and the President agreed to write expressing thanks from the Society.

ANY OTHER BUSINESS

Mr M. Walpole, as Chairman of the Publications Committee, reported that the Committee had appointed two new *Watsonia* Editors: Dr R. R. Mill and Dr E. C. Nelson. Both were present and were welcomed. Dr R. J. Gornall had retired and Dr B. S. Rushton would now be Receiving Editor. Thanking Dr Gornall on behalf of the Society he observed that the high standards of *Watsonia* had increased during the ten years of Dr Gornall's editorship. He was thanked for competently coping with the very heavy workload, and for his skill at conforming to prescribed budgets. Thanks were extended also to all the Society's Editors, not least to Mr R. G. Ellis (*B.S.B.I. News*) and Mr D. H. Kent (*B.S.B.I. Abstracts*).

The *Report of the B.S.B.I. Monitoring Scheme* by Dr T. C. G. Rich was complete in two large format volumes, of which copies of Vol. II (the maps), sufficient for distribution to v.c. Recorders, were now available, and a matching number of copies of Vol. I were in production. Because of their large size, publication of further copies would be costly and, at the request of Council, the Hon. Secretary asked how many of the members present (who were not v.c. Recorders) would be interested in purchasing copies if these were to be published at approximately £20. Almost all those members signalled by a show of hands as wanting to purchase a copy if published. Possible ways to reduce the cost, e.g. smaller paper size for Vol. I, or a shortened text as an Introduction to the maps, were discussed. Dr Rich noted that he had submitted three papers to *Watsonia* on the results of the Scheme. Dr Rushton pointed out that if these papers were accepted by and published in *Watsonia*, they could not be published elsewhere. A lengthy and lively discussion followed and the matter was referred to Council with some urgency, in view of the time that had elapsed since the end of the field work and the completion of the *Report*.

Following some general announcements, the President then thanked Dr J. R. Edmondson and his assistants for the excellent local arrangements and the meeting closed at 12.23.

MARY BRIGGS

PAPERS READ AT THE ANNUAL GENERAL MEETING

Four papers were presented on the theme of "Botanists and Books". Michael Walpole first spoke on *British Floras and the book collector*, explaining his personal reasons for collecting local Floras and sharing some anecdotes on the sometimes difficult relationships with antiquarian booksellers. He found it particularly difficult to confine his collecting to a severely restricted field, given the large number of publications which have botanical data in their contents.

Charles Nelson then gave a talk entitled "*Out of olde bokes . . . cometh al this newe science*": *musings on bibliography and botanists*. Aptly complementing the previous speaker, he chose a series of examples to illustrate his theme that it was not only the printed contents of the books which were of significance to posterity, but also the jottings, scribblings and more deliberate mutilations of books (such as bookplates – several exuberant examples were shown) which provide rich pickings for botanical historians.

After the tea break, Tim Rich presented a paper *Towards an Atlas of the British Flora 2000*, the date being millennial rather than a firm prediction. Based on his experience during the recently completed Monitoring Scheme project, he outlined various methods for the efficient capture of distributional data and made a strong plea for the continuation of involvement in field recording which would lead to the publication of a new *Atlas*.

The final speaker, Bob Barnard of H.M.S.O. Publications, gave a professional publisher's account of *The new technology of publishing botany books*, showing examples from various recent H.M.S.O. publications to demonstrate new methods of typesetting, illustrating and distributing books. Reference was made to CD-ROM technology as well as to more conventional printed products, with helpful guidance on the various ways in which publishers price their products.

THE NATURAL HISTORY BOOK FAIR

This was the first occasion on which a Book Fair had been arranged as a commercial venture at the Maritime Museum. It was organized by the Botany Department of Liverpool Museum to take place in conjunction with the Annual General Meeting. The following booksellers participated:

B.S.B.I. Publications (Oundle)
Broadleaf Books (Cardiff)
Chantrey Books (Sheffield)
John Price (Marlborough)
Parry Books (Liverpool)
Subbuteo Natural History Books (Treuddyn)
Summerfield Books (Brough)
Tim Oldham, of Wyseby House Books, had to withdraw at a late stage because of illness.

It was generally agreed that this event enhanced the value of a conference on "Botanists and Books" as well as providing tempting purchasing opportunities for bibliophiles. The agreeable atmosphere of the Maritime Museum's historic warehouse galleries was also appreciated.

EXHIBITION: SOME NORTH-WEST BOTANISTS AND THEIR BOOKS

A small display was mounted by the Botany Department of Liverpool Museum containing short biographical sketches of some of the principal authors of botanical books in N.W. England together with examples of the books themselves as well as items from the archives. One of the highlights of the exhibition was a copy of Thomas Johnson's 1633 edition of Gerard's *Herball*.

The following botanists with North-west connections were featured: William Bean (1817–1864); Joseph Dickinson (1805–1865); John Gerard (1545–1612); Conrad Theodore Green (1863–1940); Leopold Hartley Grindon (1818–1904); Thomas Batt Hall (1814–1886); William Roscoe (1753–1831); William Gladstone Travis (1877–1958); John Warren, Baron de Tabley (1835–1895); James Alfred Wheldon (1862–1924) and Albert Wilson (1862–1949).

Also on show were samples of the manuscript of de Tabley's *Flora of Cheshire*, together with examples of specimens from his herbarium, on loan from the National Botanic Gardens, Glasnevin, Dublin. The organizers are indebted to the authorities at Glasnevin, as well as to Mr Neville Carrick, the City of Liverpool's Librarian and Mr Eric Greenwood, Keeper of the Liverpool Museum, for the loan of items for this exhibition.

A leaflet entitled *Some North-west Botanists and their Books* was prepared by Lorna Cunliffe-Lister, a student from the Department of Museum Studies, University of Leicester, to accompany the exhibition.

FIELD EXCURSION HELD IN CONJUNCTION WITH THE A.G.M.

BODNANT GARDEN AND THE GREAT ORME, NORTH WALES. 5 MAY 1991

A coach party of 42 people together with about 20 travelling by car made the journey to Bodnant Garden, near Conwy, on a day which started cloudy but developed into a gloriously sunny afternoon. The garden at Bodnant, which was given to the National Trust by the late Lord Aberconway, is set in a precipitous valley close to the estuary of the River Conway. It is managed partly as a formal garden and partly as a 'wilderness' garden with steeply sloping rocky banks and a network of crazily angled paths. The facilities have been enhanced by a garden centre (under refurbishment) and a new restaurant and coffee shop which, despite the Bank Holiday crush, was able to offer an efficient luncheon service.

After lunch the coach departed for Llandudno, hoping to take its passengers to a rendezvous with the car-borne botanists at the foot of the Great Orme. Alas, Bank Holiday crowds attending a "Victorian Extravaganza" in Llandudno, coupled with the closure (due to a landslip) of the coastal road which encircles the peninsula, conspired to delay the coach to the point where the two parties set off separately for the limestone massif of the Great Orme. Led by three local botanists, Wendy McCarthy, Ted Phenna and Geoff Battershall, 17 members set off on an 'alternative A.G.M. excursion'. Numerous specialities were seen including *Aster linosyris*, *Hypochoeris maculata*, *Helianthemum canum*, *Hornungia petraea*, *Orchis morio* and *Cotoneaster integerrimus*. The coach party, having finally reached the ungrazed area below the cablecar station, were able to scramble up the slopes above the foot of the Happy Valley gardens in order to see some of the characteristic early-flowering limestone plants, including *Scilla verna*, and *Brassica oleracea* at its northern limit of distribution in Wales.

Thanks are due to Tim Rich for contributing to this report, to all the speakers and exhibitors at the Book Fair, to the staff of the Conference Office at the Merseyside Maritime Museum for their efficient handling of the front-of-house arrangements, and to the Trustees of the National Museums and Galleries on Merseyside for their hospitality.

J. R. Edmondson

B.S.B.I. Conference Reports

*1. BRITISH FLOWERING PLANTS AND MODERN SYSTEMATIC METHODS
Ed. A. J. Wilmott, 1948, 104 pages, 18 plates. £5.25.

2. THE STUDY OF THE DISTRIBUTION OF BRITISH PLANTS.
Ed. J. E. Lousley, 1951. 128 pages, illustrations and maps.

3. THE CHANGING FLORA OF BRITAIN
Ed. J. E. Lousley, 1953. 203 pages, 9 plates, 25 text figs.

*4. SPECIES STUDIES IN THE BRITISH FLORA
Ed. J. E. Lousley, 1955. 189 pages, 2 plates and 23 text figs. £5.25.

*5. PROGRESS IN THE STUDY OF THE BRITISH FLORA
Ed. J. E. Lousley, 1957. 128 pages, 4 plates and 9 text figs. £5.25.

6. A DARWIN CENTENARY
Ed. P. J. Wanstall, 1961. 140 pages, 7 plates, 12 text figs.

7. LOCAL FLORAS
Ed. P. J. Wanstall, 1963. 118 pages, 1 plate (map), 9 text figs.

8. THE CONSERVATION OF THE BRITISH FLORA
Ed. E. Milne – Redhead, 1963. 90 pages.

9. REPRODUCTIVE BIOLOGY AND TAXONOMY OF VASCULAR PLANTS
Ed. J. G. Hawkes, 1966. 182 pages, 1 plate, 9 text figs.

10. MODERN METHODS IN PLANT TAXONOMY
Ed. V. H. Heywood, 1968. 312 pages, numerous text figs.
Held in association with the Linnean Society of London.

*11. THE FLORA OF A CHANGING BRITAIN
Ed. F. H. Perring, 1970. 158 pages, 21 text figs. £3.50 (1973 reprint).

12. TAXONOMY, PHYTOGEOGRAPHY AND EVOLUTION
Ed. D. H. Valentine, 1972. 431 pages, numerous text figs and tables. Held in association with The Linnean Society of London and the International Organisation of Plant Biosystematists.

*13. PLANTS WILD AND CULTIVATED
Ed. P. S. Green, 1973. 232 pages, 8 plates and 24 text figs. £3.20.

*14. THE OAK: ITS HISTORY AND NATURAL HISTORY
Ed. M. G. Morris & F. H. Perring, 1974. 376 pages, illustrations. £8.25

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Recording bias in botanical surveys

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ABSTRACT

Recording bias in botanical surveys arises primarily from the recording behaviour of individual botanists, sometimes coupled with the survey techniques and the types of plants being recorded. Recording bias is probably widespread in botanical surveys; it does not invalidate the records, but requires that care is taken with interpretation. Some generalizations are made to help assess recording bias, and are illustrated using examples found during the B.S.B.I. Monitoring Scheme.

INTRODUCTION

In any botanical survey, there is an inevitable degree of recording bias (Hope-Simpson 1940; Sykes *et al.* 1983; Nilsson & Nilsson 1983; Kirby *et al.* 1986; West & Hatton 1990, etc.). Efforts are therefore usually made to minimise bias by adopting a controlled, systematic, repeatable method (Greig-Smith 1964).

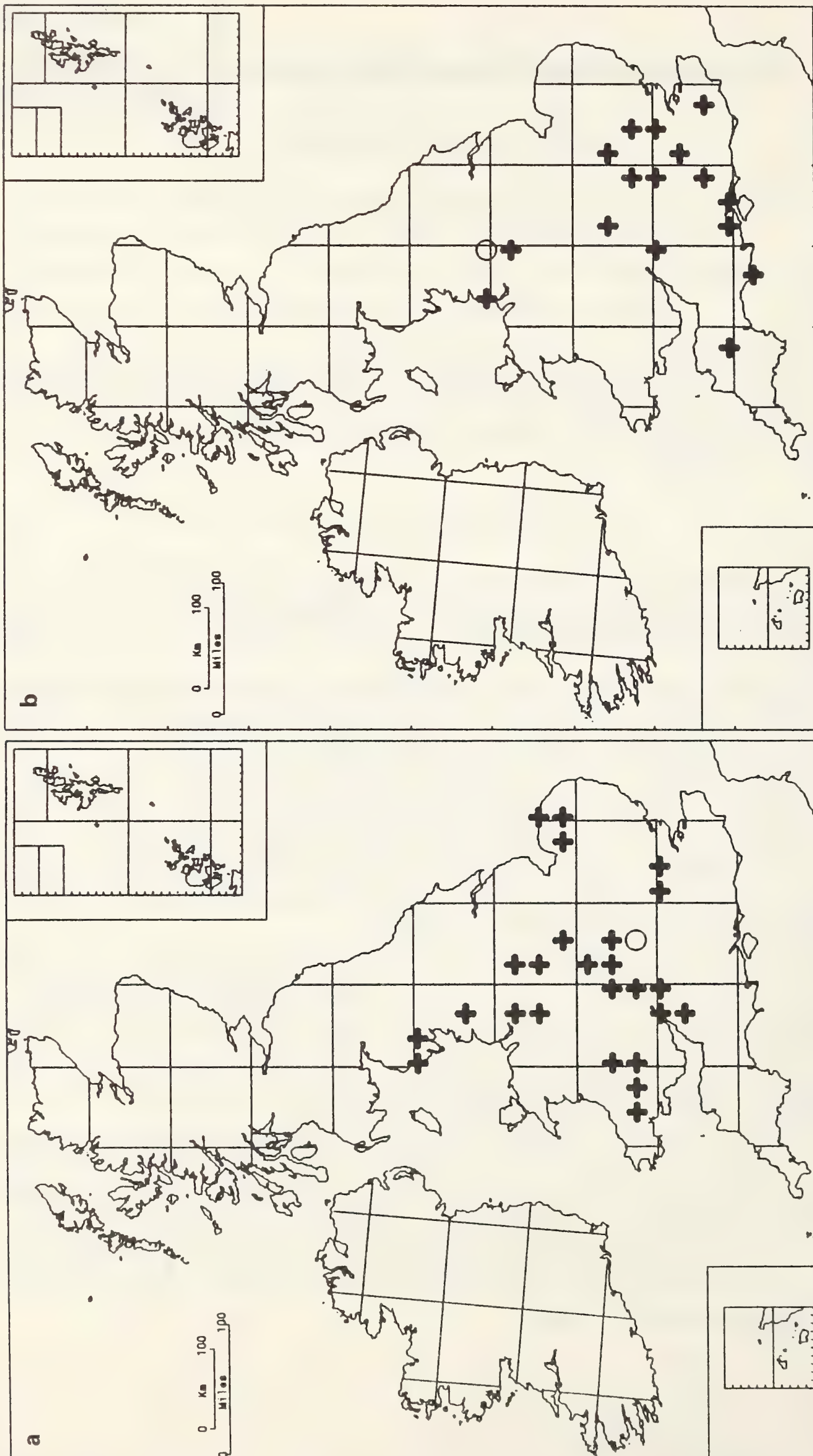
In the recording techniques adopted for most national or county plant atlases (e.g. Perring & Walters 1962; Hall 1980), recorders individually select the areas within squares to visit, and then record the species present to fill the time available, or until the list is felt to be comprehensive. Such an unstructured recording technique might be expected to introduce considerable local bias to the data collected, and especially if the surveys are to be repeated. For instance, only 52% of the records collected by two independent parties of botanists six weeks apart in the same tetrads (2-km squares) were common to both surveys (Rich & Woodruff 1990, 1992). Efforts are often made to achieve even coverage (e.g. Dony 1963), but failure to achieve this is only one of many sources from which bias can arise. Documentation of what was done and where and when and by whom can help with interpretation of the data, but such details are rarely collected.

Bias originates primarily from differences in the recording behaviour and the ability of individual botanists, but may also arise from the survey techniques or the types of plants being recorded. The extent of bias in the data collected is rarely known, and few cases are described in detail. Perring & Walters (1962) presented provisional distribution maps of about 40 taxa and explained why the data were thought to be inadequate. Nilsson & Nilsson (1983) found that sampling error accounted for two-thirds of the apparent species turnover rates on islands in Sweden. Preston & Eversham (1992) describe selected examples of botanical and zoological recording bias.

The purpose of this paper is to draw attention to the problems of recording bias by using some examples encountered during the B.S.B.I. Monitoring Scheme (Rich & Woodruff 1990, 1992). The B.S.B.I. Monitoring Scheme was a 10-km square sample survey of Britain and Ireland during 1987 and 1988 to assess the current status of the flora. Over 1600 botanists collected 985,000 records in 425 out of the 429 sample 10-km squares, representing 2660 taxa. Many of the examples are drawn from a comparison of these data with those collected for the *Atlas of the British flora*† (Perring & Walters 1962).

Nomenclature follows Clapham *et al.* (1987).

* Present address: 24 Lombardy Drive, Peterborough, PE1 3TF
† hereafter referred to as the *Atlas*.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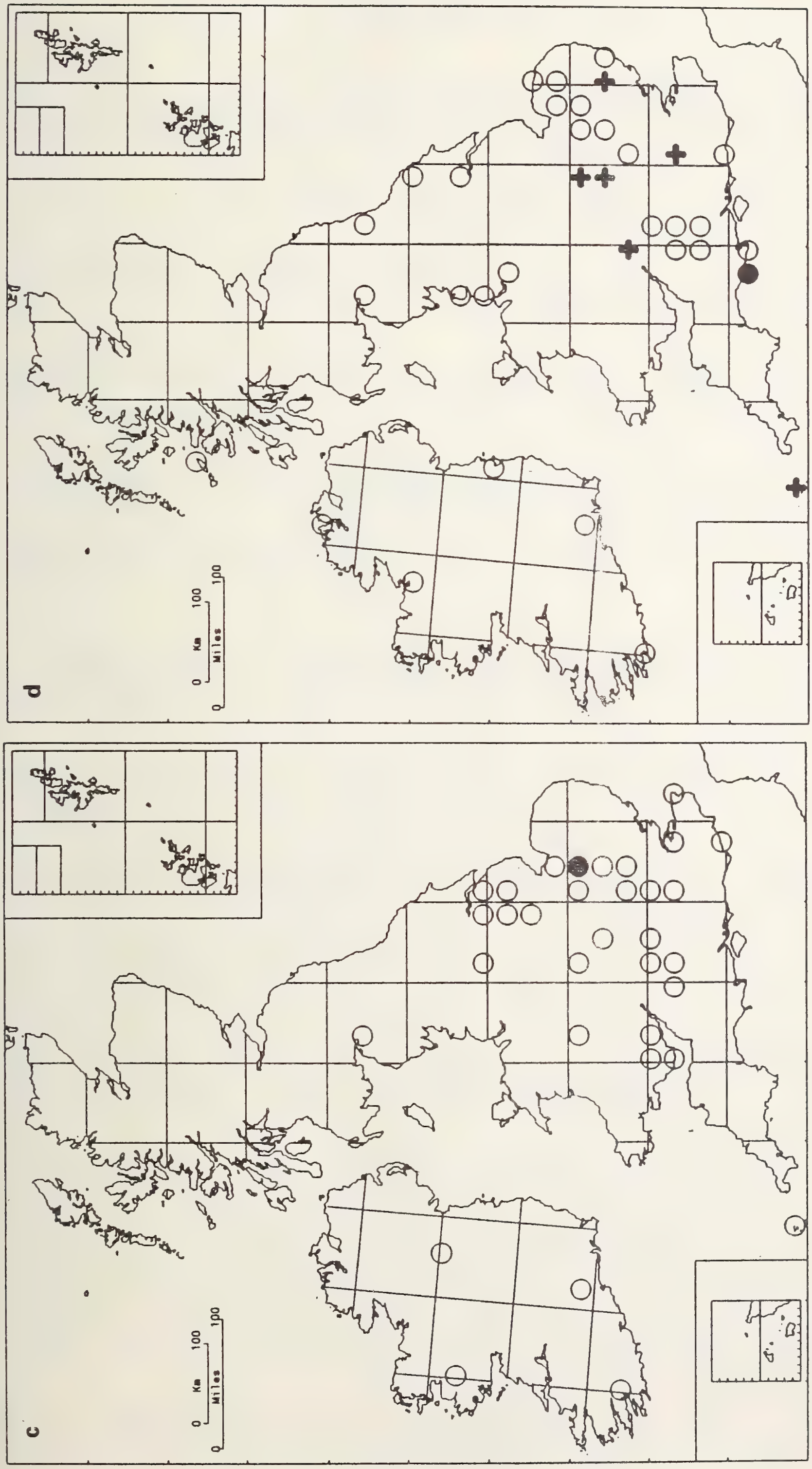


FIGURE 1. Selected pairs of taxa showing apparently similar patterns of change: (a, b) *Rubus vestitus* and *Lagarosiphon major*; (c, d) *Polygonum nodosum* and *Agrostemma githago*.

EXAMPLES OF RECORDING BIAS

NOTE ON PRESENTATION OF THE MAPS

The maps show only data from the 10-km squares sampled for the B.S.B.I. Monitoring Scheme (one in every nine; see Rich & Woodruff 1992). The symbols are enlarged so that they are clear to read when the maps are reduced and do not indicate the actual areas covered. The symbols used are as follows:

○ Recorded only for the *Atlas* (1930–1960 in Britain, before 1960 in Ireland).
✚ Recorded only for the Monitoring Scheme (1987–1988).
● Recorded for both the *Atlas* and the Monitoring Scheme.

Thus, a predominance of open circles may suggest a decline in relative frequency between the surveys, and a predominance of pluses, an increase.

THE IMPORTANCE OF ASSESSING BIAS

The importance of assessing bias can be seen from the apparent similarities between the following selected pairs of maps. Unless the extent of recording bias is known, any conclusions drawn from the data may be misleading.

Rubus vestitus and *Lagarosiphon major* (Figs 1a, b): The increase in records for the former species reflects an increase in recording of critical taxa coupled with incomplete historical data; for the latter it reflects a real increase in the frequency of the plant.

Agrostemma githago and *Polygonum nodosum* (Figs 1c, d): The former species has decreased markedly during the last 30 years; the latter has undergone a taxonomic revision and is no longer recognised by most recorders.

BIASES RELATED TO THE QUALITY AND QUANTITY OF RECORDING

It is often said that the distribution of plants reflects the distribution of botanists, and this is particularly true for the more critical taxa and for small areas. Fig. 2 shows how the apparent distribution of *Carex hostiana* × *viridula* correlates with areas recorded by A. O. Chater and J. Harron who know this obscure hybrid well. It is, however, probably widespread in the north and west where its parents grow together. Another botanist, M. Porter, recorded critical taxa in great detail in Brecon for the Monitoring Scheme, resulting in apparently highly localised concentrations of records of species of *Rubus*, *Hieracium*, *Taraxacum* and *Euphrasia* (Rich & Woodruff 1990).

Taxonomic awareness and recording fashions may bias results on a wider scale and for commoner taxa. Many critical groups have been more widely recorded for the Monitoring Scheme than for the *Atlas* (e.g. *Hieracium*, Fig. 3a), but some were more widely recorded for the *Atlas* (e.g. *Rhinanthus*, Fig. 3b), resulting in artificial changes in frequency. Compared to a general average of 16% more records for the Monitoring Scheme than the *Atlas*, there are 24% more records for five selected genera (*Carex*, *Polygonum*, *Populus*, *Rumex* and *Salix*) covered by the *B.S.B.I. Handbook* series (Jermy *et al*. 1982; Kent & Lousley 1981; Meikle 1984). Trist & Sell (1988) drew attention to the occurrence of two subspp. of *Molinia caerulea* in the British Isles; there were four records of the subspp. in 1987 and 33 in 1988. These increases in records are no doubt due to increased awareness of the taxa concerned. Fig. 4 shows 10-km squares where above average percentages of critical taxa were recorded for the *Atlas* and Monitoring Scheme surveys; the squares correlate well with areas known to have been well-recorded.

There are differences in opinion between recorders over which introduced species or garden escapes to record. In recent years it has also become more acceptable to record all introductions as they have become more widespread in the wild. Consequently, exaggerated rates of increase may be observed for species which were present but often ignored during recording for the *Atlas* (Fig. 5). However, it is also still more acceptable to record some introductions than others – taxa are more likely to be recorded if they are included in national or local Floras or if listed on the record cards. Crops such as Wheat (*Triticum aestivum*) and Barley (*Hordeum vulgare*), which are not listed on cards, are poorly recorded on roadsides compared to others, such as Oil-seed Rape (*Brassica napus*) (Fig. 6), which are listed on the cards and are widely recorded.

Bias also arises from differences in taxonomic opinion and also from common errors; many recorders simply follow the major floras. There is little agreement on the current taxonomic status of the subspp. of *Juncus bulbosus*, resulting in confusion between the records (Fig. 7a, b). *Viola canina*

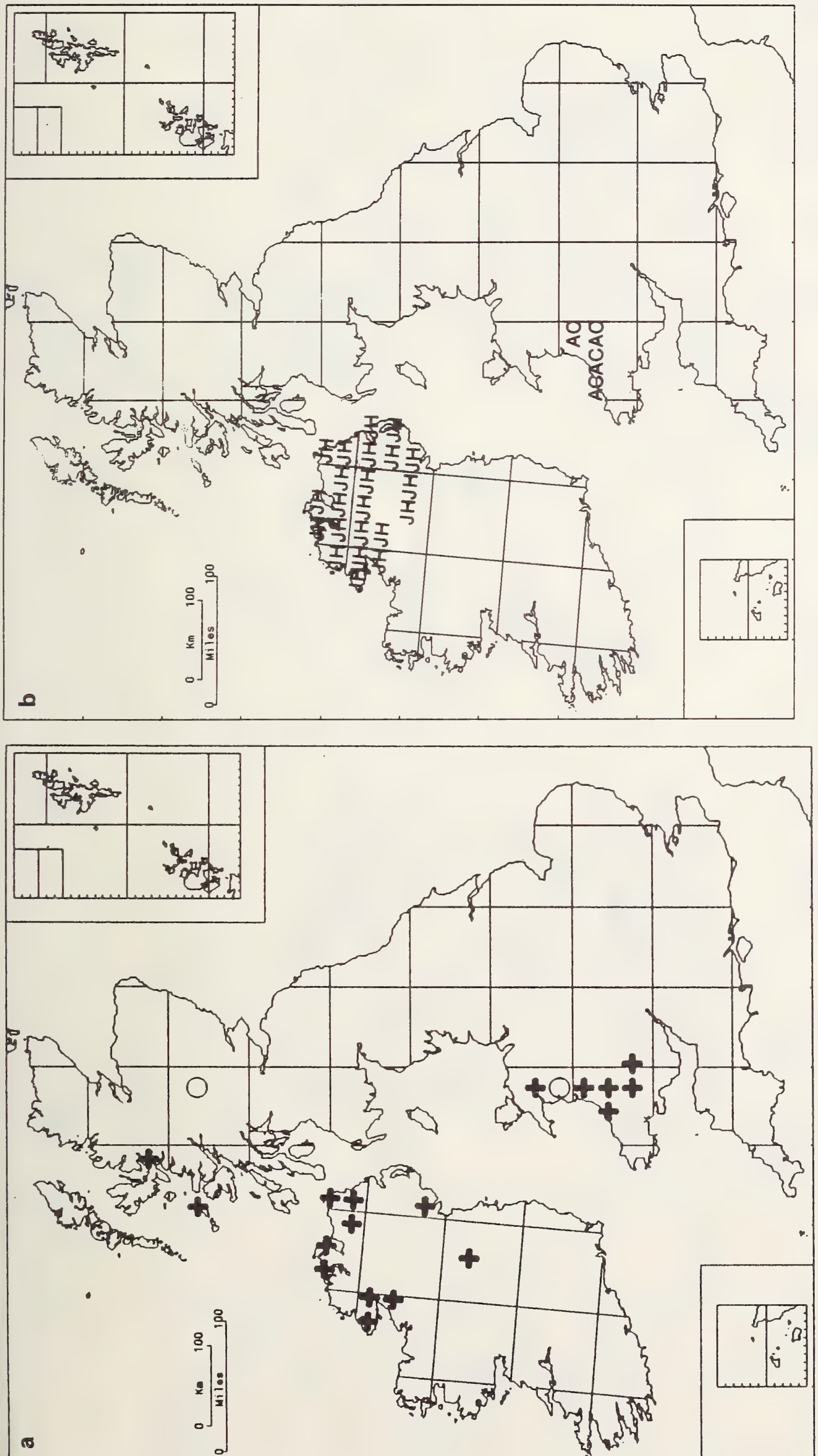


FIGURE 2. Correlation between (a) the distribution of *Carex hostiana* × *viridula* and (b) the areas recorded by two botanists (AC = A. O. Chater, JH = J. Harron).

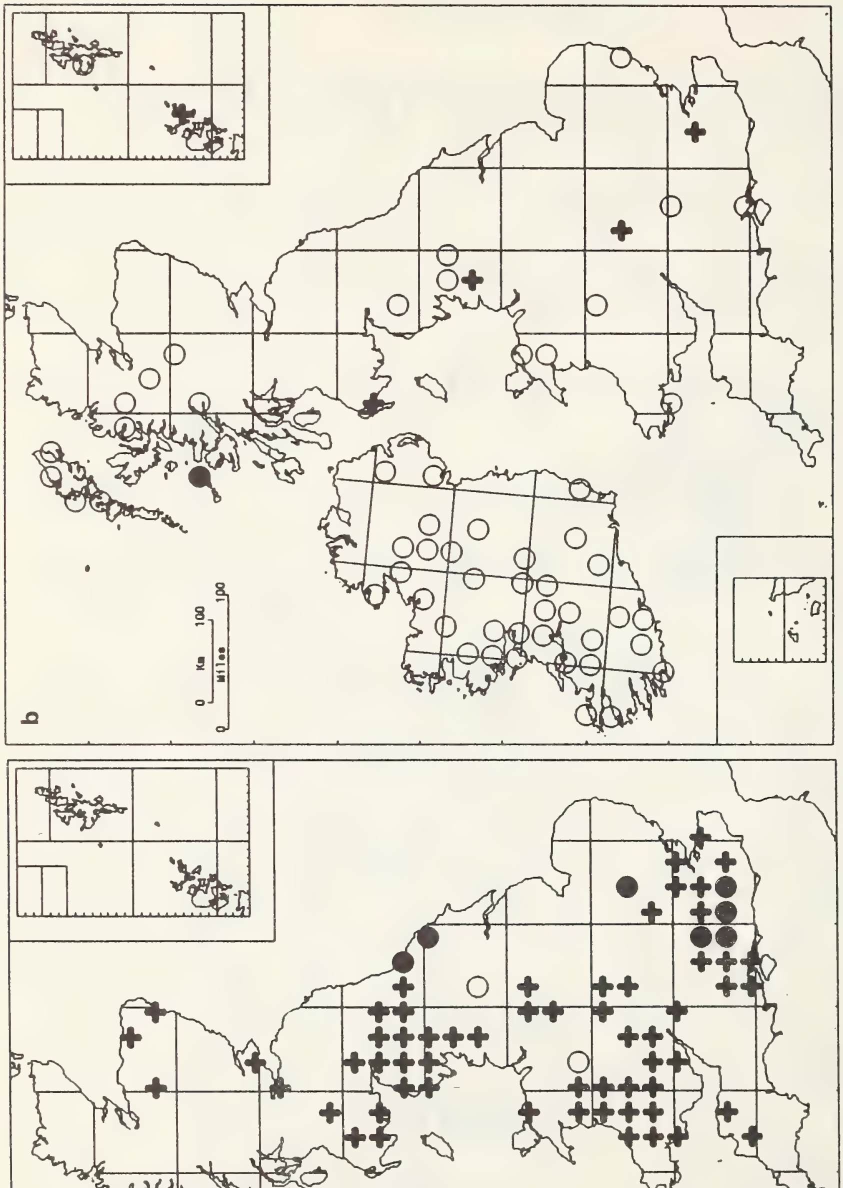


FIGURE 3. Examples of critical taxa better recorded during one survey than the other: (a) *Hieracium perpropinquum*, more widely recorded for the Monitoring Scheme; (b) *Rhinanthus minor* subsp. *minor*, more widely recorded for the *Atlas*.

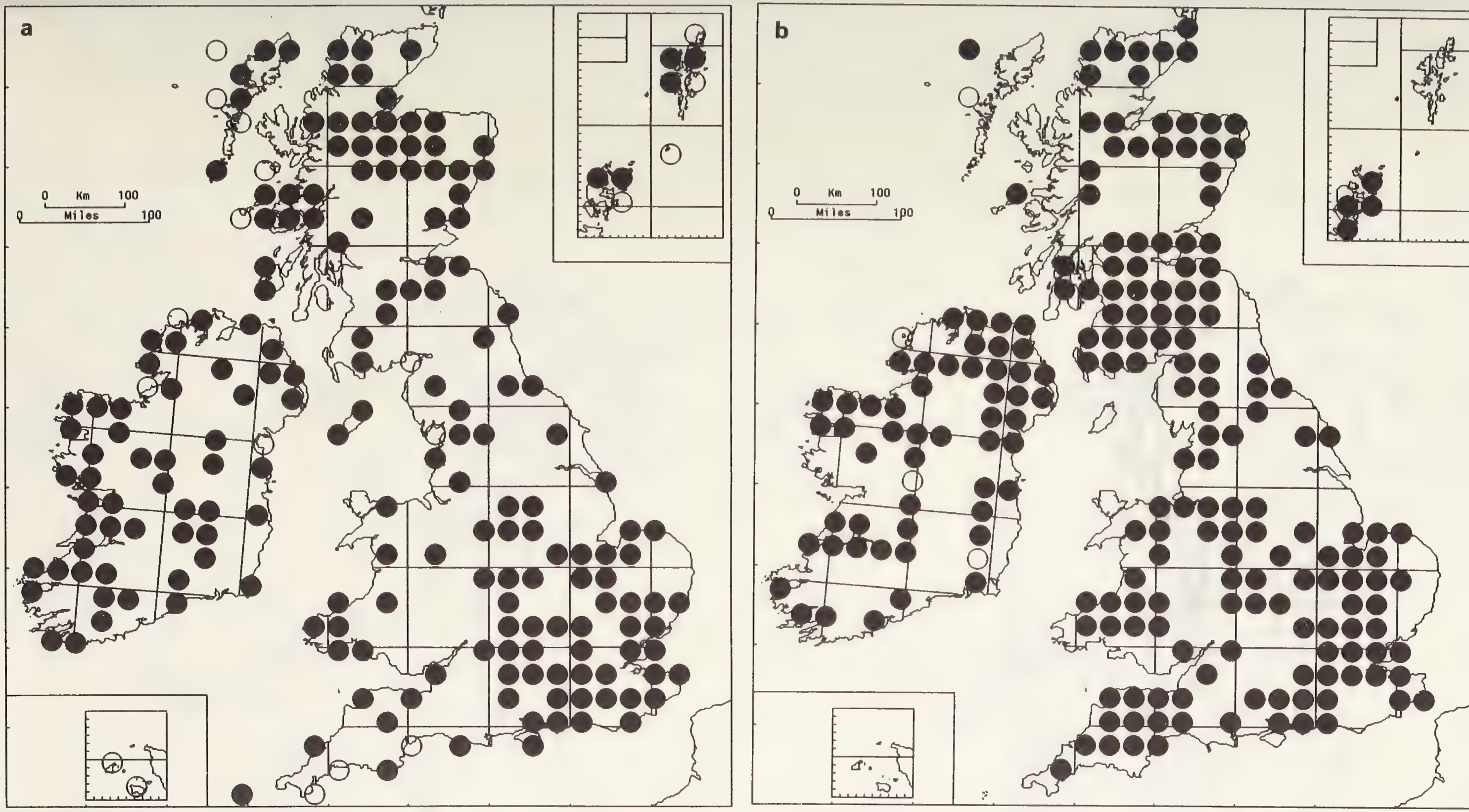


FIGURE 4. 10-km squares with an above average % of critical taxa recorded (number of critical taxa/total number of taxa recorded per square): (a) *Atlas* survey; (b) Monitoring Scheme survey. Britain and Ireland have been assessed separately due to inherent differences in the flora. Open circles show 10-km squares not recorded for both surveys.

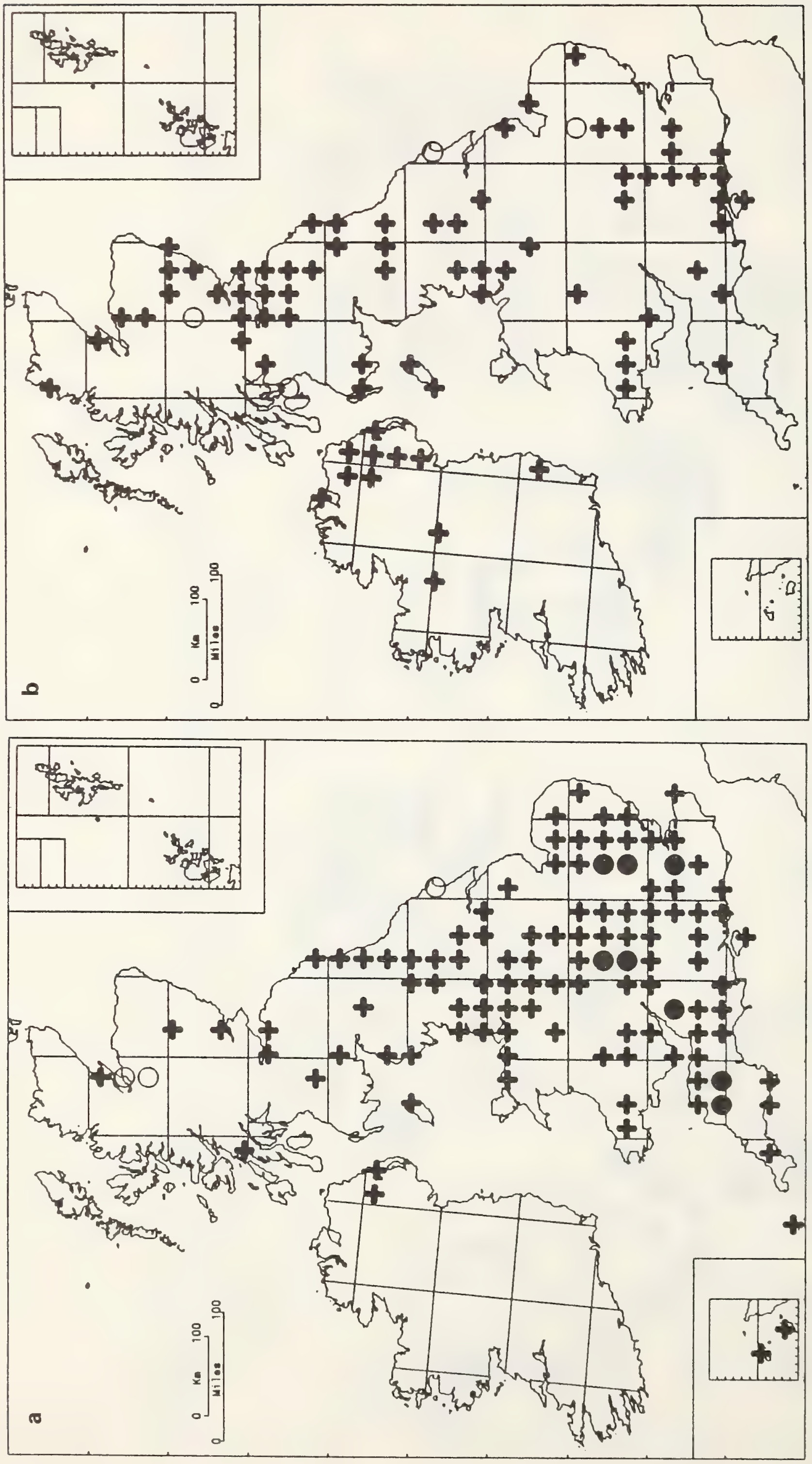


FIGURE 5. Examples of increased recording of garden escapes resulting in exaggerated rates of increase: (a) *Lunaria annua*; (b) *Ribes sanguineum*.

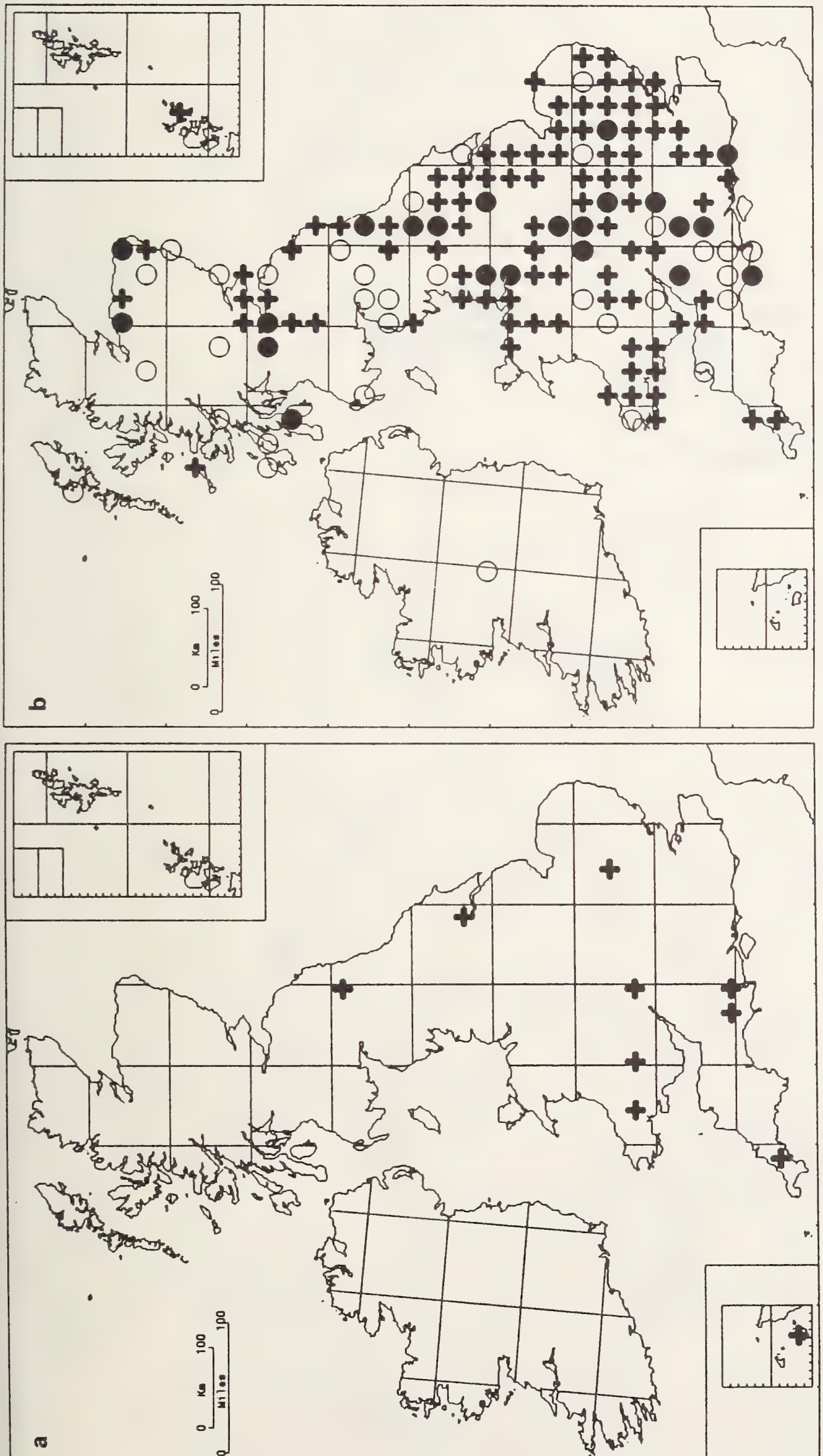
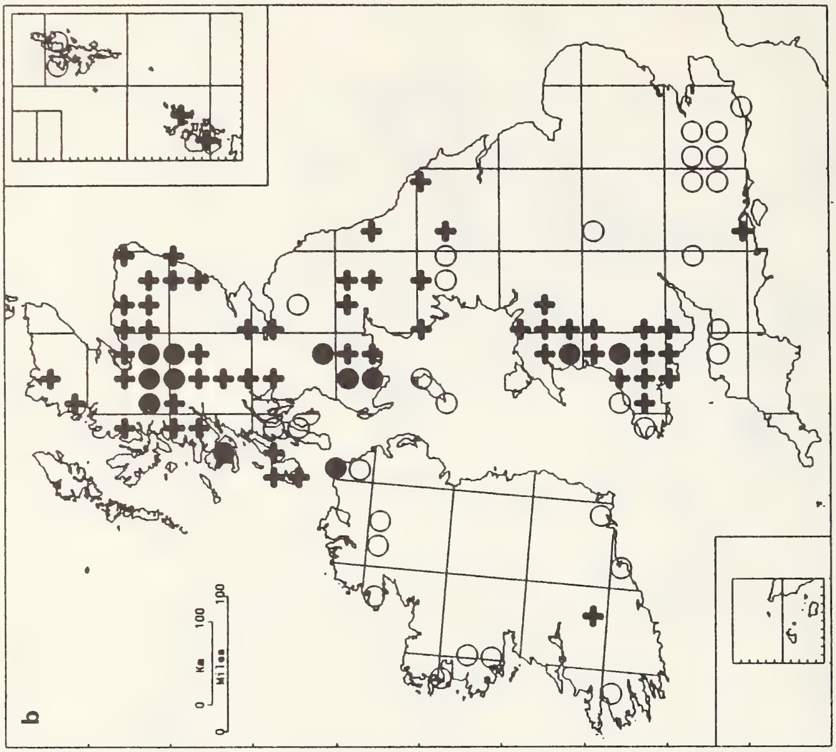


FIGURE 6. Differences in recording of crop plants occurring outside cultivated fields. It is much less acceptable to record (a) Barley (*Hordeum vulgare*) than (b) Oil-seed Rape (*Brassica napus*) despite the widespread occurrence of both on roadsides.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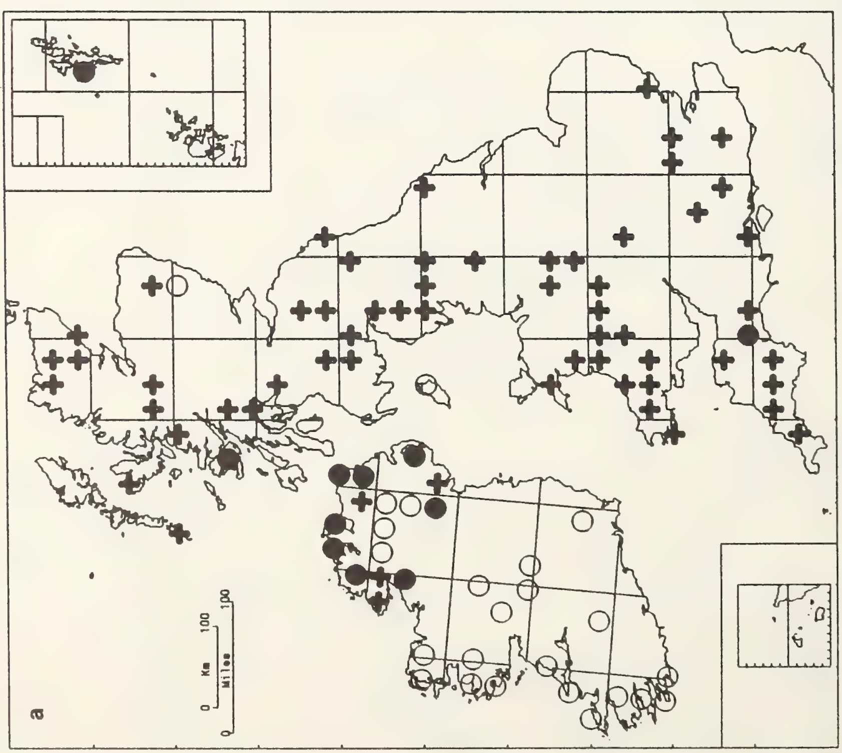
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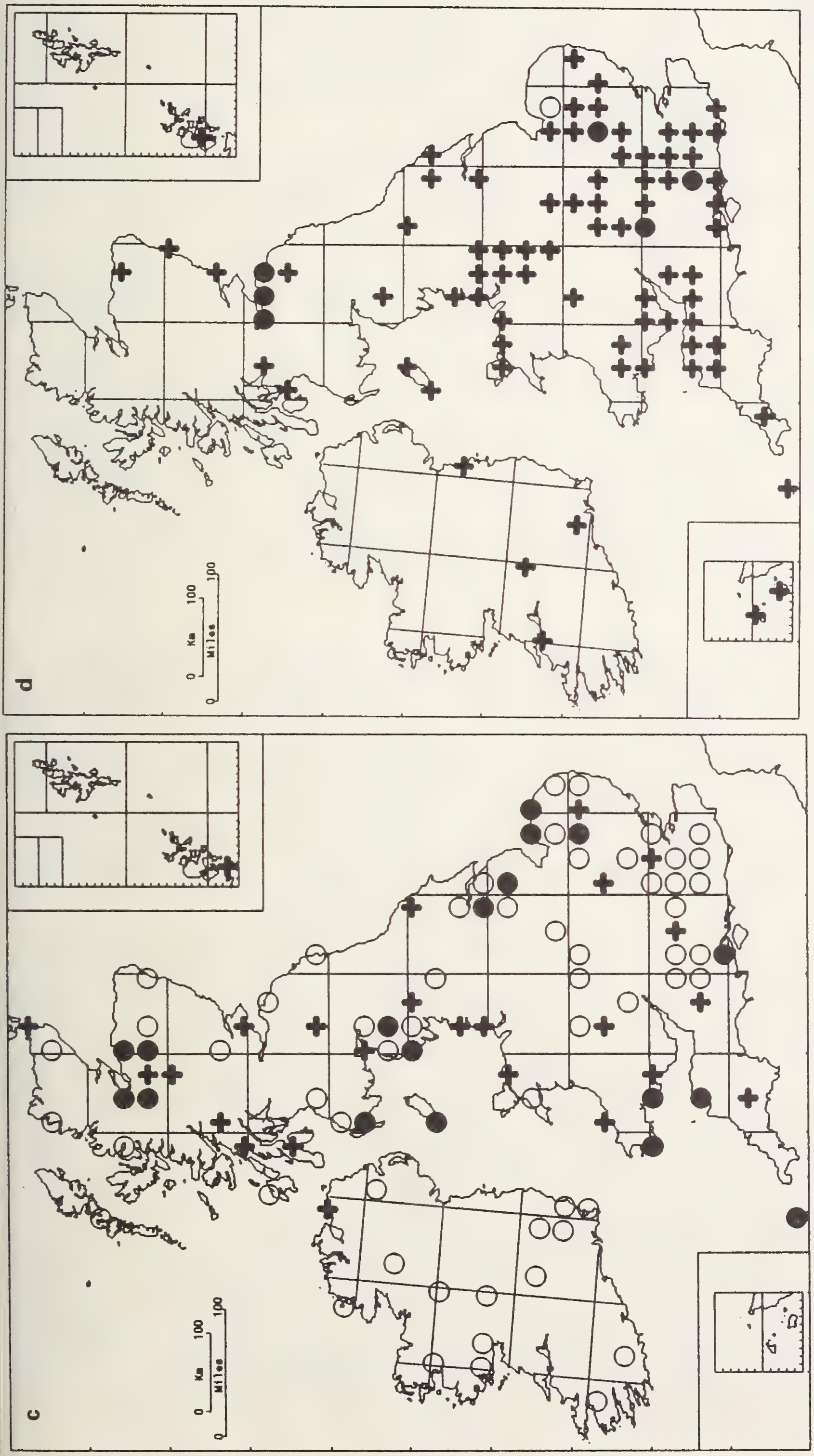


FIGURE 7. Examples of taxa recorded with differences of opinion or recorded erroneously (see text for details): (a) *Juncus bulbosus* subsp. *bulbosus*; (b) *J. bulbosus* subsp. *kochii*; (c) *Viola canina*; (d) *Hyacinthoides hispanica*.

may have been over-recorded inland for the *Atlas* (Fig. 7c), possibly because in *Bentham & Hooker*, the Flora that most British botanists at that time had been raised on, *V. riviniana* was included in *V. canina* (F. H. Perring, pers. comm.). *Hyacinthoides hispanica* has been over-recorded in error for the much more common but less well known *Hyacinthoides hispanica* × *H. non-scripta* (Page 1987; Fig. 7d); the latter is not included in Clapham *et al.* (1987).

Other plants may simply be overlooked if recorders are unaware of their presence in an area. *Festuca altissima* is an uncommon plant of rocky woods and ravines and was almost certainly under-recorded for the *Atlas* (Fig. 8a). *Chenopodium ficifolium*, a weed similar in appearance to the common *C. album*, may also have been overlooked in some areas (Fig. 8b).

Some habitats may be recorded better or more poorly than others due to differences in accessibility. Arctic-alpines such as *Luzula arcuata* and *Juncus castaneus* in Scotland, and *Polygonum viviparum* in Ireland, were under-recorded for the Monitoring Scheme partly due to the remoteness of the localities and partly due to inclement weather. Conversely, car-parks and churchyards have been well-recorded as they are easily accessible.

Increases in numbers of records may result simply from increased recording effort for the Monitoring Scheme (Rich & Woodruff 1992). Numerous examples could be cited, but a clearer demonstration is probably from outside the Scheme itself where the effects can be seen in a wider context. The spread of *Cardaria draba* has been documented by Scurfield (1962). Fig. 9 shows the cumulative number of 10-km squares from which *C. draba* has been recorded. The enormous increase in the 1950s coincides with the *Atlas* field work and reflects a simple increase in recording effort rather than a dramatic spread of the plant. Similar patterns can also be seen in *Epilobium ciliatum*, *Veronica filiformis* and *Impatiens glandulifera*. The Monitoring Scheme results suggest little increase in *C. draba* since 1960.

BIASES RELATED TO RECORDING METHODS

Constraints imposed by the recording methods may result in some systematic biases in addition to those introduced by the botanists. Bias introduced by changes in the areas recorded, the repeatability of surveys, concentration on the selected A, J and W tetrads, and by the time span of recording have been briefly discussed by Rich & Woodruff (1990, 1992). Examples of how changes in coverage and in the areas recorded may result in apparent increases of plants are shown in Fig. 10. *Plantago maritima* was recorded for the Monitoring Scheme in 22 out of the 26 coastal 10-km squares not recorded for the *Atlas*; if these records are ignored there is no significant change in frequency. Similarly, apparent increases in *Trifolium repens* around the coast are due to the new squares being recorded, and apparent losses in Ireland are squares not re-recorded for the Monitoring Scheme. Examples of species under-recorded in the Dublin square due to concentration on the selected tetrads are *Oenanthe aquatica* and *Myriophyllum spicatum*.

Exaggerated rates of decline of casual species may result from different time spans of surveys. Casuals or fugitives (Preston & Eversham 1992) are usually short-lived, non-persistent species which are unpredictable in occurrence (they are often accidentally introduced by man). As records accumulate with time, a longer survey period is likely to yield more 10-km square records than a shorter period. Table 1 shows the number of sample 10-km squares recorded for three arable weed species; in all cases there are considerably more records for 1930–1960 than 1987–1988 and it might be concluded that the species have declined by 75% or more. If the numbers of records per year are calculated, all taxa appear to have become *more* frequent. Neither conclusion is strictly valid because the numbers of records also need to be corrected to take into account the amount of recording effort which generated them. There is little doubt that these species have declined, but at a lower rate than suggested by a simple comparison of numbers.

The taxa listed on the cards may introduce bias by prompting records for selected taxa. The records for *Malus sylvestris* sensu lato, *M. sylvestris* sensu stricto and *M. domestica* are highly correlated with the taxa listed on the five regional record cards (Fig. 11). Similar effects were found in *Asplenium trichomanes*, *Juniperus communis* and *Veronica serpyllifolia*. The commonest segregate or infraspecific taxon of an aggregate or species may also be under-recorded simply because it is the assumed taxon; there were only two records for *Hedera helix* var. *helix* for the Monitoring Scheme compared to 34 for var. *hibernica* even though the former is the more common taxon (McAllister & Rutherford 1990).

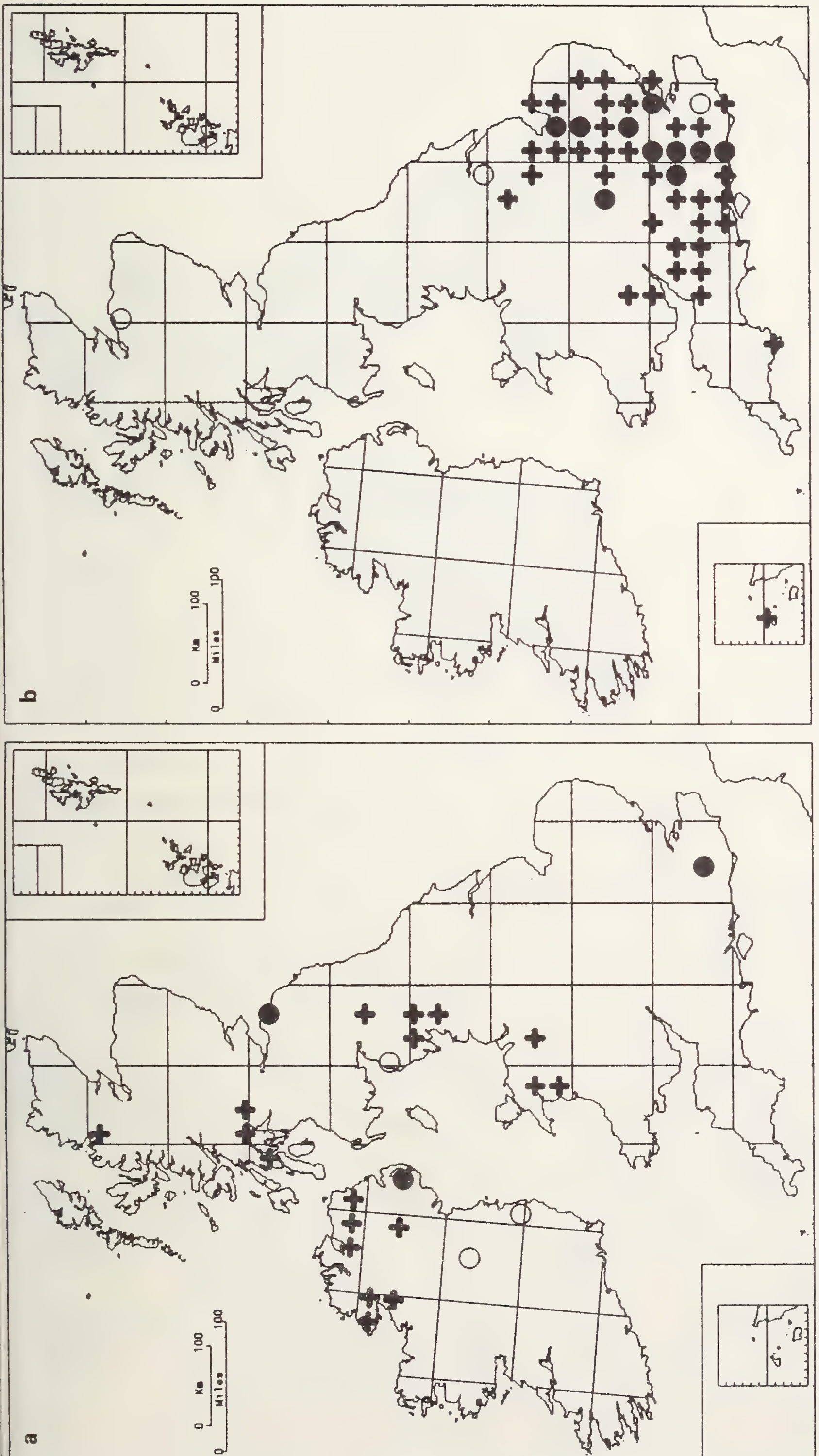


FIGURE 8. Examples of species which may have been overlooked for the *Atlas*: (a) *Festuca altissima*; (b) *Chenopodium ficifolium*.

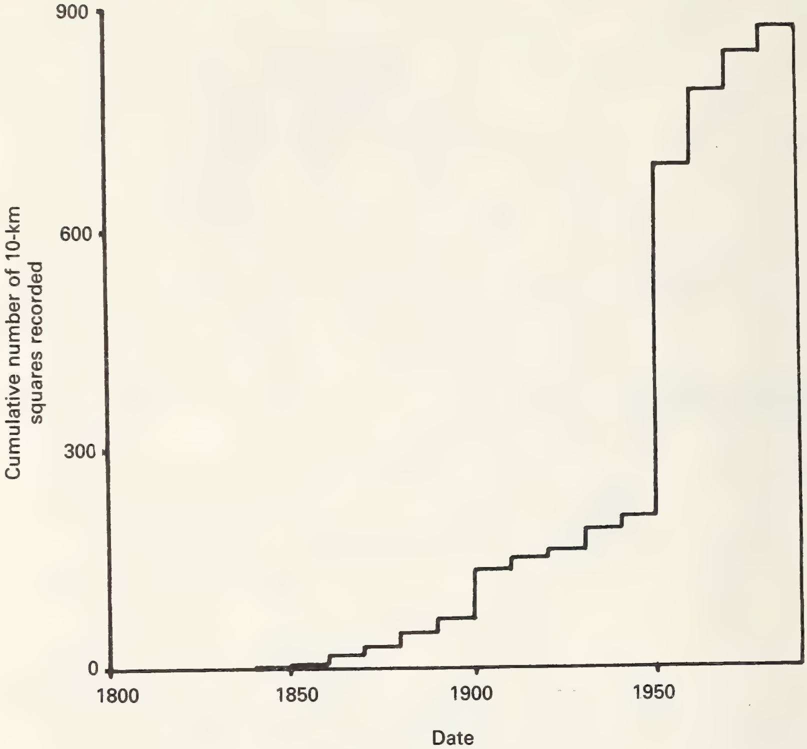


FIGURE 9. Cumulative increase in the number of 10-km squares recorded for *Cardaria draba* with time.

BIASES RELATED TO THE TYPES OF PLANTS BEING RECORDED

Some biases in recording may depend on the type of plants being recorded in addition to the behaviour of the botanists.

The apparency, or ease with which a plant is seen may dictate how consistently it is recorded. *Chamerion angustifolium* has large, purple flowers at eye-level and is unlikely to be missed. *Leersia oryzoides* is a large grass of ditches and watersides which rarely flowers; it is very difficult to see amongst *Phalaris arundinacea* with which it usually grows and closely resembles vegetatively, and is easily overlooked. Small, fine-leaved or widely dispersed taxa are often more poorly recorded than large, broad-leaved or clumped species (Sykes *et al.* 1983; Clymo 1980). Plants abundant in an area are more likely to be found than those less frequent, simply due to the higher probability of a recorder finding them.

The seasonality of appearance of plants is well-known. In the genus *Scilla*, for example, *S. verna* is most conspicuous in spring and early summer, whilst *S. autumnalis* is seen mainly in late summer and autumn. The seasonality of recording by botanists is also well-known, most activity taking place during the summer. Species which are most conspicuous at the beginning or end of a season are likely to be less consistently recorded than those most conspicuous in the middle.

Seasonal bias may arise from variations in the occurrence of the plant (e.g. spring annuals, woodland herbs), variations in the apparency, or from difficulties in identifying particular taxa at certain times of year (e.g. *Nasturtium* spp. are most reliably identified from ripe seeds which are unavailable early in the season (Rich 1987)). Fig. 12 shows examples of seasonal bias based on records collected during 1987 and 1988, and includes records of both flowering and vegetative plants. Fig. 12a shows the relative numbers of records collected in each month; most records are collected between May and September, reflecting seasonality of both plants and recorders.

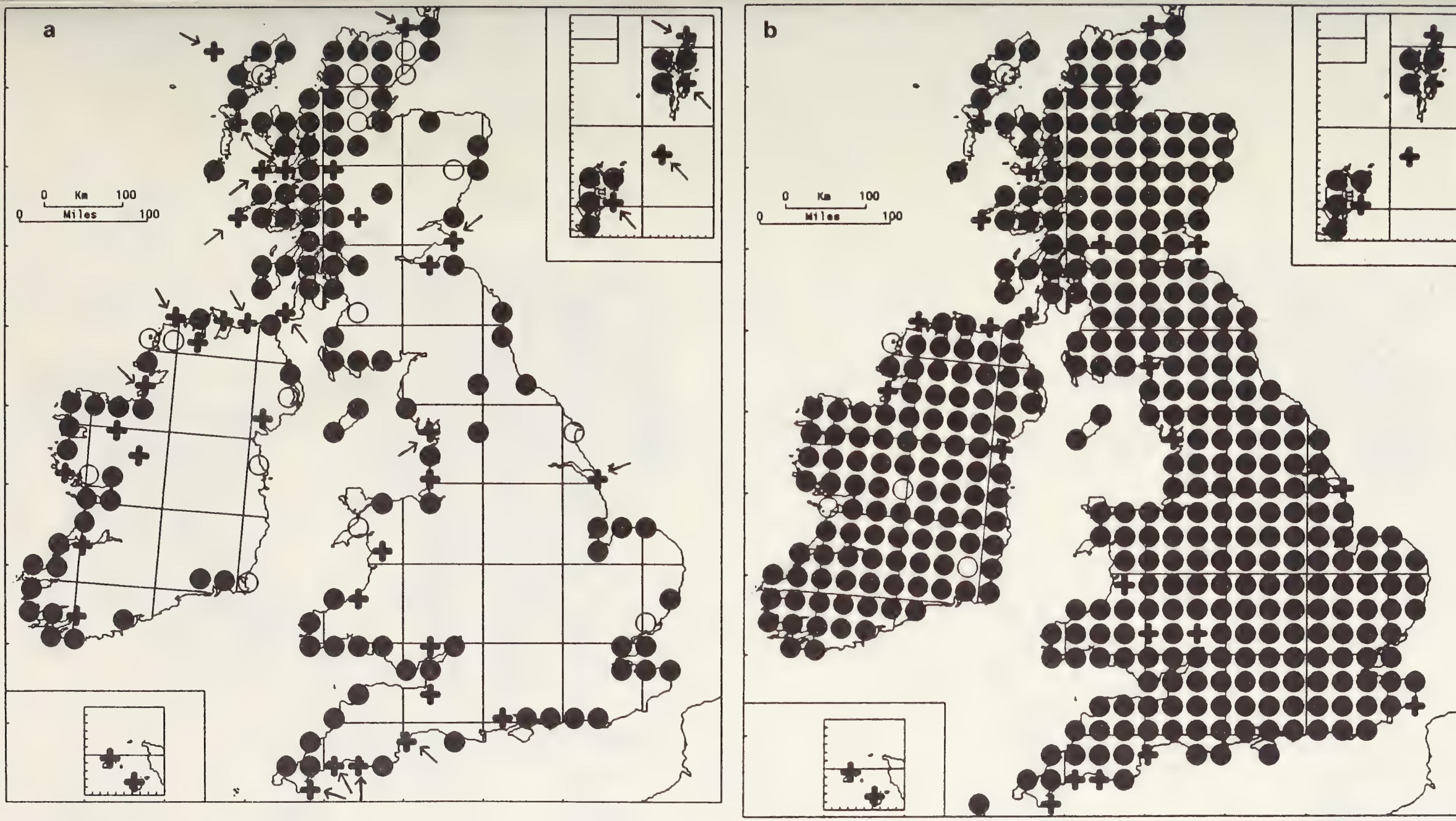
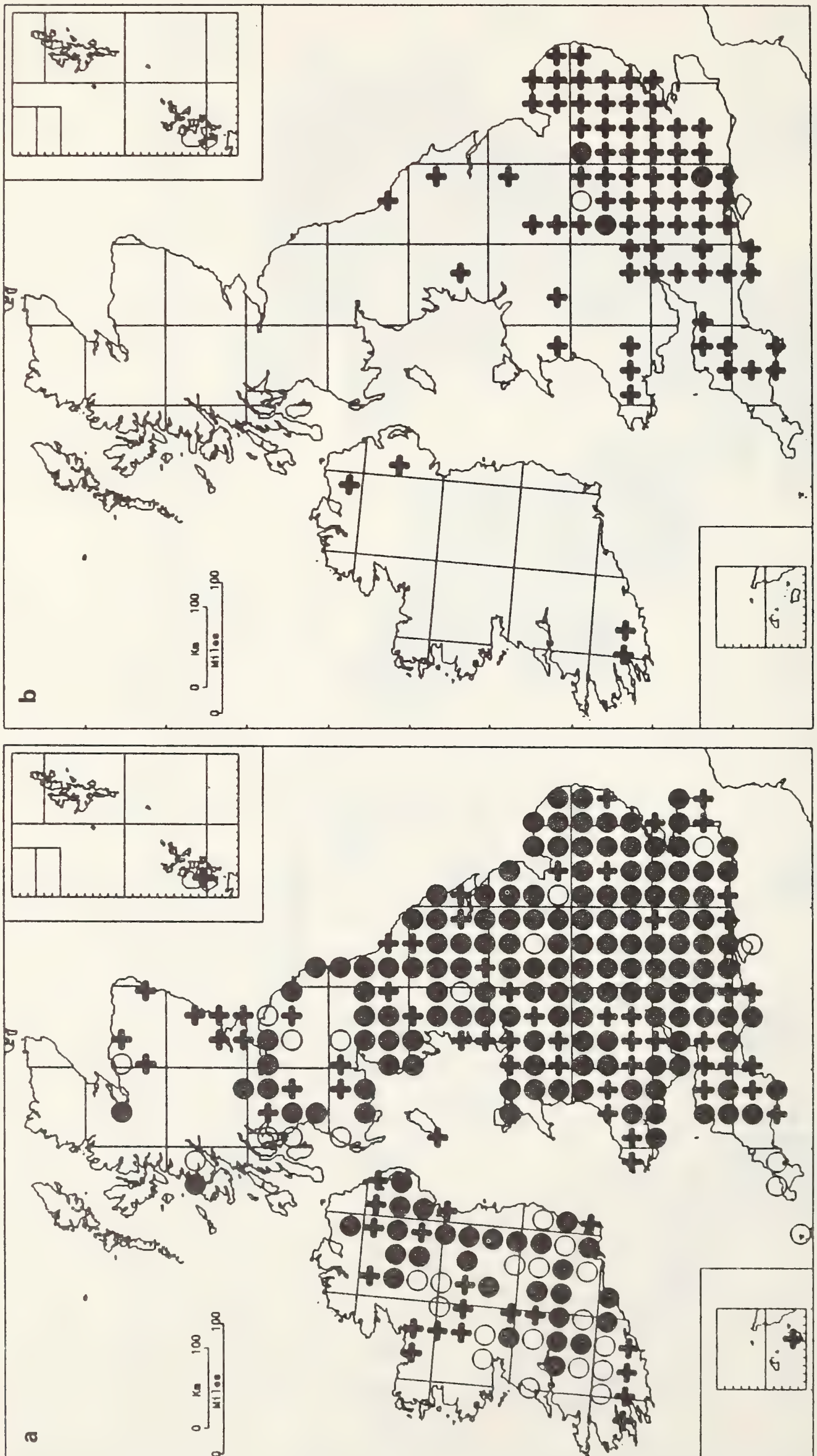


FIGURE 10. Apparent changes due to differences in areas surveyed: (a) Apparent increases in *Plantago maritima* due to increased recording of coastal squares (coastal squares not recorded for the *Atlas* are arrowed); (b) *Trifolium repens*, increases in coastal squares are again visible, and the apparent losses in Ireland are due to squares recorded for the *Atlas* not being re-recorded for the Monitoring Scheme.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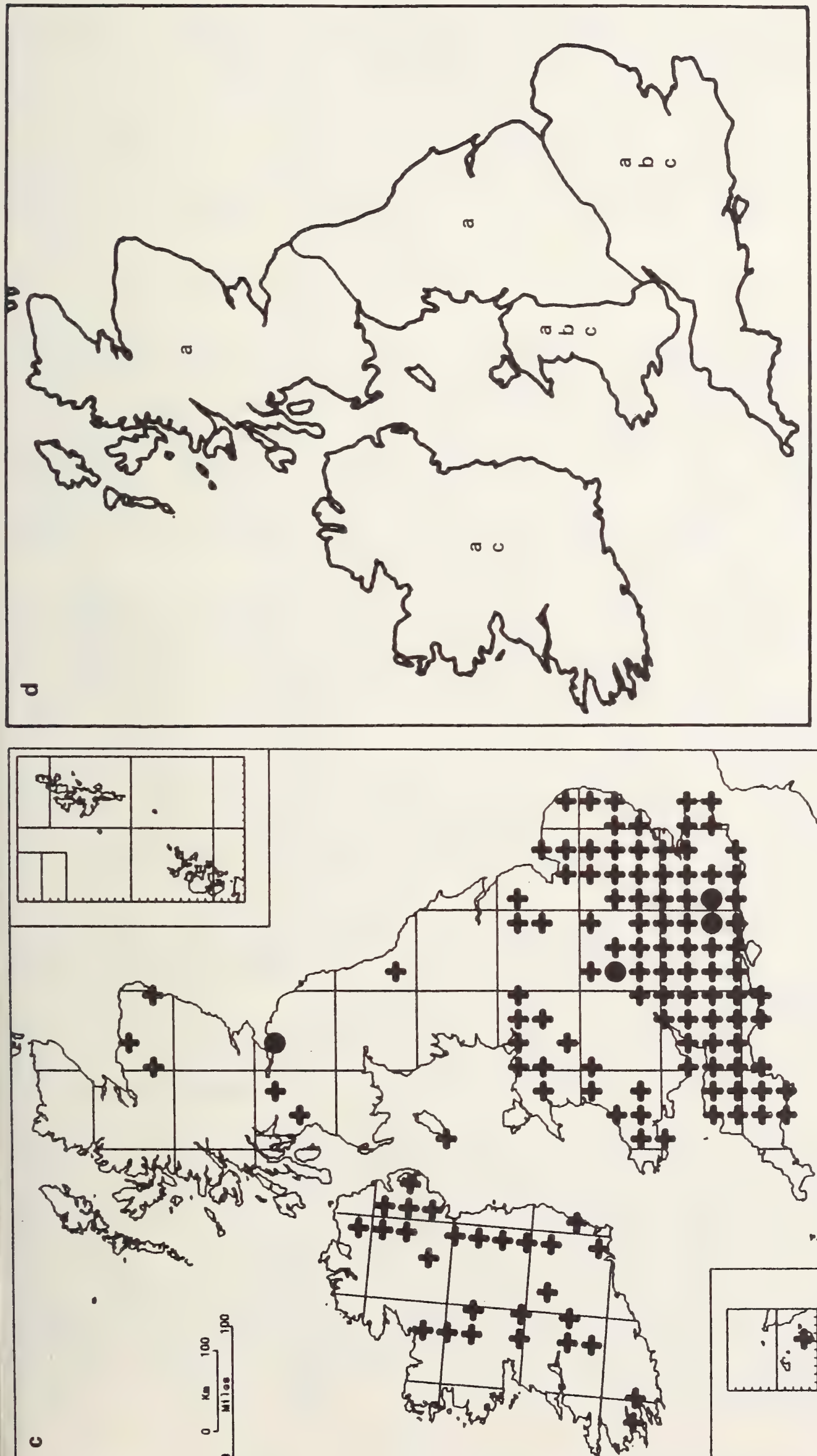

FIGURE 11. Correlations between taxa listed on the record cards and records of the taxa: (a) *Malus sylvestris* sensu lato; (b) *Malus sylvestris* sensu stricto; (c) *Malus domestica*; and (d) taxa listed on the cards (a, b and c as above).

TABLE 1. NUMBER OF 10-KM SQUARES RECORDED AND NUMBER OF RECORDS PER YEAR FOR THREE SPECIES OF ARABLE WEED FOR 1930–1960 AND 1987–1988 BASED ON RECORDS FROM THE B.S.B.I. MONITORING SCHEME SAMPLE SQUARES ONLY

	Number of 10-km squares recorded		Number of records per year	
Species	1930–60	1987–88	1930–60	1987–88
Agrostemma githago	29	7	0·94	3·5
Ranunculus arvensis	55	14	1·77	7
Scandix pecten-veneris	71	6	2·3	3

Trifolium repens is a virtually ubiquitous species present all year, and its seasonal recording pattern would therefore be expected to be similar to that of all records; Fig. 12b shows that it is.

Histograms for species showing seasonal variations in occurrence are shown in Figs 12c–e. *Adoxa moschatellina* is a perennial herb of woodlands and waysides with a very short period of growth from about March to June, after which it withers rapidly and disappears. *Hyacinthoides non-scripta* is also primarily a plant of the spring, but the fruiting stalks persist and it is consequently recorded until late summer. *Spiranthes spiralis* is a perennial herb of calcareous grasslands which flowers in late August and September but whose leaves are usually absent during the summer (Wells 1967). In these cases the seasonality of occurrence of the plants is matched by the records.

Two examples of changes in apparency are shown in Figs 12f & 12g. *Arum maculatum* is a perennial herb of woodlands, hedgerows and waysides, etc. throughout Britain and Ireland. It is conspicuous in spring when the leaves and inflorescences appear, but becomes less obvious in summer when the leaves die back, the fruiting heads are small and green, and other vegetation grows up around them. In August, the fruits begin to ripen and turn red, and the plants once again become conspicuous. These changes in apparency are reflected by the bimodal nature of the records; note that the plant is present in the summer but relatively under-recorded. The seasonality of records of *Viscum album*, an evergreen parasitic herb usually of deciduous trees and shrubs, is not quite as might be predicted. Records increase to May and then decrease, presumably related to the appearance of leaves on the trees. A rise in records might be predicted again in October when leaves are shed, but there is a surprising peak in August instead; the cause of this peak is not known. The small increase at Christmas may not be coincidence.

Fig. 12h shows the seasonality of records of *Salicornia europaea* sensu stricto. *Salicornia* is a critical genus (e.g. Rich & Rich 1988) whose species can only be reliably distinguished in autumn when in fruit, and Fig. 12h reflects this. *Salicornia* records not determined to species show a much broader spread of records as expected. Other similar examples of taxa which can only be identified at certain times of year include *Ruppia*, *Taraxacum* and *Hieracium*.

Such seasonal biases may influence assessments of change with time and might be reflected in the distribution maps. Fig. 13 shows 10-km squares which were not recorded before July or after June for the Monitoring Scheme in 1987 and 1988. Autumn and spring species might be expected to be under-recorded in these squares.

Perring & Walters (1962) noted that some species had died down before observers had arrived to record them for the *Atlas*, and thus appear to be rarer on the maps than they actually are. This effect was particularly marked in S.W. Ireland due to the early flowering season and the remoteness of the south west from the main centres of botanical activity. This is shown by the Monitoring Scheme results for one vernal species, *Anemone nemorosa* (Fig. 14a). The six new records for the Monitoring Scheme in S.W. Ireland are a direct result of more work earlier in the season; five of these new records are for squares visited early in the year (compare Fig. 14a with Fig. 13). No doubt the species also occurs in some of the squares only visited later. Similar results are shown for other vernal taxa such as *Ranunculus ficaria*. An increase in *Chrysosplenium oppositifolium* in Ireland (Fig. 14b), another species most conspicuous early in the year but present all season, may also be explained by this phenomenon.

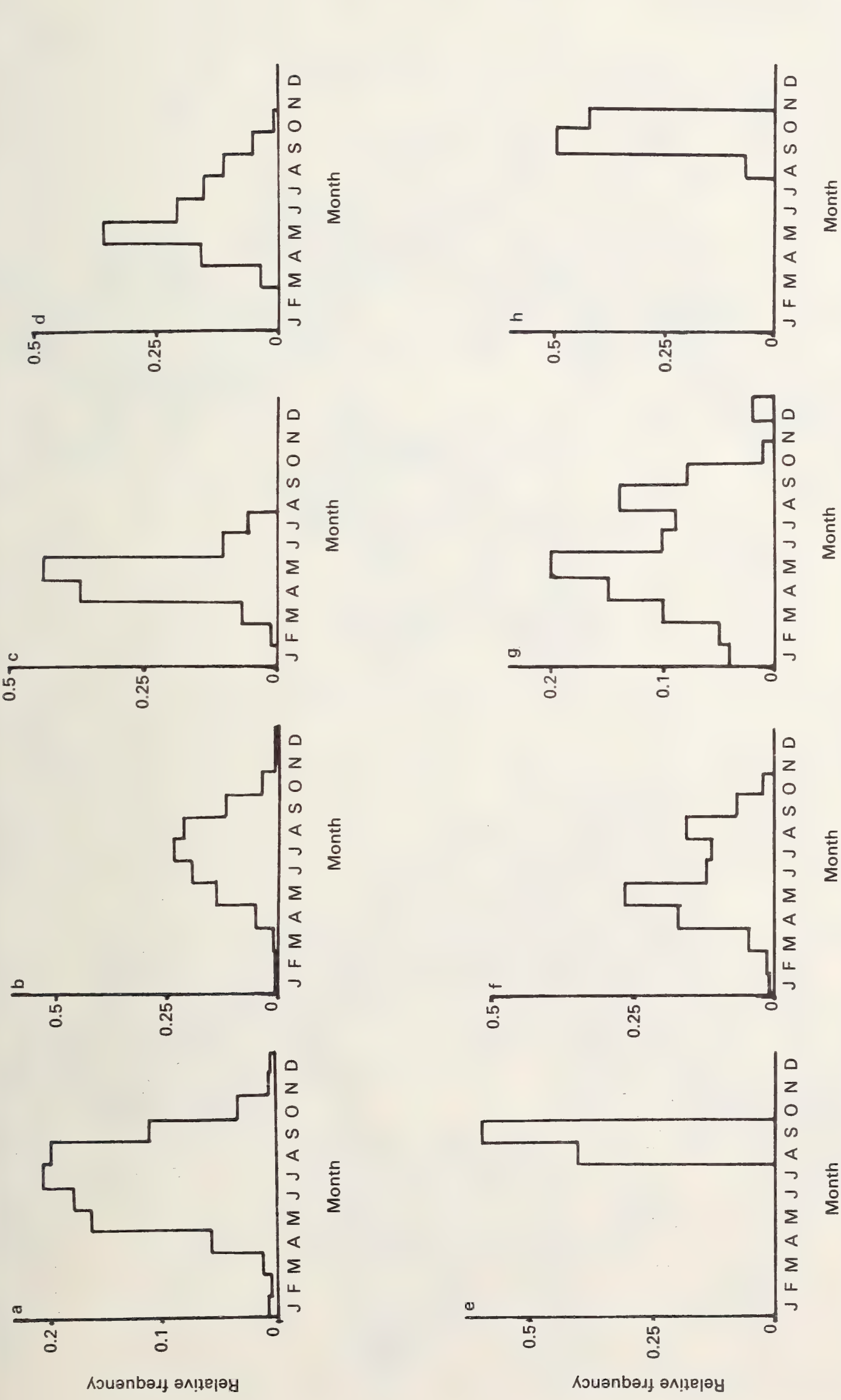

FIGURE 12. Histograms showing relative numbers of records per month for selected species recorded during the Monitoring Scheme in 1987 and 1988: (a) all records; (b) *Trifolium repens*; (c) *Adoxa moschatellina*; (d) *Hyacinthoides non-scripta*; (e) *Spiranthes spiralis*; (f) *Arum maculatum*; (g) *Viscum album*; (h) *Salicornia europaea* sensu stricto.

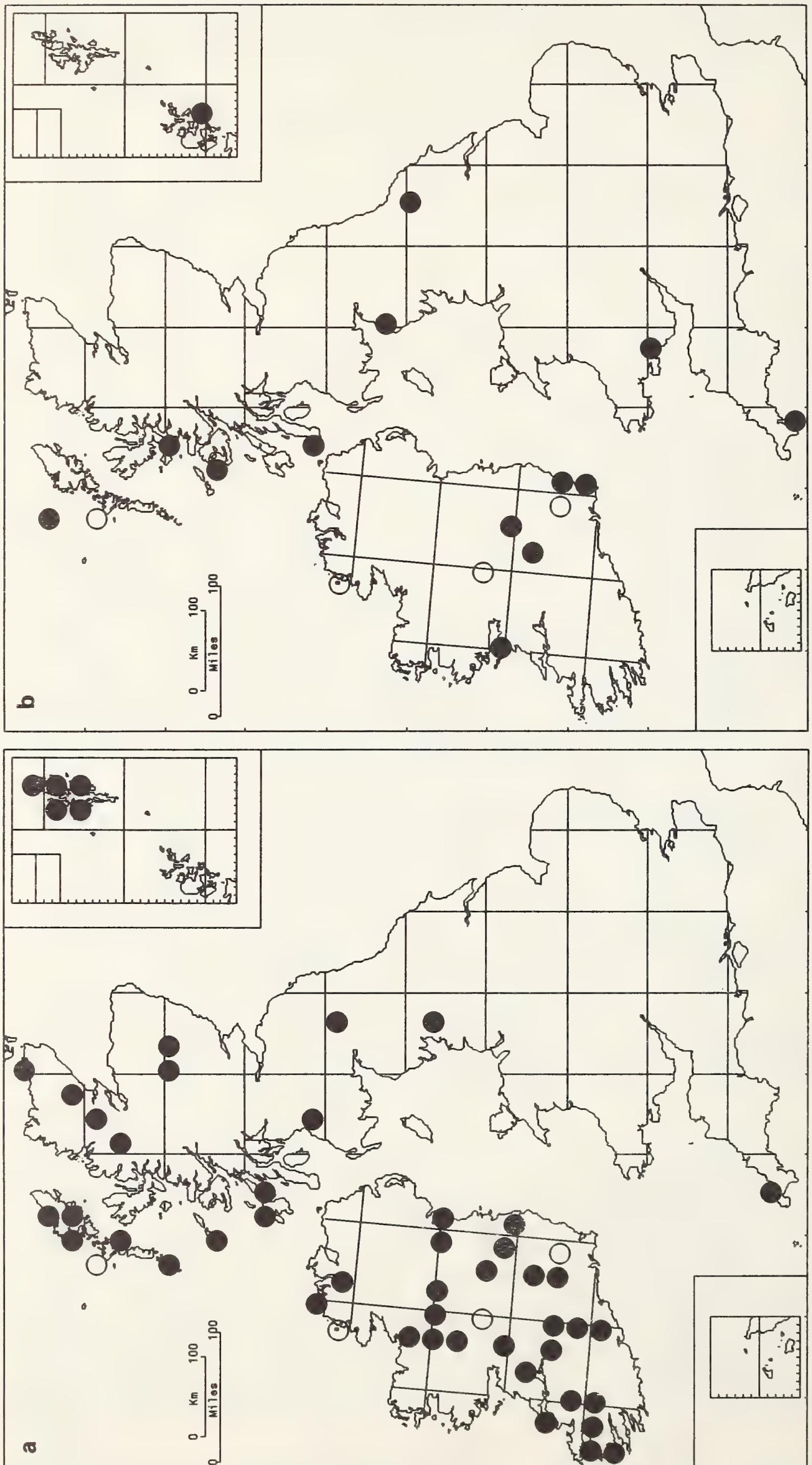

FIGURE 13. 10-km squares with a seasonal bias to the records for the Monitoring Scheme in 1987 and 1988: (a) squares not recorded before July; (b) squares not recorded after June. 10-km squares not recorded for either survey are shown as open circles.

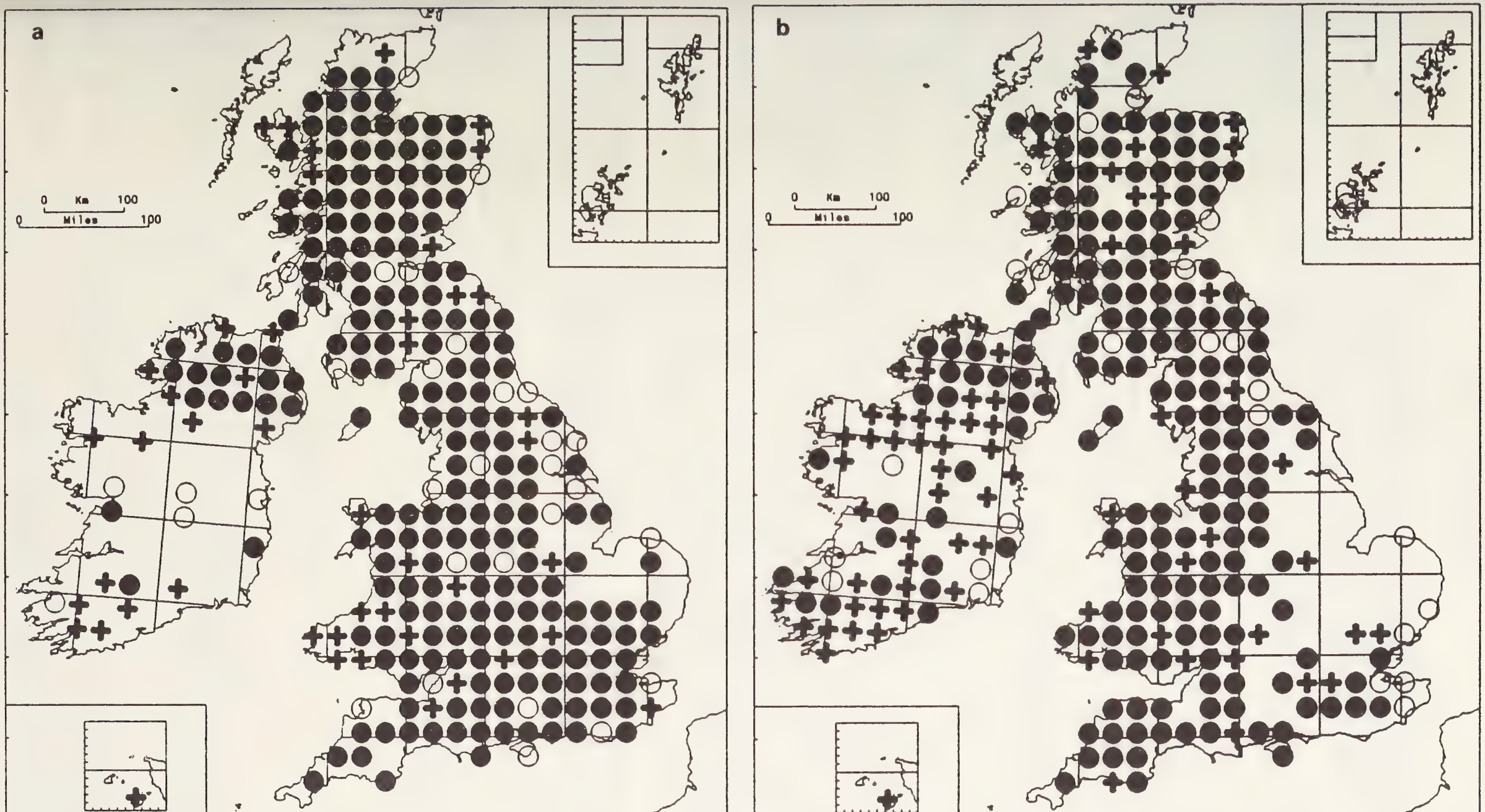

FIGURE 14. Taxa probably under-recorded in S.W. Ireland due to seasonal bias: (a) *Anemone nemorosa*; (b) *Chrysosplenium oppositifolium*.

DISCUSSION

It is clear from the examples above that recording bias is widespread in data collected for the *Atlas* and for the Monitoring Scheme. Approximately one third of the taxa analysed for the Monitoring Scheme were found to have unacceptable degrees of recording bias which could not be corrected. More than one form of bias may also be present – all examples presented here include a bias of greater recording effort (Rich & Woodruff 1990, 1992) for the Monitoring Scheme. Presumably biases similar to those presented here occur in most other botanical surveys, though they are rarely pointed out.

The extent of recording bias indicates that care should be taken with interpreting sets of records. Assessing recording bias is difficult and requires intimate knowledge of the taxa concerned, how they are recorded now and how they were recorded in the past, their habitats, general distribution and frequencies, variations in the quality and quantity of recording, etc. Although each case has to be judged on its merits, a few generalizations can be made:

1. Critical, infraspecific, hybrid and the more obscure taxa will generally show larger amounts of recording bias related to individual recorders.
2. Aliens, casuals, garden escapes, forestry trees, crops and deliberately planted taxa may be less consistently recorded than native species.
3. Areas briefly covered by few botanists will be less consistently recorded than areas well-covered by many botanists.
4. Localized areas may show considerable bias related to the activities of individual recorders.
5. Some habitats with difficult or limited access (e.g. mountains, cliffs, water) will be relatively poorly recorded. Others with easy access (e.g. car-parks, churchyards) may be well-recorded.
6. Large, obvious or clumped taxa will be more consistently recorded than small, inconspicuous or widely dispersed ones. Abundant species will be more consistently recorded than rarer species but national rarities tend to be well documented.
7. Species characteristic of the beginning and end of the field season will be less consistently recorded than those in mid season.
8. The number of records will primarily be dictated by recording effort put into collecting them.
9. Methods of survey may introduce systematic bias.

As records accumulate, the influence of recording bias will diminish, provided that adequate quality control is exercised. Experience is required to judge whether the bias is large enough to affect the interpretation of the records. It is easier to spot bias by comparing two similar surveys than to assess it in isolation.

The widespread occurrence of recording bias suggests that information about recorders and their behaviour should be collected and analysed as carefully as information about the organisms themselves. Unrecognised bias in a sample of records will result in an incorrect interpretation of the data. Those who collect, compile and present the data should therefore also provide interpretation to guide those unfamiliar with the problems.

ACKNOWLEDGMENTS

The work would not have been possible without the 1600 volunteers, largely members of the B.S.B.I., who contributed to the Monitoring Scheme in 1987 and 1988. Thanks are especially due to the B.S.B.I. vice-county Recorders and other nominated botanists who helped to co-ordinate the recording.

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A method for predicting the probability of species occurrence using data from systematic surveys

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ABSTRACT

Presence data for species in 2-km squares, recorded systematically during the B.S.B.I. Monitoring Scheme, were smoothed to derive probability response surfaces for *Euonymus europaeus* L., *Hyacinthoides non-scripta* (L.) Chouard ex Rothm., *Trientalis europaea* L. and *Veronica montana* L. Logistic regression was used to predict species frequencies from the response surfaces together with information on species occurrence in 10-km squares. Predicted frequencies were compared with those reported in some recent county floras. Agreement was generally good, but county differences in recording intensity were apparent.

INTRODUCTION

Accurate information on the spatial distribution of plants is now needed more than ever as human impacts on the environment intensify. Agricultural expansion and intensification (Green 1989), atmospheric pollutants (e.g. nitrogen compounds – see Tamm 1991) and climate change (Huntley *et al.* 1989) – thought to be a consequence of the increasing release of 'greenhouse' gases – are all seen to result in habitat change and species loss. Some gains are also to be expected as governments try to reduce agricultural surpluses by extensification and habitat creation, for example planting new woods on farms (Insley 1988).

Currently, and perhaps foreseeably, it is not possible to predict the presence or absence of a species from a knowledge of environmental factors and autecological characteristics alone. Prediction is dependent on good floristic survey data. Plant distribution maps with 10-km square resolution (Perring & Walters 1976), and local floras with tetrad (2-km square) resolution, are examples of such data for Britain. Dony (1963) described how floristic surveys can be used to predict the numbers of species occurring in tetrads. Hill (1991) demonstrated a method for using environmental data to estimate the probability of finding bird and plant species in 10-km squares. He concluded that the quality of the estimates varied with habitat preference, and that those species with strong edaphic requirements (e.g. *Helianthemum nummularium* (L.) Miller) were only poorly predicted in a broad-scale analysis.

For many species, the frequency of occurrence in tetrads provides a better indication of local abundance than a map of distribution at the 10-km square scale. However, a complete survey of vascular plants in Britain and Ireland at the tetrad scale would hardly be feasible, even if it were desirable. Fortunately, a systematic survey of a selected subset of tetrads not only is feasible but was accomplished by the B.S.B.I. Monitoring Scheme (Rich & Woodruff 1990). Data from this survey can be used to estimate the probability of finding species in tetrads that were not surveyed, and hence give an indication of local frequency.

The main purpose of this paper is to develop and compare methods for estimating such probabilities, using data from the Monitoring Scheme and other systematic surveys. In addition, we show how probability estimates can be used to generate species frequency maps at the national scale.

MATERIALS AND METHODS

The B.S.B.I. Monitoring Scheme (funded by the Nature Conservancy Council and the Department of the Environment, Northern Ireland) was a survey carried out in 1987 and 1988 and administered

TABLE 1. SAMPLING STATISTICS FOR THE B.S.B.I. MONITORING SCHEME
The British subset used in this work excludes data from Ireland and the Channel Islands.

Sample units	Sample size	Actual number surveyed	Number in British subset
10-km squares	429	425	298
Tetrads (A, J & W only)	1114	1080	796
Mean number of tetrads per 10-km square	2·60	2·54	2·67

through *B.S.B.I. News* (see Ellis 1986; Rich 1986, 1987, 1988, 1989). For the survey, one in nine of the 10-km squares were systematically selected from the British and Irish National Grids. Within selected 10-km squares, presence records for plant species were recorded in each of three systematically positioned tetrads (designated A, J and W). Some tetrads did not contain land, so that, on average, slightly fewer than three tetrads were sampled per 10-km square (Table 1). The Monitoring Scheme data are held by the Biological Records Centre (B.R.C.) at the Institute of Terrestrial Ecology (I.T.E.), Monks Wood. They are in ORACLE database format on a VAX computer cluster running under VMS (Rich & Woodruff 1990).

Records of species presence or absence in tetrads were smoothed to a response surface whose z-axis value is the probability of finding that species in the local tetrad. Each smoothed value is a weighted average of the neighbouring values, with weights specified by the bivariate Gaussian function with a root-mean-square deviation 30 km (Fig. 1). This smoothing radius was chosen because 30 km is the spacing of the Monitoring Scheme 10-km squares. A smaller radius would result in a response surface that showed marked local variation, reflecting frequencies in individual 10-km squares.

The smoothed value is

$$p_i = \frac{\sum_{k=1}^{n} w_k \alpha_{ik}}{\sum_{k=1}^{n} w_k}$$

where $w_k = \exp(-(x_k^2 + y_k^2)/r^2)$, p_i = estimated probability of finding the i^{th} species in the target tetrad, w_k = weight assigned to the k^{th} tetrad in the sample area, α_{ik} = value (1 or 0) specifying presence or absence of the i^{th} species in the k^{th} tetrad, r = smoothing radius (30 km), and x_k and y_k are the easting and northing distances of the k^{th} tetrad from the target tetrad. A smoothing radius of 30 km ensures that 98% of the weight comes from within a 60 km radius. Note that the summation is taken over tetrads surveyed for the Monitoring Scheme. A tetrad near the coast is given a smoothed value by averaging over nearby tetrads inland. This average is taken over a smaller number of points than for a non-coastal position, but is not otherwise affected by proximity to the sea.

Since presence and absence data are not normally distributed, the method of logistic regression analysis (cf. Jongman *et al.* 1987) was used to estimate species frequency in 10-km squares. Each Monitoring Scheme 10-km square was allocated a species frequency value which was calculated as the ratio of the number of occupied tetrads to the number of recorded (maximum three) tetrads. These values were regressed against the mean of the expected probabilities, estimated from the response surface, averaging probabilities over all the tetrads (25 maximum) within that square. Two models were considered: firstly, a model using only the spatially smoothed probability as independent variable (Model 1 below); secondly, a model (Model 2) using the spatially smoothed probability together with 10-km presence and absence data. For this purpose, 10-km data were obtained from the records held by B.R.C. at I.T.E., Monks Wood. These data comprise validated plant records from a variety of sources and were the records used to plot the *Atlas of the British flora* (Perring & Walters 1976).

The regression models, fitted by means of generalized linear modelling using the GENSTAT computer package, were

$$\log_e \left(\frac{q_i}{1-q_i}\right) = a_i + b_i\bar{p}_i \qquad \text{Model 1}$$

$$\log_e \left(\frac{q_i}{1-q_i}\right) = a_i + b_i\bar{p}_i + c_iB_i \qquad \text{Model 2}$$

where q_i = probability of finding the i^{th} species in a given tetrad of a Monitoring Scheme 10-km square, $\bar{p}_i$ = mean estimated probability of occurrence smoothed over the tetrads in the 10-km square, B_i = presence or absence (one or zero) of the i^{th} species in the 10-km square, and a_i, b_i & c_i are constants.

The accuracy of the smoothed probability surface was further investigated using a validation set of data from independent surveys obtained from a selection of those English county Floras meeting three criteria. Firstly, publication had to be relatively recent; secondly, records had to be available in atlas form for ease of data extraction; thirdly, mapping had to be at tetrad or 1-km square resolution. Those selected were for Bedfordshire (Dony 1976), Devon (Ivimey-Cook 1984), Durham (Graham 1988), north-east Essex (Tarpey & Heath 1990), Hertfordshire (Dony 1967), Kent (Philp 1982), Leicestershire (Primavesi & Evans 1988) and Sussex (Hall 1980). None of the available atlases from Wales or Scotland met the criteria (McCosh 1988). Only those 10-km squares falling wholly within the county (or vice-county) boundaries were considered. For each species and each 10-km square a table of presences out of the number of tetrads per 10-km square (25) was produced. For the north-east Essex Flora the published data are for 1-km squares and were summarized for each tetrad prior to processing.

Data from the county atlases were compared with both point estimates from simple Gaussian smoothing and predicted values from each of the logistic regression models. The basis for the comparison was the average number of presences in tetrads per 10-km square, county by county. Analysis of variance was used to test the significance of differences. Accuracy of predictions was measured by the root-mean-square difference between predicted and observed values.

To illustrate the technique we have selected four species, namely *Euonymus europaeus* L., *Hyacinthoides non-scripta* (L.) Chouard ex Rothm., *Trientalis europaea* L. and *Veronica montana* L. *E. europaeus* is a southern species of calcareous soils. *T. europaea* is a boreal species having a requirement for cooler northern winters. The other two species are generally distributed in older woodlands, but *H. non-scripta* is much the commoner of the two. Tetrad presences and absences (obtained from the B.S.B.I. Monitoring Scheme database) for each species have been plotted in Fig. 2. Version 6 of the UNIRAS computer package (I.U.C.C. Information Services Group 1989) was used for this and subsequent distribution maps and figures. Orkney and Shetland have been omitted. For them, as for the Isle of Man (which was included, but which had only three tetrads), a larger smoothing radius than 30 km might be desirable.

RESULTS

The response surfaces obtained by Gaussian smoothing are illustrated in Fig. 3. Regression coefficients and significance levels for Models 1 and 2 are shown in Table 2. Highly significant results can be expected because the independent regression variables were derived from the observed values (dependent variables) by smoothing. Both Models 1 and 2 contain the derived variable $\bar{p}_i$.

The comparisons between county atlas records and the estimated values from Gaussian-smoothed and regression models are shown in Table 3. The Gaussian-smoothed values were obtained by summing p_i for each tetrad in the 10-km square; predicted values from Models 1 and 2 were obtained by inserting appropriate $\bar{p}_i$ values into the regression equations to obtain values of q_i. Although many of the estimated values were close to those expected from the county Floras there were some substantial differences (Table 3).

The mean deviation (bias) was smallest for the prediction method using Model 2, but the bias of all three methods was small and not statistically significant (Table 4). The root-mean-square error for Model 2 was less than for Model 1 and approached that of the Gaussian-smoothed probabilities. The analysis of variance shows no effect due to species but a highly significant county effect. The bulk of the county effect can be attributed to underestimation by the three methods of tetrad frequencies in Kent and possible over-estimation in Bedfordshire.

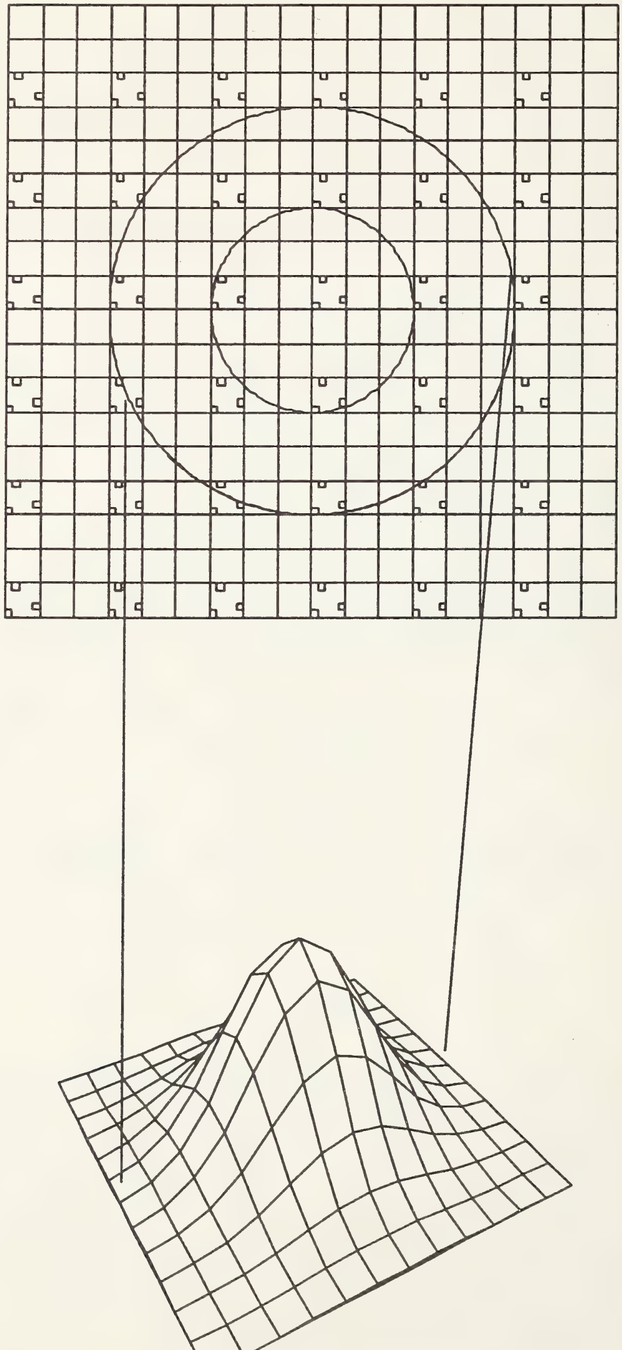


FIGURE 1. Gaussian smoothing of occurrence in tetrads (2-km squares). At any point in Britain the probability of a species being found in that tetrad is estimated as a weighted mean local frequency. Weights are defined by a Gaussian function with root-mean-square deviation 30 km. The diagram shows the weight function projected on to a 10-km square grid with the A, J and W tetrads for the one-in-nine sample indicated.

TABLE 2. LOGISTIC REGRESSION OF OBSERVED AGAINST PREDICTED FREQUENCIES IN 10-KM SQUARES OF THE B.S.B.I. MONITORING SCHEME

Coefficients a_i, b_i and c_i are defined in the text for Models 1 and 2. Degrees of freedom were (1, 296) for Model 1 and (2, 295) for Model 2.

Species	a_i	b_i	c_i	Deviance explained (%)	Significance
		Model 1			
Euonymus europaeus	−4·27	8·50	—	74·3	p<0·001
Hyacinthoides non-scripta	−3·86	7·40	—	69·2	p<0·001
Trientalis europaea	−5·51	11·71	—	83·3	p<0·001
Veronica montana	−3·90	9·29	—	62·7	p<0·001
		Model 2			
Euonymus europaeus	−10·35	6·35	7·34	80·8	p<0·001
Hyacinthoides non-scripta	−10·28	6·86	6·80	71·9	p<0·001
Trientalis europaea	−10·20	7·68	6·73	87·9	p<0·001
Veronica montana	−10·81	7·65	7·67	72·1	p<0·001

TABLE 3. OBSERVED (1) AND PREDICTED (2–4) NUMBERS OF TETRADS OCCUPIED BY SPECIES PER 10-KM SQUARE IN SELECTED COUNTIES

1 – average number of tetrads occupied according to the county atlases; 2 – expected value using the Gaussian-smoothed Monitoring Scheme data; 3 and 4 – expected values using regression models 1 and 2 respectively.

	Beds.	Devon	Durham	Essex	Herts.	Kent	Leics.	Sussex	Total
n	5	49	15	7	5	22	10	24	137
				Euonymus europaeus					
1	11·4	9·8	0·0	13·0	15·2	19·7	0·4	15·4	11·0
2	15·7	14·1	0·0	15·1	19·6	8·0	0·5	11·4	10·4
3	18·4	15·4	0·4	17·5	22·9	4·8	0·4	11·3	10·7
4	18·0	11·4	0·3	13·0	21·9	7·0	0·7	11·3	9·4
				Hyacinthoides non-scripta					
1	14·8	20·1	13·1	15·6	20·2	23·2	14·4	23·8	19·6
2	20·1	18·8	17·0	19·4	22·8	13·2	8·3	18·4	17·1
3	21·8	20·4	18·8	21·6	23·6	12·8	5·8	20·4	18·2
4	21·8	20·4	16·7	21·4	23·4	13·2	5·7	20·4	18·0
				Trientalis europaea					
1	0	0	0	0	0	0	0	0	0
2	0	0	0·2	0	0	0	0	0	0
3	0·2	0·1	0·1	0·1	0·2	0·1	0·1	0·1	0·1
4	0	0	0·1	0	0	0	0	0	0
				Veronica montana					
1	0·8	12·0	6·9	5·0	11·0	14·2	3·6	16·0	11·1
2	4·1	13·2	11·4	7·2	10·0	6·1	3·1	10·5	9·9
3	2·4	17·0	14·5	6·0	11·5	5·9	1·5	12·4	11·7
4	2·7	15·2	11·8	6·7	12·1	6·7	1·4	11·9	10·9

n = number of 10-km squares.

DISCUSSION

Smoothed distribution maps (Fig. 3) demonstrate the potential of the Monitoring Scheme data for depicting probabilities of occurrence in tetrads. Similar smoothed maps could be used in future to compare survey and re-survey results given a common survey protocol.

The ability of all the methods, including simple Gaussian smoothing and regression, to predict the

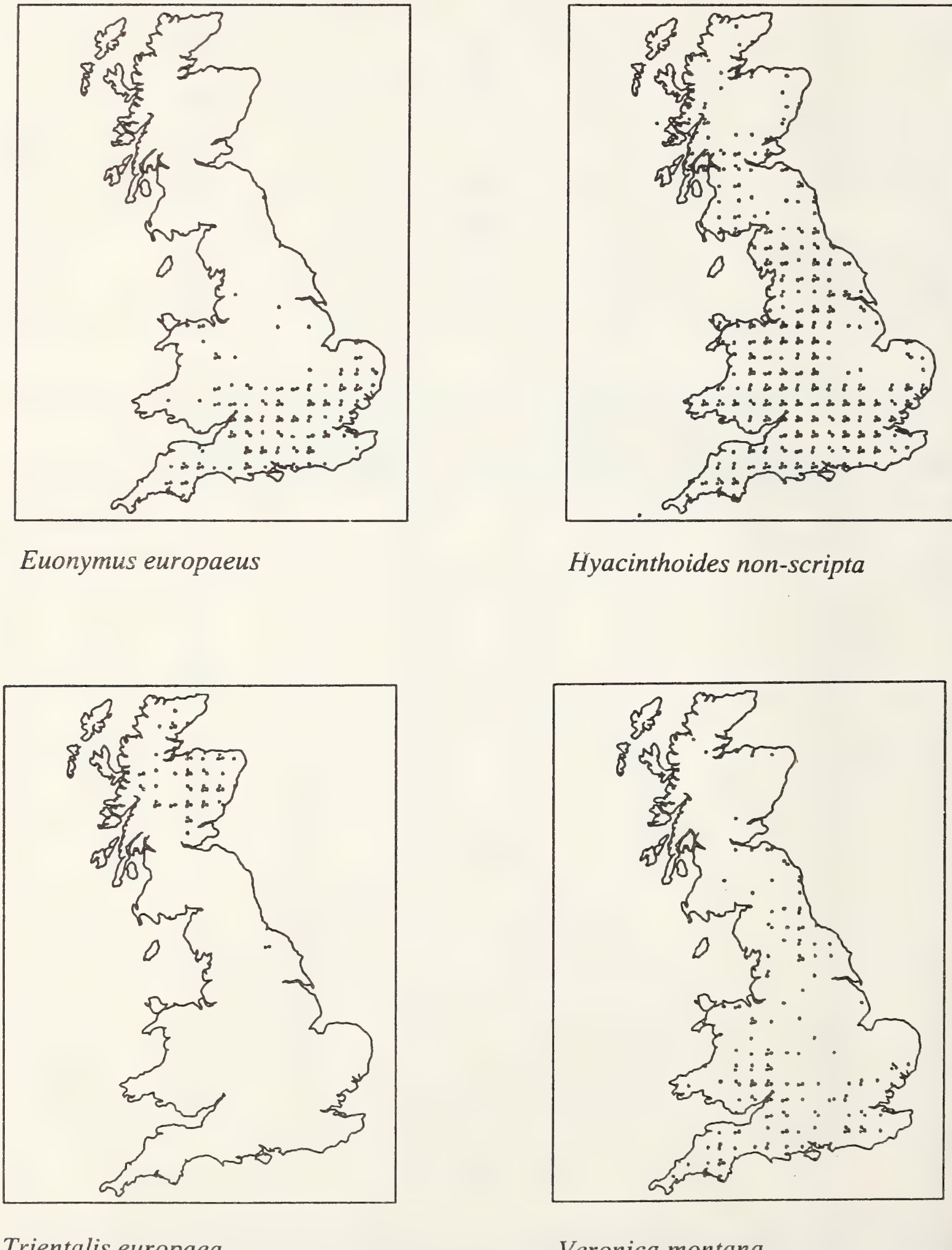
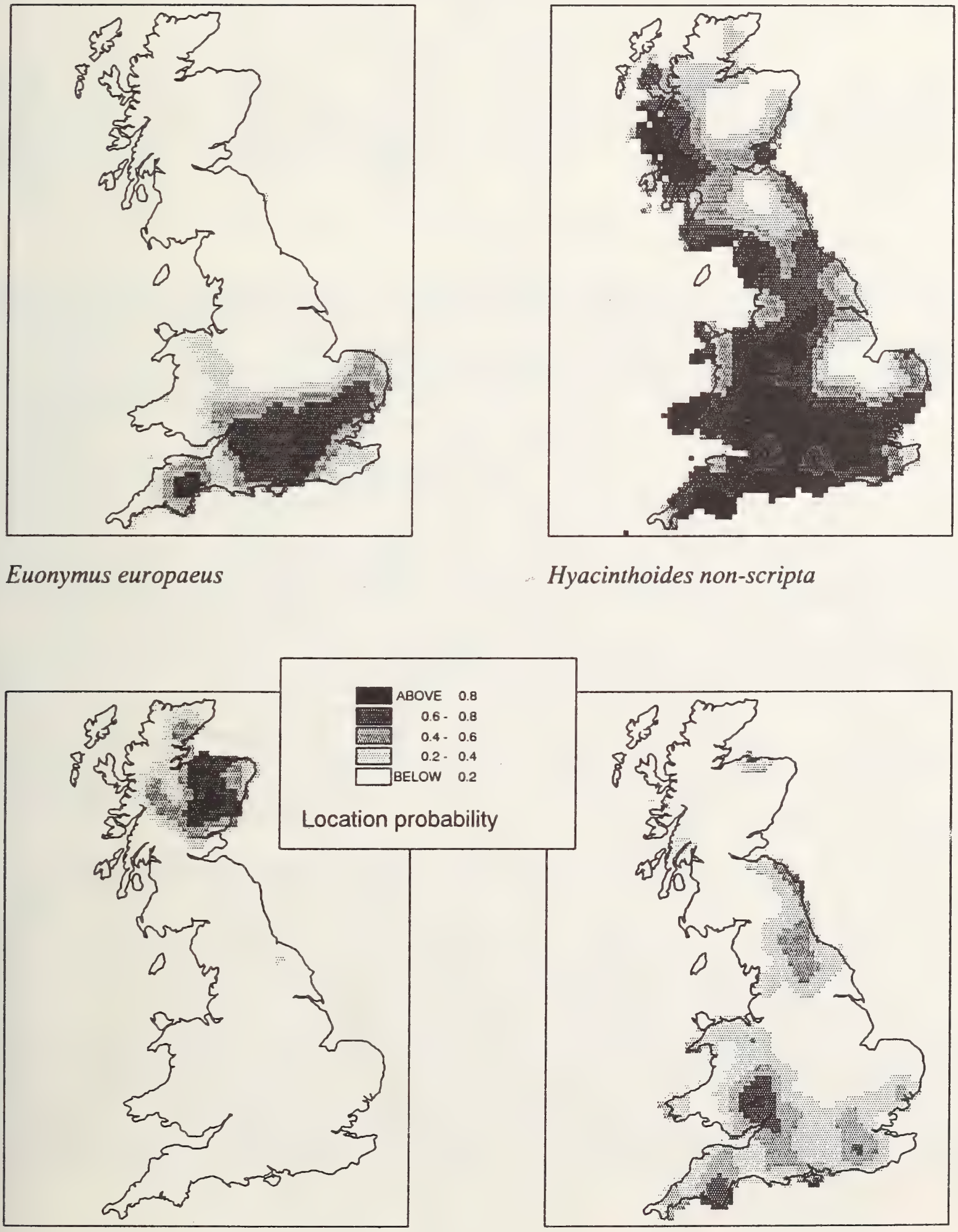


FIGURE 2. Species occurrence in tetrads (2-km squares) recorded during the B.S.B.I. Monitoring Scheme.



Euonymus europaeus *Hyacinthoides non-scripta*

Trientalis europaea *Veronica montana*

FIGURE 3. Probabilities of species occurrence in tetrads (2-km squares), estimated by smoothing the data in Fig. 2 with a Gaussian function.

TABLE 4. ANALYSIS OF THE DIFFERENCES BETWEEN TETRAD FREQUENCIES FOR 10-KM SQUARES, COMPARING FREQUENCIES OF *EUONYMUS EUROPAEUS*, *HYACINTHOIDES NON-SCRIPTA* AND *VERONICA MONTANA* PREDICTED FROM THE MONITORING SCHEME WITH THOSE OBSERVED IN COUNTY FLORAS

Models 1 and 2 are defined in the text. Method effect refers to tests of the null hypothesis that the mean deviation is zero.

Observed mean county density	Mean deviation (bias)	RMSE	Method effect t_{14}	Species effect $F_{2,14}$	County effect $F_{7,14}$	Kent vs others $F_{1,14}$
Gaussian smoothed	−0·50	4·91	−1·05 ns	0·25 ns	13·11 ***	56·6 ***
Regression Model 1	0·32	6·10	0·46 ns	0·10 ns	8·88 ***	39·0 ***
Regression Model 2	−0·19	5·34	−0·36 ns	0·00 ns	8·97 ***	37·6 ***

RMSE = root-mean-square error; ns = not significant; *** = $p<0{\cdot}001$.

B.S.B.I. Monitoring Scheme data was generally quite good. The mean deviation (bias) was smallest for the prediction method using Model 2, the root-mean-square error indicating its advantage over Model 1. However the error was least for simple Gaussian smoothing.

There was a notable and statistically very significant difference between counties (Table 4). In terms of effort per tetrad, Kent was more intensively surveyed for the county Flora than for the Monitoring Scheme, whilst Bedfordshire was less so. In any survey the uniformity of sampling effort is of great importance. The B.S.B.I. Monitoring Scheme was carefully controlled with this objective (Rich & Woodruff 1990), but differences must inevitably have occurred. Variation also exists between the county Floras, some being over-sampled in comparison with the Monitoring Scheme, whilst others were relatively under-sampled.

For validation we have selected county Floras with a high and fairly uniform sampling coverage. Even though the per-tetrad effort may sometimes have been less than that achieved by the Monitoring Scheme, overall they will all have had more intensive sampling. Thus the resolution of the response surfaces produced from the Monitoring Scheme will be poorer than those which could be obtained from the county Floras. In general we would expect those species with a fairly general but patchy distribution, such as those requiring habitats in old woods, to be less easy to predict than those species with distributions depending on some more widespread factor of the physical environment such as climate or soil type. This seems to be the case when comparing the deviances explained for *E. europaeus* and *T. europaea* on the one hand, with *H. non-scripta* and *V. montana* on the other (Table 2). It is also supported by the closer agreement between overall county atlas data and the Gaussian-smoothed response surface (rows 1 and 2 in Table 3) for *E. europaeus* than for *H. non-scripta* and *V. montana*.

The ability to predict species presence or absence using regression methods also seems to be somewhat species-specific (Table 2). Those whose distribution is strongly restricted by specific environmental factors such as climate (*E. europaeus* and *T. europaea*) are seen to be better predicted than the others. Predictions were substantially improved by including information on 10-km square occurrence (Model 2). It is interesting that the coefficients a_i, b_i, c_i in Model 2 were so close in value that a single regression would have sufficed for all four species.

One of the main advantages of the logistic regression approach is that it can readily be extended to include other information (Le Duc *et al.* 1992). Such information might include, for instance, soil type (Avery 1973) and local climate (Bendelow & Hartnup 1980). Perhaps more important for many widespread species would be inclusion of additional habitat information such as the presence of woods, rivers, or a coastline. Such information is now becoming available in, for instance, the I.T.E. land classification database (Bunce *et al.* 1981). The more accurately the present frequency of a species can be estimated the better we shall be able to detect change in the future.

CONCLUSIONS

In Great Britain, sufficiently good survey data are now available to derive reliable national estimates of the probability of species occurrence in tetrads. Such estimates can be validated using independent data from county Floras. Using Gaussian-smoothed data from the Monitoring Scheme, combined with additional information about each tetrad, regression models can be developed which would improve the accuracy of estimates. These estimates can be used in future to detect the effects of major disturbances such as climate change or large-scale shifts in land use.

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The distinction between the *Festuca ovina* L. and *Festuca rubra* L. aggregates in the British Isles

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ABSTRACT

The *Festuca rubra* L. and *F. ovina* L. aggregates (Poaceae) are defined and reliable means of distinguishing them in the British Isles are given. The best character concerns the young tiller leaf-sheaths, which are tubular in the former and split and overlapping in the latter aggregate. Characters that are often used to separate the two aggregates but are unreliable and therefore frequently cause misidentification are also listed.

INTRODUCTION

Festuca ovina L. and *F. rubra* L. fall into section *Ovinae* Fries (= sect. *Festuca*) according to Hackel's (1882) classification of the genus in Europe. Apart from these two species, which were each subdivided into a complex hierarchy of subspecies, varieties and subvarieties, Hackel included only nine other species, none of them British. He divided the section into two groups: *Intravaginales*, including *F. ovina* and eight other species; and *Extravaginales vel Mixtae*, with *F. rubra* and *F. porcii* Hackel.

Markgraf-Dannenberg (1980) abandoned Hackel's infrageneric classification, placing the 170 European species that she recognised into a number of informal, unnamed groups. However, it is clear that 129 of these species would have been included in section *Ovinae* by Hackel. The increase from eleven to 129 over a period of 100 years is partly due to the description of newly discovered taxa, and partly due to a much narrower species concept that gradually developed.

All the British taxa now recognised were placed by Hackel (1882) into either *F. ovina* or *F. rubra*, which are for convenience here referred to as the *F. ovina* and *F. rubra* aggregates. These taxa are listed under the names used by Hackel, Markgraf-Dannenberg and us (Wilkinson & Stace 1991, Al-Bermani 1991) in Table 1.

Both the aggregates are very variable and also very important from both ecological and economic points of view. It is vital that plants of such importance are identified correctly, so it is particularly unfortunate that not only have the segregates of both aggregates been very widely misunderstood, but the two aggregates have been and are still frequently confused, particularly by British botanists. Virtually all the current British Floras, identification manuals and flower-guides that we have examined contain errors that would prevent accurate determination of at least some plants. Although most taxa of *F. ovina* agg. are easily separated from most taxa of *F. rubra* agg., certain taxa are not so easily placed. For example, within *F. ovina* agg., *F. lemanii* Bast. and *F. brevipila* Tracey are usually much more robust than, for example, *F. ovina* and are often misidentified as *F. rubra*. Conversely, *F. rubra* subsp. *commutata* Gaudin usually lacks rhizomes and is sometimes identified as a robust variant of *F. ovina* agg. In addition, pseudoviviparous variants of *F. rubra* are quite frequent and usually misdetermined as *F. vivipara* (L.) Sm., which belongs to the *F. ovina* agg. Although characters such as spikelet, lemma or awn lengths, leaf thickness and flatness and degree of adaxial ridging, culm height, degree of tuftedness and presence of rhizomes are important diagnostically in the section as a whole, they are of very little value on their own in distinguishing between the two aggregates, being in fact the most usual causes of confusion. Moreover, habitat preferences are of very limited value in separating these aggregates. For accurate determination it is

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TABLE 1. CLASSIFICATION OF *FESTUCA RUBRA* AND *F. OVINA* AGGREGATES IN THE BRITISH ISLES

Hackel (1882)				Markgraf-Dannenberg (1980)	Present paper
F. ovina	subsp. *eu-ovina*	var. *vulgaris*	subvar. *genuina*	*F. ovina*	*F. ovina* subsp. *ovina*
—				—	subsp. *hirtula*
			subvar. *guestphalica*	?*F. guestfalica*	
				F. ophioliticola	subsp. *ophioliticola*
			subvar. *firmula*	*F. lemanii*	*F. lemanii*†
		var. *capillata*		*F. tenuifolia*	*F. filiformis*
—				*F. armoricana*	*F. armoricana*
—				*F. huonii*	*F. huonii*
		var. *supina*	subvar. *vivipara*	*F. vivipara*	*F. vivipara*
		var. *glauca*	subvar. *caesia*	*F. longifolia*	*F. longifolia**
		var. *duriuscula*	subvar. *trachyphylla*	*F. trachyphylla*	
				F. brevipila	*F. brevipila*†
F. rubra	subsp. *heterophylla*			*F. heterophylla*	*F. heterophylla*
	subsp. *dumetorum*			*F. juncifolia*	*F. arenaria*
	subsp. *eu-rubra*	var. *genuina*	subvar. *arenaria*	*F. rubra* subsp. *arenaria*	
			subvar. *vulgaris*	subsp. *rubra*	*F. rubra* subsp. *rubra*
—				subsp. *litoralis*	subsp. *litoralis*
			subvar. *juncea*	subsp. *juncea*	subsp. *juncea*
			subvar. *pruinosa* (1885)	subsp. *pruinosa*	
			subvar. *grandiflora*	*F. diffusa*	subsp. *megastachys*
		var. *planifolia*			
		var. *fallax*		*F. nigrescens*	subsp. *commutata*
—				*F. richardsonii*	subsp. *arctica*
—				—	subsp. *scotica*

* The name *F. glauca* has often been wrongly applied to this species.
† The name *F. longifolia* has often been wrongly applied to these species.

important that all these misleading characters be abandoned and that attention be focused on the characters described in the next section.

The purpose of this paper is to provide infallible means of distinguishing between the *F. ovina* and *F. rubra* aggregates in the British Isles. Distinctions between the various segregates as listed in Table 1 have been detailed by Wilkinson & Stace (1991) for the *F. ovina* aggregate and will be detailed by Al-Bermani & Stace (in prep.) for the *F. rubra* aggregate. The data presented in the present paper have been gathered from many thousands of specimens, both living and preserved, over the past 20 years. Several hundred clones are grown and frequently studied in the University of Leicester Botanic Garden.

The characters discussed here would require some modification if they were to be used successfully in some other parts of Europe.

DIAGNOSTIC CHARACTERS

The first two characters below provide an infallible distinction between the two aggregates; the others may be useful guides but should not be relied upon.

TILLER LEAF-SHEATHS – FUSED OR OVERLAPPING

In almost all grass leaves there is a clear distinction between the sheath, which encircles the stem and/or developing leaves above, and the blade, which arises from the top of the sheath. In some cases this overlapping structure persists to the base of the sheath, i.e. to the stem-node below, but often it progresses only part of the way down to the node, becoming a fused tube further down. In other cases the sheath has no free overlapping edges, but is a fused tube from the node below right up to the mouth of the sheath. This is particularly characteristic of the genera *Glyceria* and *Melica*.

In the *Festuca rubra* aggregate the leaf-sheaths are tubular right up to or almost to the mouth, whereas in the *Festuca ovina* aggregate they have free overlapping edges for at least the upper 40% (and usually the upper 75%) of their length (Fig. 1). Only in very rare cases in the latter aggregate are the leaf-sheaths as much as 50% tubular.

This difference is very clear-cut, but careful examination (preferably with a lens) must be made in order to avoid mistakes. Fresh material is much more easily observed than dried or pressed material. Moreover the tubular sheaths of *F. rubra* agg. are easily split on handling. It is essential that this observation is made on *sterile innovation shoots (tillers)*, not on flowering shoots (culms), and that only the younger sheaths are examined. Older sheaths, including all those on the culms, become naturally split to the base. The older leaves should be successively stripped back from a tiller, leaving the uppermost sheath that was partly exposed as the one to examine.

This is the single best character to distinguish the two aggregates.

TILLERS – EXTRAVAGINAL OR INTRAVAGINAL

Tillers arise from lower nodes of culms or of other tillers (actually from the axil between the stem and the base of the leaf-sheath) in one of two ways.

In intravaginal branching (Fig. 1) the new shoot grows up more or less parallel with its parent stem and remains enclosed for some distance within the leaf-sheath in whose axil it arose. Higher up, the new shoot diverges from its parent, and later on the parental leaf-sheath often decays away, but the parallel growth of the old and new stems at the very base usually persists as evidence of intravaginal branching. In the *Festuca ovina* aggregate all branching is of this sort.

In extravaginal branching (Fig. 1) the new shoot does not grow up parallel with the parent stem but grows out more or less at right angles, breaking through the base of the parent leaf-sheath (cf. lateral branches of *Equisetum* stems). Members of the *Festuca rubra* aggregate always exhibit extravaginal branching, but this varies in relative frequency from being the only type of branching to being much less common than intravaginal branching (hence Hackel's group *Extravaginales vel Mixtae*). With copious fresh material the presence of extravaginal branches is therefore diagnostic of *F. rubra* agg. (and their absence diagnostic of *F. ovina* agg.), but with herbarium material, which is often very poorly collected, it is not safe to use this character except in a positive way.

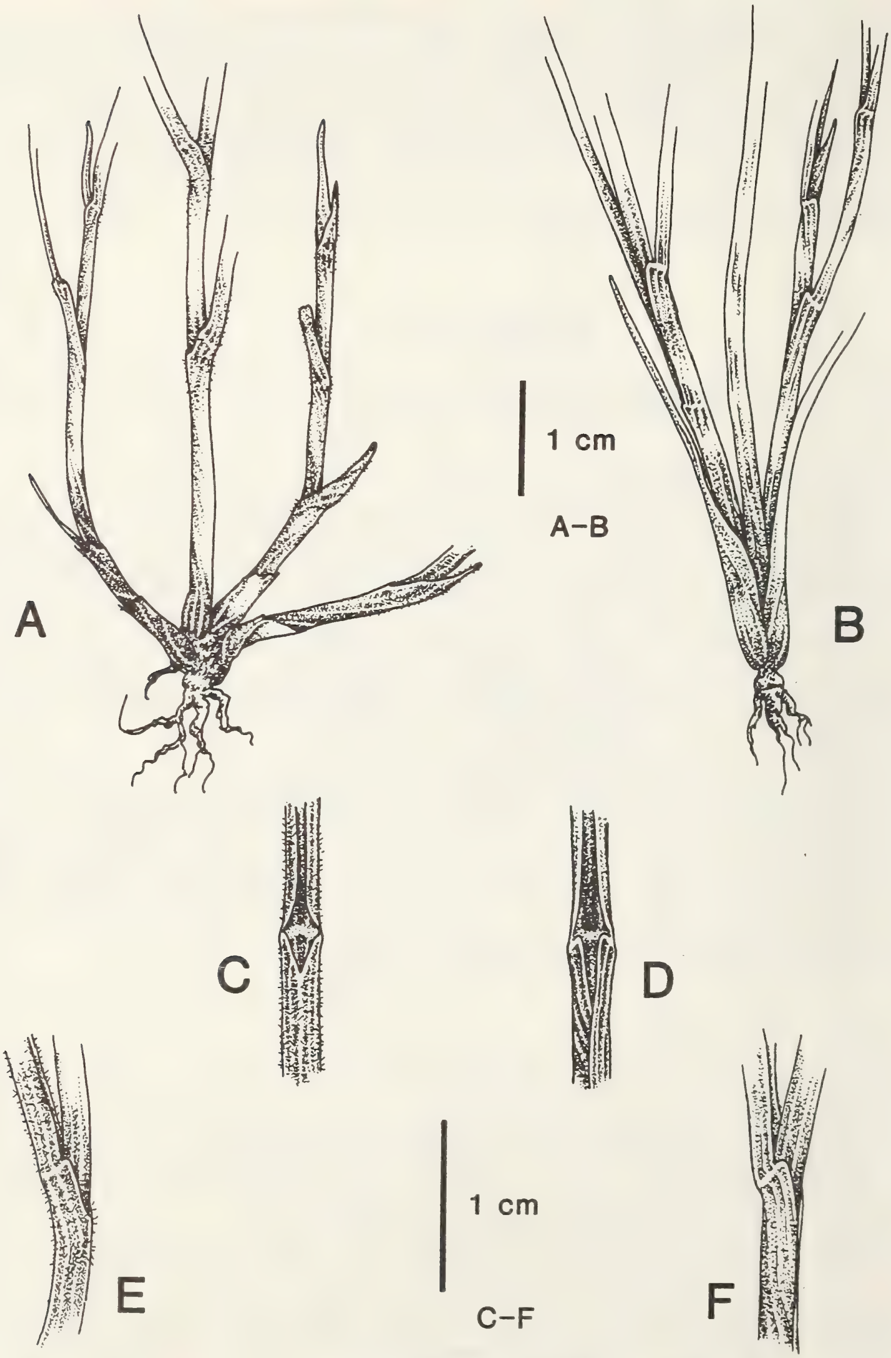

FIGURE 1. Morphological characters of *Festuca rubra* agg. and *F. ovina* agg. A, extravaginal tillers. B, intravaginal tillers. C, fused tiller leaf-sheath as in *F. rubra* agg. D, overlapping tiller leaf-sheath as in *F. ovina* agg. E, vestigial auricles as in *F. rubra* agg. F, distinct auricles as in *F. ovina* agg.

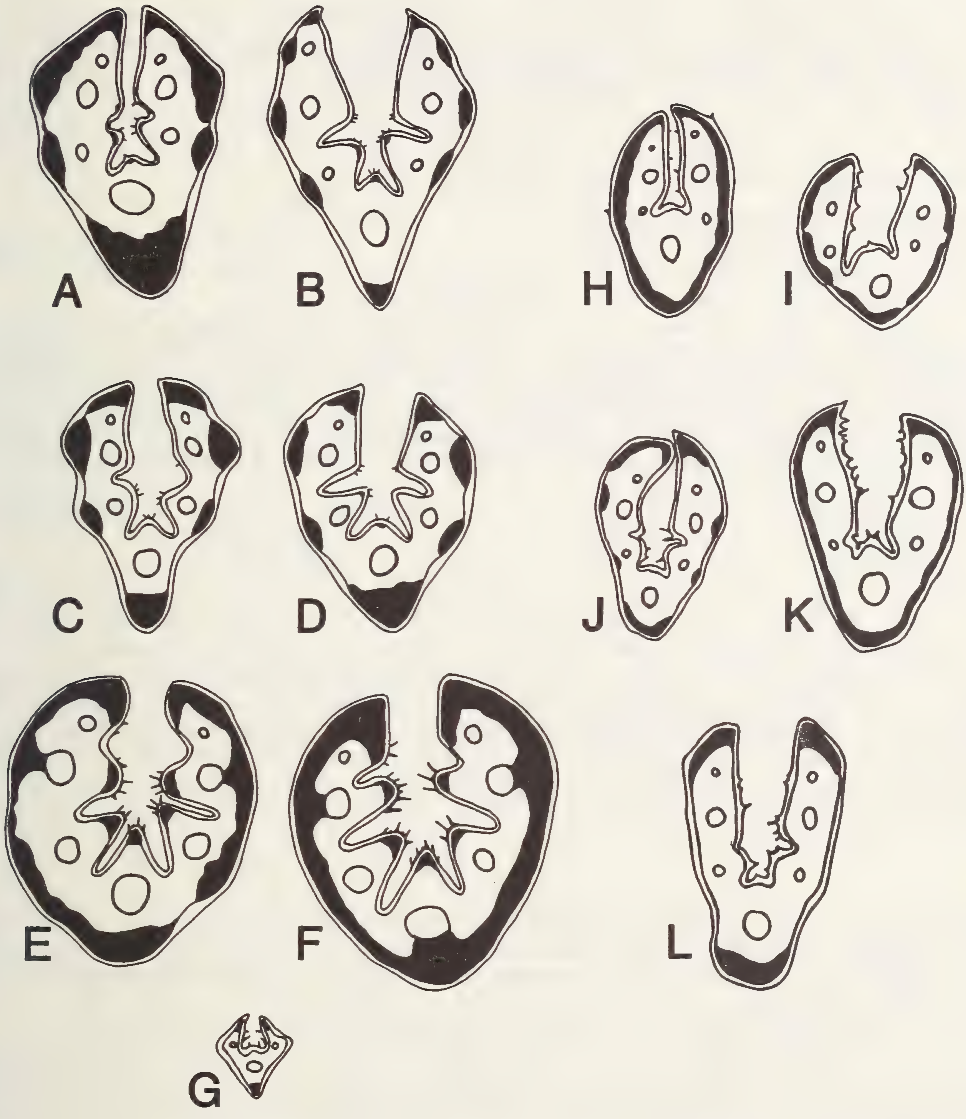

FIGURE 2. Patterns of sclerenchyma distribution (in black) in tiller leaf sections of *Festuca rubra* agg. (A–G) and *F. ovina* agg. (H–L).

GROWTH HABIT – TUFTED OR RHIZOMATOUS

Rhizomes always develop from extravaginal branches, but both intravaginal and extravaginal branches may remain close to the parent stem, resulting in a densely tufted habit. Hence the presence of rhizomes is diagnostic of *F. rubra* agg., but their absence is not diagnostic of *F. ovina* agg. Some rhizomes exist even on plants of *F. rubra* agg. that are very densely tufted, except in *F. heterophylla* Lam. and some specimens of *F. rubra* subsp. *commutata*. Mat-forming plants are almost always rhizomatous to some degree.

AURICLES – CONSPICUOUS OR INCONSPICUOUS

Auricles are developed in many grasses at the top of the leaf-sheath, on either side of its point of junction with the leaf-blade and ligule. In some species, such as *Festuca pratensis* Hudson, these are very conspicuous and developed as pointed projections. In the *F. rubra* aggregate auricles are virtually absent (Fig. 1), but in the *F. ovina* aggregate they are present as distinct rounded extensions (Fig. 1). This difference is clear-cut and unequivocal when the two types are viewed together but it is a comparative rather than absolute character and should be used only after experience with the ranges exhibited by both aggregates.

LEAF ANATOMY – PATTERN OF SCLERENCHYMA

The pattern of sclerenchyma distribution as seen in transverse section of tiller leaves is a very important character in the genus *Festuca*. Knowledge of the range of patterns found in the *F. rubra* and *F. ovina* aggregates (Fig. 2) can be used to distinguish between them.

Sclerenchyma bundles are usually found in the subepidermal position opposite each of the veins (including the midrib) on the abaxial side, and in the subepidermal position at the leaf margins (e.g. Fig. 2B, G, J). Sometimes smaller subepidermal bundles are found opposite the veins on the adaxial side (e.g. Fig. 2A, E, F), and sometimes a girder of sclerenchyma connects the abaxial bundle with its adjacent vein (e.g. Fig. 2E, F). In some cases the abaxial sclerenchyma bundles extend laterally to form a band of sclerenchyma, in extreme cases forming a continuous zone from leaf-margin to leaf-margin (e.g. Fig. 2F, H).

Both the continuous and the discrete patterns of sclerenchyma occur in both the *F. rubra* and *F. ovina* aggregates, but in the case of each pattern the two aggregates can, with practice, be distinguished. The continuous/discontinuous band is almost always accompanied by some girders connecting with the veins and/or by some small adaxial sclerenchyma bundles in the case of *F. rubra* agg., but never in the case of *F. ovina* agg. In addition the sclerenchyma at the leaf-margins and abaxially to the midrib is often much thicker than elsewhere in *F. ovina* agg. (e.g. Fig. 2J, K), but not in *F. rubra* agg. The discrete abaxial sclerenchyma bundles are usually of approximately equal size and are sometimes accompanied by small adaxial bundles in *F. rubra* agg. (e.g. Fig. 2B), whereas in *F. ovina* agg. adaxial bundles are always absent and the marginal and midrib abaxial bundles are usually conspicuously larger (e.g. Fig. 2J) than the others (or there are no others, e.g. Fig. 2L) in *F. ovina* agg. In addition, when the sclerenchyma is in discrete bundles, the leaf outline is much more angular in *F. rubra* agg. (e.g. Fig. 2B, C, G) than in *F. ovina* agg. (e.g. Fig. 2J, L).

SUMMARY

Only two characters can be used with complete success in distinguishing the *Festuca ovina* and *F. rubra* aggregates in the British Isles. Other characters vary in usefulness from being helpful after considerable experience to being highly misleading. The two diagnostic characters are summarized in the following couplet:

Sheaths of young tiller-leaves fused into tube almost up to top; some or all tillers extravaginal ... *F. rubra* agg.

Sheaths of young tiller-leaves with at least the upper 40% with free, overlapping margins; all tillers intravaginal .... *F. ovina* agg.

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Host range and specificity of *Orobanche minor* Sm. on Crymlyn Burrows

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ABSTRACT

A survey of hosts reported for the broomrape *Orobanche minor* Sm. (Orobanchaceae) in Britain and Ireland, indicates a very wide range for this species with most hosts recorded from the Leguminosae and the Compositae. Results from an investigation of the host range of a large coastal population of *O. minor* Sm. var. *minor* (sensu Rumsey & Jury) on Crymlyn Burrows, West Glamorgan, confirm 15 host species by observation of direct root contact between host and parasite. Some individual broomrapes were noted to parasitise more than one (up to three) host, each a different species. Seeds of *O. minor* var. *minor* taken from plants parasitising *Eryngium maritimum* germinated to produce plants that were able to parasitise *Hypochoeris radicata*, *Trifolium hybridum* and *T. pratense*.

INTRODUCTION

Of the 45 species of *Orobanche* L. recognised in Europe by Webb & Chater (1972), seven were assigned to the *Orobanche minor* group and two of these, *O. minor* Sm. and *O. loricata* Reichenb., are in the British flora (Clapham *et al.* 1987). Both these species have predominantly south-eastern distributions in Britain, with *O. minor* extending discontinuously west and north-west, more or less along the coast. Taxonomically, the *O. minor* group is rather problematic, a situation which is exacerbated by the great intraspecific variation exhibited by *O. minor* itself. In a recent account of *Orobanche* L. in Britain and Ireland, Rumsey & Jury (1991) divide *O. minor* into four varieties, (var. *minor*, *compositarum*, *flava* and *maritima*), and describe a number of features which aid their identification including a guide to their host ranges.

Correct identification of the host can be helpful in the identification of several species of *Orobanche*. Unfortunately, however, although host specificity within the *O. minor* group may be of some significance taxonomically, it is confusing for at least two reasons. Firstly, some taxa appear to have rather wide, overlapping host ranges. Secondly, it is usually difficult to identify the host unequivocally in the field (Chater 1986) and it is likely that several hosts reported in the literature have been recorded in error. Nevertheless, some taxa may parasitise a well defined, narrow spectrum of hosts, e.g. *O. minor* var. *maritima* (Rumsey & Jury 1991), and the concept of physiological races with very specific host requirements (Musselman & Parker 1982) has often been suggested. Comments in county Floras indicate that coastal populations have frequently caused difficulties and this appears to be, in part, a consequence of an incomplete understanding of the host ranges of *O. minor* and *O. maritima* Pugsley (Pugsley 1940) in particular. Recent exchanges in the literature (e.g. Hambler 1991; Rumsey 1991) underline the controversial nature of this problem.

In this account, the host range of a large population of *O. minor* growing in mobile and partially fixed sand dune communities on Crymlyn Burrows in West Glamorgan (v.c. 41) is described. These studies exemplify the problems associated with coastal populations of *O. minor* and confirm a number of hosts, unequivocally.

MATERIALS AND METHODS

A large sand dune population of *Orobanche minor* was studied on Crymlyn Burrows (GR SS/ 710.930). In recent years the size of this broomrape population has usually numbered more than

TABLE 1. HOSTS FOR *OROBANCHE MINOR* RECORDED IN BRITAIN AND IRELAND

Host	Reference
CARYOPHYLLACEAE	
Honkenya peploides	Rumsey & Jury (1991)
GERANIACEAE	
Geranium columbinum	White (1912)
G. rotundifolium	White (1912)
Erodium cicutarium	Petch & Swann (1968)
Pelargonium spp.	Lousley (1976)
	Murphy (1972)
	Jones (1985)
LEGUMINOSAE	
Clianthus puniceus	Margetts & David (1981)
Vicia faba	Jones (1985)
Ononis repens	Savidge *et al.* (1963)
	White (1912)
	Jones (1985)
	Rumsey & Jury (1991)
Medicago arabica	McClintock (1975)
M. lupulina	Bowen (1968)
	Jones (1985)
Trifolium arvense	Trimen & Thiselton-Dyer (1869)
T. campestre	McClintock (1975)
	Jones (1985)
T. hybridum	Grose (1957)
	Jones (1985)
T. medium	Savidge *et al.* (1963)
T. pratense	Ravenshaw (1860)
	Salmon (1863)
	Archer Briggs (1880)
	Grose (1957)
	Savidge *et al.* (1963)
	Bowen (1968)
	Messenger (1971)
	McClintock (1975)
T. repens	Kent (1975)
	White (1912)
	Murray (1896)
Lotus corniculatus	Grose (1957)
Onobrychis viciifolia	Grose (1957)
ARALIACEAE	
Hedera hibernica	Jones (1985)
UMBELLIFERAE	
Eryngium maritimum	Wolley-Dod (1970)#
	White (1912)#
	McClintock (1975)##
	Bevis *et al.* (1978)§§
	Davey (1909)#
	Margetts & David (1981)§§
	Allen (1984)
	Jones (1985)
	Rumsey & Jury (1991)
Anthriscus sylvestris	Grose (1957)
Pastinaca sativa	Grose (1957)
	Holland *et al.* (1986)
	Jones (1985)
Daucus carota (including subsp. *gummifer*)	Ravenshaw (1860)#
	Grose (1957)
	White (1912)#
	McClintock (1975)§
	Davey (1909)#
	Margetts & David (1981)§
	Holland *et al.* (1986)
	Jones (1985)
Garden spp. (e.g. carrot, caraway)	Lousley (1976)
BUDDLEJACEAE	
Buddleja davidii	Jones (1985)
POLEMONIACEAE	
Polemonium caeruleum	Patrick & Hollick (1975)
CONVOLVULACEAE	
Calystegia soldanella	Rumsey & Jury (1991)
SOLANACEAE	
Nicotiana cultivar	Jones (1985)
SCROPHULARIACEAE	
Parahebe catarrhactae	Margetts & David (1981)
LABIATAE	
Salvia verbenaca	White (1912)
Glechoma hederacea	Murray (1896)##
	Grose (1957)
	White (1912)
	Jones (1985)
PLANTAGINACEAE	
Plantago coronopus	Ravenshaw (1860)
	McClintock (1975)
	Davey (1909)#
	Jones (1985)
P. major	Grose (1957)
P. maritima	McClintock (1975)§
CAMPANULACEAE	
Campanula portenschlagiana	Murphy (1972)
C. poscharskyana	Jones (1985)
DIPSACACEAE	
Dipsacus fullonum	Jones (1985)
COMPOSITAE	
Brachyglottis cv. 'Sunshine'	Bowen (1968)
	Swann (1975)*
	Lousley (1976)
	Margetts & David (1981)
	Jones (1985)
	Rumsey & Jury (1991)*
Olearia macrodonta	Jones (1985)
Achillea millefolium	Grose (1957)
Tripleurospermum inodorum	Rumsey & Jury (1991)*
Matricaria spp.	Kent (1975)
Carduus nutans	Rumsey & Jury (1991)*
Cirsium arvense	Grose (1957)
C. vulgare	Jones (1985)

TABLE 1. *cont.*

Host	Reference	Host	Reference
COMPOSITAE *cont'd*			
Hypochoeris radicata	Bowen (1968)*		Petch & Swann (1968)*
	Petch & Swann (1968)*		Jones (1985)
	McClintock (1975)		Holland *et al.* (1986)
	Jones (1985)		Rumsey & Jury (1991)*
	Rumsey & Jury (1991)*	*C. vesicaria*	Dony (1953)
Leontodon autumnalis	McClintock (1975)		
Picris echioides	Dony (1953)	GRAMINEAE	
Crepis capillaris	Linton (1919)	*Elymus farctus*	Rumsey & Jury (1991)
	Grose (1957)	*Ammophila arenaria*	Murray (1896)
	Grose (1957)*		Murphy (1972)

* = recorded as var. *compositarum*; # = recorded as *O. amethystea*; ## = recorded as *O. amethystea* but queried by author(s) as *O. minor*; § = recorded as *O. maritima*; §§ = recorded as *O. maritima* but queried by author(s) as *O. minor*.

5,000 individuals. This presented opportunities to sample a relatively small number of specimens with minimal disturbance to a thriving population. Plants rooted in sand were excavated carefully (usually with ease and minimal disturbance to the rooting systems of host and parasite) and examined for host-parasite root connections. Hosts were traced via their root systems and identified. Often, it was possible to replace plants with little disturbance after substantiating host root contact.

Plants were also cultivated in containers using as hosts *Trifolium hybridum* (cv. 'Alsyke', Elsoms Seeds Ltd, Spalding, England), *T. pratense* and *Hypochoeris radicata* (both grown from local stock). Seeds of *O. minor* were collected from individuals parasitising *Eryngium maritimum* on Crymlyn Burrows. Host plants were established in pots before inoculation with broomrape seeds which were applied in suspension directly on to the host roots.

REPORTED HOST RANGE OF *OROBANCHE MINOR* SM.

A cursory glance at the literature would reveal that *O. minor* has been recorded most frequently as a parasite of *Trifolium* spp., often as a weed in clover fields. It became well known, however, that other (often exotic) species were also parasitised by this broomrape and enthusiastic observations have led to a number of reports of largely unsubstantiated hosts. Table 1 lists a representative selection of hosts that have been reported over the last 130 years, and includes reports referring to all varieties of *O. minor* as well as *O. amethystea* Thuill. which has been recorded in error for *O. minor* in Britain (Clapham *et al.* 1987; Rumsey & Jury 1991). It is not a definitive list and, undoubtedly, many species that have been recorded as hosts for *O. minor* are missing from it.

HISTORY AND IDENTIFICATION OF *OROBANCHE MINOR* SM. ON CRYMLYN BURROWS

The accurate records of Rev. J. Lightfoot describing his visit in 1773 to "Breton Sands", in the vicinity of Crymlyn Burrows (Carter 1954), do not mention any broomrapes. One of the first records of *O. minor* in the region was made by A. M. Barnard at Swansea in 1853 and nearly a hundred years later, in 1943, J. A. Webb, a very active, local botanist, recorded it at nearby Aberavon West Burrows (Hyde & Wade 1957) where it still grows today. During this period, this species would have been regarded as a local rarity and its presence would have attracted the attention of active recorders. It is possible that *O. minor* was present in small numbers on Crymlyn Burrows at that time but, if so, it remained unrecorded until 1970 when a small population of about 100 individuals was noted. By 1979, the population had increased markedly to approximately 6000 plants (author's own records). It appears that *O. minor* is either a relatively recent arrival at Crymlyn Burrows (within the last 50 years) or was present in small numbers until the 1970s but had been overlooked by a number of recorders. Similar, but smaller, populations of *O. minor* now occur elsewhere in West

Glamorgan, e.g. on the sand dune systems of Swansea Bay, South Gower and Margam Burrows and in Mid Glamorgan, on Kenfig Burrows.

Several casual recorders have visited Crymlyn Burrows in the last ten years and named the *Orobanche* population there tentatively as *O. maritima* Pugsley. However, the morphological features of this population conform strongly with *O. minor* var. *minor* as described by Rumsey & Jury (1991).

Thus:

1. Plants varied greatly in size, up to 60 cm in height, with the largest individuals usually found in association with *Eryngium maritimum* and then often in large clumps. Plants associated with other hosts were rarely as vigorous.
2. The bases of stems were not obviously bulbous.
3. The sizes and densities of inflorescences were variable. For example, inflorescence lengths varied from 5 cm to 50 cm with overall flower densities varying between 1·4 and 3·2 flowers/cm. Some individuals had inflorescences which were lax below and dense above and some were relatively lax throughout. Other plants exhibited inflorescences which were relatively dense throughout their length.
4. Bracts were 14–18 mm, similar in length to the flowers but often slightly shorter in upper flowers.
5. Calyces were 11–13 mm and unequally bifid.
6. Corollas were 15–18 mm, suffused purple, glandular pubescent, the lower lip with subequal crisped lobes.
7. Flower diameters were always greater than 5 mm.
8. Filaments were hairy below and inserted 2 mm above the corolla base.
9. Stigma lobes were purple and united at base.

A small number of pigment-less individuals were noted in the Crymlyn Burrows populations during the study; similar albino forms have been noted by Rumsey & Jury (1991).

It should also be noted that *Daucus carota* subsp. *gummifer* is not a host for *O. minor* on Crymlyn Burrows.

HOST RANGE OF *OROBANCHE MINOR* SM. ON CRYMLYN BURROWS

O. minor var. *minor* has been observed to parasitise a number of hosts on Crymlyn Burrows. So far, 15 species of host have been identified and these are indicated in Table 2. Each host was substantiated by direct observation of contact between the host root and the distinct, swollen haustorial region of the parasite. Where indicated, root specimens were taken, sectioned and examined under the light microscope. When this was done, microscopic examination confirmed physical interaction between host and parasite vascular systems.

The most commonly recorded host was *Eryngium maritimum*. On Crymlyn Burrows, this species is very common in open mobile sand communities behind the foredunes, where there are often high densities of broomrape spikes (up to 25 spikes/m^2). Other plants recorded with broomrapes in this type of community are listed in Table 2(a). Many broomrape spikes were noted in the vicinity of Marram Grass (*Ammophila arenaria*) in this community. Indeed, several plants were noted growing in the middle of marram tufts. All such plants were investigated; none made any apparent contact with marram roots, but did make contact with the extensive root systems of *E. maritimum*. Parasitism of hosts other than *E. maritimum* appears to be relatively rare in this community but a single broomrape individual was observed to parasitise *Pastinaca sativa*.

More species were parasitised by broomrapes in partially fixed sand communities where *E. maritimum* is rare but legumes and composites are conspicuous. Typical species in these communities are listed in Table 2(b). The most commonly recorded hosts here were *Ononis repens*, *Lotus corniculatus* and *Hypochoeris radicata*. In addition, the composites *Leontodon taraxacoides*, *Crepis capillaris*, *C. vesicaria*, *Senecio jacobaea*, *Erigeron acer* and *Tragopogon pratensis* were also recorded as hosts. There was only one substantiated record of root contact with the legume *Anthyllis vulneraria*, although this species dominates large areas of partially fixed-dune on Crymlyn Burrows. Other minor hosts recorded were the crucifers *Arabis hirsuta* and *Coincya monensis* subsp. *recurvata*, and the plantain, *Plantago lanceolata*.

TABLE 2. HOSTS FOR *OROBANCHE MINOR* VAR. *MINOR* IN MOBILE AND PARTIALLY FIXED SAND COMMUNITIES ON CRYMLYN BURROWS
+ root contact with *O. minor* observed.

(a) *Mobile sand communities*		(b) *Partially fixed sand communities*	
CRUCIFERAE		CRUCIFERAE	
Coincya monensis subsp. *recurvata*	–	*Arabis hirsuta*	+
Matthiola sinuata	–	*Coincya monensis* subsp. *recurvata*	+
CRASSULACEAE		VIOLACEAE	
Sedum acre	–	*Viola canina*	–
ONAGRACEAE		*V. tricolor* subsp. *curtisii*	–
Oenothera cambrica	–	CARYOPHYLLACEAE	
UMBELLIFERAE		*Cerastium diffusum*	–
*Eryngium maritimum**	+	*C. fontanum*	–
Pastinaca sativa	+	*Arenaria serpyllifolia*	–
EUPHORBIACEAE		GERANIACEAE	
Euphorbia paralias	–	*Geranium molle*	–
CONVOLVULACEAE		LEGUMINOSAE	
Calystegia soldanella	–	*Ononis repens**	+
COMPOSITAE		*Trifolium arvense*	–
Senecio jacobaea	–	*Lotus corniculatus*	+
S. squalidus	–	*Anthyllis vulneraria*	+
Hypochoeris radicata	–	UMBELLIFERAE	
Leontodon taraxacoides	–	*Pastinaca sativa*	–
Crepis capillaris	–	GENTIANACEAE	
CYPERACEAE		*Centaurium erythraea*	–
Carex arenaria	–	PLANTAGINACEAE	
GRAMINEAE		*Plantago lanceolata*	+
Vulpia fasciculata	–	COMPOSITAE	
Ammophila arenaria	–	*Senecio jacobaea*	+
Phleum arenarium	–	*S. squalidus*	–
		S. vulgaris	–
		Erigeron acer	+
		Carlina vulgaris	–
		Hypochoeris radicata	+
		Leontodon taraxacoides	+
		Tragopogon pratensis	+
		Crepis capillaris	+
		C. vesicaria	+
		Taraxacum officinale agg.	–
		GRAMINEAE	
		Festuca rubra	–
		Aira praecox	–
		Ammophila arenaria	–
		Phleum arenarium	–

* Haustoria-root connections of some plants were sectioned and examined under the light microscope.

In transitional areas between mobile and partially fixed sand communities, *Eryngium maritimum* often grows in close proximity to *Ononis repens*, *Lotus corniculatus* and *Hypochoeris radicata*. In those places, broomrapes were observed making root contact with each of these species.

On four separate occasions, single specimens of *O. minor* were observed making root contact with two separate hosts. The following dual-host combinations were noted: (a) *Hypochoeris radicata* and *Ononis repens* (in partially fixed sand); (b) *Eryngium maritimum* and *Lotus corniculatus* (transitional areas); (c) *Crepis capillaris* and *Ononis repens* (in partially fixed sand); (d) *Crepis capillaris* and *Plantago lanceolata* (partially fixed sand).

On one occasion a triple-host combination of *Arabis hirsuta*, *Hypochoeris radicata* and *Lotus corniculatus* was noted in a partially fixed sand community.

Minor hosts such as *Arabis hirsuta* and *Erigeron acer* often appeared greatly weakened by the parasite and supported smaller broomrape specimens with lax inflorescences. In contrast, common hosts such as *Eryngium maritimum*, *Ononis repens* and *Lotus corniculatus* often showed normal vigour and the roots of leguminous hosts that were investigated always bore abundant nodules. *E. maritimum* often supported large broomrape specimens with dense inflorescences in clusters of 20 or more individual spikes.

Seeds of *O. minor* var. *minor* taken from specimens parasitising *Eryngium maritimum* in mobile sand communities were sown into separate pots containing *Hypochoeris radicata* (grown from seed taken from an individual in a typical partially fixed-dune community), *Trifolium hybridum* (cv. 'Alsyke') or *T. pratense* (transplanted from a local meadow) as potential hosts. All three species were able to act as hosts and supported specimens of *O. minor* that flowered and set seed.

O. minor on Kenfig Burrows (GR SS/796.812) appeared to parasitise *Eryngium maritimum* and *Ononis repens*, mostly, whereas a small and short-lived population which occurred on a roadside verge in Swansea (GR SS/652.912) appeared to be parasitising *Trifolium pratense* and *T. repens*. However, none of these plants was excavated and investigated for root contact.

DISCUSSION

Positive verification of host species for *O. minor* in the field is difficult, particularly when specimens are growing in compacted soil, due to the fragile connections between parasite and host roots. Moreover, in some areas, *O. minor* is a rare or local species and potentially destructive sampling should not be attempted. Under these circumstances the observer has to rely on a judgement based on the presence and proximity of suitable hosts. Most records of host species, such as those in the survey shown in Table 1, are probably based on such observations. However, significant patterns emerge from this survey and a number of relevant points may be deduced from it as follows:

1. Dicotyledonous perennials predominate as hosts for *O. minor*, whereas woody perennials are rarely reported.

2. Certain families such as Leguminosae and Compositae appear to contain several species which are suitable hosts for *O. minor* and there are many reports in the literature of parasitism on members of these families.

3. Other families also appear to be well represented in the survey such as Umbelliferae, Plantaginaceae, Geraniaceae and Labiatae.

4. Reports of the parasite on grasses (Murray 1896; Murphy 1972; Rumsey & Jury 1991) are infrequent and of interest. Parasitism of grasses (or other Monocotyledons) is rare in the genus *Orobanche* although it is a feature of other genera such as *Aeginetia* and *Striga* (Stewart & Press 1990).

The study described here verified a number of the hosts given in Table 1 and underlines the importance of certain families such as Umbelliferae, Leguminosae and Compositae (see Table 2). Nevertheless, although Leguminosae was well represented in the study area, it was notable that certain species such as *Anthyllis vulneraria*, *Lathyrus pratensis*, *L. tuberosus*, *Medicago sativa* subsp. *falcata*, *M. lupulina*, *Melilotus alba*, *M. officinalis*, *Trifolium arvense*, *T. fragiferum*, *Vicia cracca* and *V. sativa* were rarely or never parasitised. In contrast, a much higher proportion of the composites represented were parasitised. Interestingly, two crucifers, *Arabis hirsuta* and *Coincya monensis* subsp. *recurvata*, were recorded as hosts although members of Cruciferae have rarely been reported as hosts before.

One novel feature that emerged from this study was the occasional observation of *O. minor* var. *minor* individuals parasitising more than one host, each one a representative of a separate family. Presumably, this happens during establishment on a primary host when a haustorium also makes contact with the root of another compatible, secondary host in the near vicinity.

Parasitism of more than one host at the same time may occur commonly with other populations of *O. minor* var. *minor*, a consequence of its very wide host spectrum. However, there is evidence that *O. minor* has developed host specific strains (Musselman & Parker 1982) and, clearly, populations of these would be limited in this respect.

From the outset, it seemed possible, but intuitively unlikely, that the Crymlyn Burrows population was composed of more than one physiological strain, each with a limited set of hosts. For example, it could be argued that the mobile dune population which appeared to parasitise *Eryngium* *maritimum* almost exclusively, was physiologically distinct from the partially fixed dune population which appeared to parasitise a wider spectrum of hosts. However, *O. minor* var. *minor* also occurs in transitional areas between well-defined mobile and partially fixed sand communities, where *E. maritimum* and other hosts are parasitised. Furthermore, it was shown that seed taken from a specimen parasitising *E. maritimum* in a mobile dune community germinated to produce vigorous specimens in pots containing *Hypochoeris radicata*, *Trifolium pratense* or *T. hybridum*. This evidence, together with observations of individuals parasitising multiple, unrelated hosts (including the combination of *E. maritimum* and *Lotus corniculatus*), does not support the argument that there are a number of host specific strains of *O. minor* var. *minor* on Crymlyn Burrows.

The broomrape population of Crymlyn Burrows has become a striking feature of this actively accreting coastal dune system in recent years. However, although it is likely that a small population of *O. minor* was established there about 50 years ago, it seems probable that only in the last 20 years or so has it spread so conspicuously into mobile and partially fixed dune areas. Indeed, the establishment and spread of this population on Crymlyn Burrows resemble colonisations there by a number of non-native colonists such as *Coincya monensis* subsp. *recurvata*, *Hirschfeldia incana*, *Senecio squalidus* and *Conyza canadensis*. It is notable, therefore, that Rumsey & Jury (1991) suggest that *O. minor* var. *minor* may not be native in the British Isles.

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The current distribution and abundance of *Orchis ustulata* L. (Orchidaceae) in the British Isles – an updated summary

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ABSTRACT

Recent British records of *Orchis ustulata* L. (Orchidaceae) are described and the current range of the species is shown both as a distribution map and in tabular form. This updates information presented by the author in earlier work.

INTRODUCTION

The status and distribution of *Orchis ustulata* L. in the British Isles has been previously described on a regional basis (Foley 1987, 1990). Further exploratory work and additional knowledge gained as a result of publication of this information suggests that an updated summary is now appropriate. The distribution maps which were originally included were to a differing degree of precision, and the opportunity is now taken to combine all the available information on geographical distribution into a single map plotted on a 10-km square basis.

DISCUSSION

The additional records shown below are relatively small in number and do not significantly affect the overall distribution pattern of *O. ustulata* as previously described. They often represent small isolated populations containing just a few plants at, or close to, localities previously thought likely to be extinct. Such examples include Langdon Bay (E. Kent, v.c. 15), Waddingham (N. Lincs., v.c. 54) and Knaresborough (Mid-W. Yorks., v.c. 64), at each of which a welcome reappearance of the plant has occurred. Other new records are for small populations from areas in which there is apparently no previous known occurrence – Scarcliffe (Derbys., v.c. 57), Sandale (N.E. Yorks., v.c. 62), and some in S. Wilts. (v.c. 8). Just occasionally, population strength has been previously underestimated, in some cases significantly so, as at Martin Down (S. Hants., v.c. 11) which in fact is now confirmed to hold two important colonies. One of these is of especial interest in that it is in an area ploughed in 1957, the only instance so far noted where recolonisation has occurred so quickly. During 1987 a significant find was made in N.W. Yorks. (v.c. 65) by the author and a colleague where several hundred flowering plants occur in association with *O. morio* L. on traditionally managed, lightly grazed pasture. This is undoubtedly the best surviving population in northern England. Except by the tenant farmer, by whom its significance and extent were not appreciated, this strong population has apparently been previously overlooked.

Two other unrecorded populations of significance were identified at Great Cheverell Hill (S. Wilts., v.c. 8) by G. Goodfellow, and others have been located, also in v.c. 8, on Ministry of Defence land during lulls in artillery firing. The good flowering season of 1989 illustrated that in Britain, there are still some very significant populations of *O. ustulata* and this was particularly apparent at Parsonage Down (S. Wilts., v.c. 8), where one estimate suggests that the population is in excess of 30,000 flowering plants. This is perhaps the most important surviving single population of *O. ustulata* in north-western Europe.

The late-flowering (July–August) form of *O. ustulata*, often recorded from southern England, has recently been described as var. *aestivalis* by Kümpel (1988) and subsequently raised to subspecific rank as subsp. *aestivalis* by Kümpel & Mrkvicka (1990). These latter authors record details of its morphometry and deviation from the type, based on observations made on Central European populations where white-flowered plants are also noted for this newly described taxon.

The additional British records described below, together with those previously contained in Foley (1987, 1990) (the latter modified to include new information where appropriate), have been combined and mapped on a 10-km square basis as shown in Fig. 1. The species is considered to be

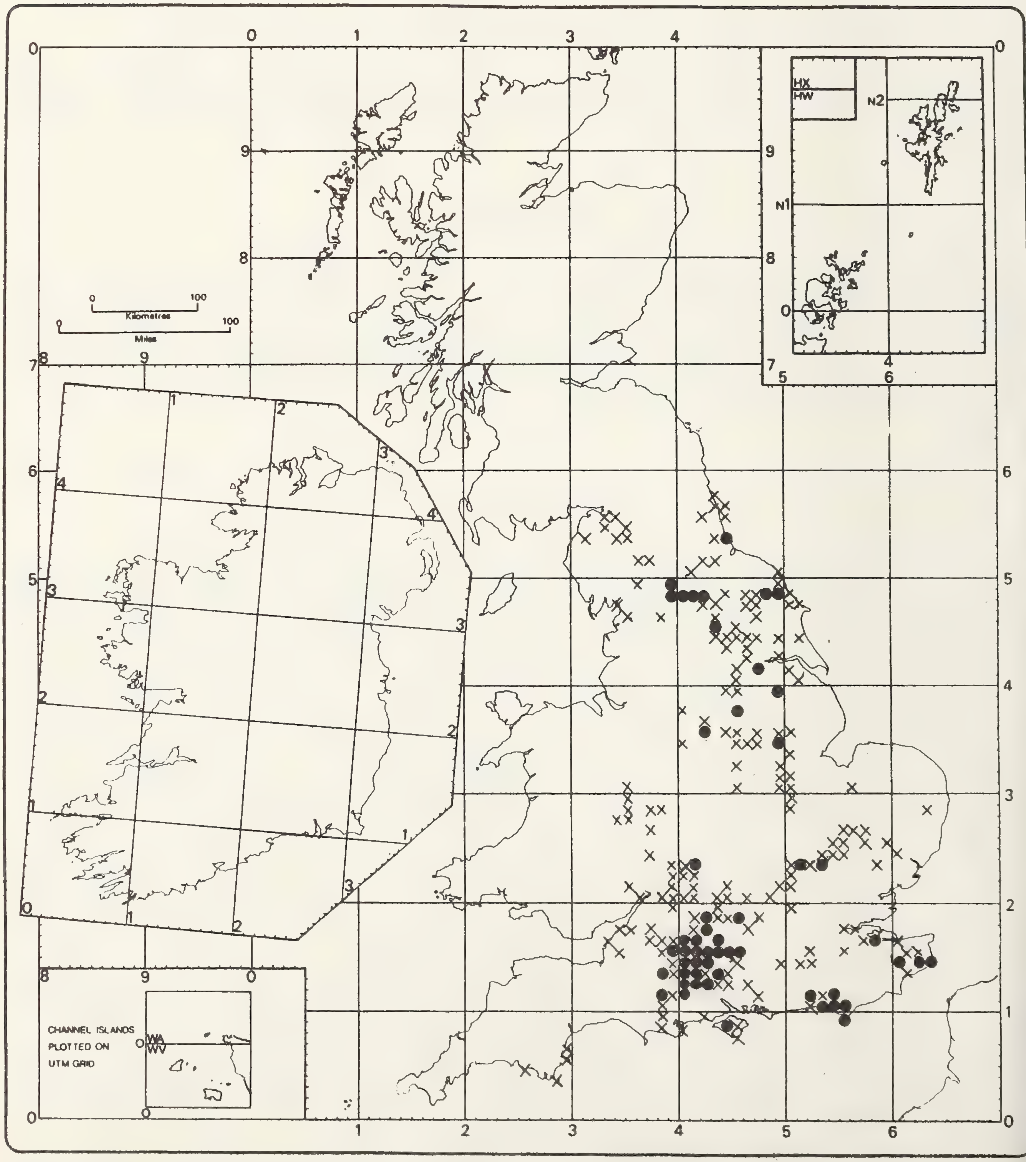

FIGURE 1. The past and present distribution of *Orchis ustulata* in the British Isles. Plotted in 10-km squares: ● still surviving, × considered extinct.

extant if it has been confirmed to be present in or after 1987, or if (and especially in the case of small colonies where an annual reappearance in flower can be unreliable) it has been seen shortly before this date and there has been no known change to the habitat likely to cause its loss. Additionally, all 54 10-km squares of the British Isles in which *O. ustulata* still occurs are listed in Table 1, and this also includes details of the respective population strengths. The 174 10-km squares for which the plant now appears to be extinct are given in Table 2, although it is possible that in some cases the plant may still reappear in small numbers.

Further records for *O. ustulata* from any new or existing localities are still welcomed, and especially so are details of any summer-flowering populations.

RECORDS

The following records should be added to, or where appropriate replace, those given earlier (Foley 1987, 1990). Population strengths (in parentheses) use the code employed in the earlier papers, as follows: A = typically 1–10 flowering plants; B = 11–25; C = 26–50; D = 51–200; E = 201–1000; F = 1000+; PX = possibly extinct; X = extinct; U = unknown status, but likely to be either small colonies or extinct.

N. Wilts., v.c. 7: SU/2.7, three new localities to the north of Aldbourne (A, A, A) (G. Goodfellow pers. comm.).

S. Wilts., v.c. 8: ST/8.3, Whitesheet Hill, a few plants over a large area (A); ST/9.5, Great Cheverell Hill (see Foley 1990), three additional sites (A, B, E); SU/0.2, Hoopside (A); Middleton Down (R. Laurence pers. comm.) (A); Knighton Down, c. 50 plants in 1989 (D); Throope Down, on rank grassland, possibly lost (PX); SU/0.3, Steeple Langford – Cow Down, very good numbers in 1987 when grazing relaxed (R. Laurence pers. comm.) (E) – this should replace "(U)" in Foley (1990); Hadden Hill, about 30 plants in 1989 (C); SU/0.4, Parsonage Down, recent estimates including the very good season of 1989 suggest a population of tens of thousands (one estimate 30,000+ plants), perhaps the best site in north-western Europe – this extends over an area approaching 95 ha and is now considered to be one continuous large colony of plants; SU/0.5, Slay Down, English Nature [formerly N.C.C.] information of a colony in centre of M.O.D. impact area – strong colony, no details, perhaps (D) in 1988; SU/1.2, Homington Down, 40 plants at one site in 1989, status should therefore be (A, C) (see Foley 1990); SU/1.3, Cockey Down, discovered by P. Mobsby in 1988 (A); SU/1.4, Alton Down, two small colonies recorded by English Nature (A, A); SU/1.5, Chisenbury Warren, small colony on M.O.D. land in 1984 (A); Giant's Grave, Pewsey Hill, up to 40 plants in 1985 on an ancient monument (C); Milton Lambourne, 20 plants in 1989 (B); SU/2.2, Witherington Down, 20 plants in 1988 – status now (B); SU/2.5, Haxton Down, reported here in 1986 by D. Soden on M.O.D. land (A). (Except where shown, all details for v.c. 8 are ex G. Goodfellow pers. comm.)

S. Hants., v.c. 11: SU/0.1, Martin Down, two populations, one of which is in old arable, last ploughed in 1957 (E), and on old grassland (E). Also on Bokerley Dyke (P. Toynton pers. comm.) (D). There were substantial populations in 1991 with two plants of the white-flowered form occurring on the Dyke.

E. Sussex, v.c. 14: TQ/4.0, Mount Caburn, Glynde at 44.08 – correct (U) to (F), there were 3000+ plants here in 1991 (F. Rose pers. comm.); TQ/5.0, Charleston Bottom, correct (A) to (D); Lullington Heath, correct (A) to (D), plants of late-flowering variant at both sites (D. C. Lang pers. comm.).

E. Kent, v.c. 15: TR/3.4, Langdon Bay, a single flowering plant was seen in 1981 (F. Horsman pers. comm.) (A).

Surrey, v.c. 17: TQ/2.4, three specimens in **KDL** collected in 1885 (X).

W. Suffolk, v.c. 26: TL/9.5, etc., Shelland, and TM/0.4, near Hadleigh (see Foley 1990) – there is some doubt about these records.

N. Lincs., v.c. 54: SK/9.9, a single plant appeared in 1991 at the Waddingham site (see Foley 1987) after an absence of ten years (I. Weston pers. comm.).

Derbys., v.c. 57: SK/2.5, eight additional very small populations (see Foley 1990), located as follows: one locality south of White Edge (L. Storer pers. comm.); four additional sites to the

TABLE 1. LOCATION AND RESPECTIVE STRENGTHS OF EXTANT POPULATIONS OF *ORCHIS USTULATA* IN THE BRITISH ISLES BY 10-KM SQUARE

Grid reference of 10-km square	Number of populations	Population strength (for code – see text)
ST/8.1	1	A
ST/8.3	1	A
ST/9.5	4	A,B,E,E
SD/9.8	2	A,B
SD/9.9	1	A
SZ/4.8	1	C
SU/0.1	4	A,D,E,E
SU/0.2	3	A,A,D
SU/0.3	2	C,E
SU/0.4	3	C,E,F
SU/0.5	1	D
SU/0.6	1	A
SU/1.2	4	A,C,F,F
SU/1.3	1	A
SU/1.4	2	A,A
SU/1.5	3	A,B,C
SU/1.6	4	B,D,D,E
SU/2.2	2	A,B
SU/2.4	1	A
SU/2.5	1	A
SU/2.7	5	A,A,A,A,B
SU/2.8	1	A
SU/3.3	1	A
SU/3.5	1	A
SU/3.6	1	A
SU/4.5	4	A,A,C,C
SU/5.5	1	A
SU/5.8	1	B
SP/1.3	1	C
SK/2.5	14	A,A,A,A,A,A,A,A,A,A,A,B,D,E
SK/5.7	1	A
SK/9.4	1	A
SK/9.9	1	A
SE/0.8	4	A,A,A,A
SE/1.8	3	A,C,C
SE/2.8	1	A
SE/3.5	1	A
SE/7.1	1	C
SE/8.8	2	A,B
SE/9.8	1	B
NZ/4.3	1	A
TV/5.9	4	B,B,B,D
TQ/2.1	1	C
TQ/3.0	1	D
TQ/4.0	2	F,F
TQ/4.1	1	A
TQ/5.0	7	A,A,B,B,D,D,E
TQ/8.6	1	A
TL/1.3	1	B
TL/3.3	1	A
TR/0.4	1	A
TR/2.4	5	A,A,A,A,B
TR/3.4	1	A
*G.R. withheld	1	E

* details withheld for a sensitive locality in v.c. 65 (N.W. Yorks.).

TABLE 2. 10-KM SQUARES FOR WHICH *ORCHIS USTULATA* IS NOW CONSIDERED TO BE EXTINCT IN THE BRITISH ISLES

SX/5.4	NY/4.5	SK/5.5	TQ/2.0
SX/8.3	NY/5.3	SK/5.9	TQ/2.4
SX/9.5	NY/5.4	SK/6.4	TQ/2.5
SX/9.6	NY/6.1	SK/7.4	TQ/3.1
SY/8.8	NY/7.1	SK/7.5	TQ/5.5
SY/8.9	SZ/0.8	SK/9.0	TQ/5.7
ST/3.6	SZ/2.9	SK/9.1	TQ/6.7
ST/4.5	SZ/5.7	SK/9.2	TQ/7.6
ST/4.7	SZ/5.8	SK/9.5	TL/0.1
ST/5.7	SU/1.7	SE/2.7	TL/0.2
ST/7.6	SU/1.8	SE/3.4	TL/0.3
ST/7.7	SU/2.3	SE/3.6	TL/0.8
ST/8.0	SU/3.2	SE/3.7	TL/0.9
ST/8.5	SU/3.8	SE/4.3	TL/2.3
ST/8.6	SU/3.9	SE/4.4	TL/3.4
ST/9.1	SU/4.2	SE/4.8	TL/4.4
ST/9.3	SU/4.3	SE/5.0	TL/4.5
ST/9.4	SU/4.8	SE/5.1	TL/5.4
ST/9.6	SU/5.4	SE/5.4	TL/5.5
ST/9.9	SU/6.2	SE/5.5	TL/5.6
SO/4.7	SU/6.7	SE/6.2	TL/6.6
SO/5.1	SU/7.1	SE/6.3	TL/7.5
SO/5.7	SU/7.8	SE/6.4	TL/7.6
SO/5.8	SU/9.4	SE/6.7	TL/8.3
SO/5.9	SP/0.0	SE/6.8	TL/9.5
SO/6.0	SP/0.2	SE/7.4	TF/0.0
SO/7.4	SP/0.3	SE/7.6	TF/0.1
SO/7.6	SP/1.0	SE/7.7	TF/0.3
SO/7.8	SP/1.1	SE/7.8	TF/0.5
SO/8.0	SP/1.2	SE/9.2	TF/6.0
SO/8.8	SP/3.0	SE/9.4	TA/0.1
SO/9.0	SP/4.0	SE/9.9	TA/0.7
SO/9.1	SP/4.1	NZ/1.0	TA/0.8
SO/9.2	SP/6.0	NZ/2.1	TA/1.0
SO/9.3	SP/8.0	NZ/2.5	TA/1.4
SJ/5.0	SP/9.1	NZ/3.1	TA/1.7
SD/4.7	SK/0.4	NZ/3.3	TR/0.6
SD/5.6	SK/0.7	NZ/3.6	TR/1.3
SD/6.9	SK/2.6	NZ/3.7	TR/1.5
SD/8.6	SK/4.5	NZ/4.5	TR/2.5
NY/1.3	SK/4.9	NZ/4.6	TM/0.4
NY/3.4	SK/5.0	NZ/9.0	TM/3.8
NY/3.5	SK/5.2	TQ/0.9	
NY/4.3	SK/5.4	TQ/1.4	

north-west of Brassington (L. Storer & B. G. Tattersall pers. comm.); two additional sites to the south-west of Longcliffe (east of Beardsley Plantation) (L. Storer pers. comm.); near Pinder's Rock in 1987, recorded by M. Buckley – all these probably (A); SK/5.7, Scarcliffe, lightly grazed Magnesian limestone meadow, discovered in 1986 by R. A. Frost, three plants (A).

S. E. Yorks., v.c. 61: SE/6.4, Fulford Ings, collected by H. Britten on 13 May 1928, **herb. P. Burnett** (R. Gulliver pers. comm.) (X); SE/9.4, Arras (not TA/0.4, Arram (Foley 1987) – an error) (Robinson 1902) (X).

N. E. Yorks., v.c. 62: SE/5.5, Clifton Ings, still extant in 1926 when collected by H. E. Britten, **herb. P. Burnett** (R. Gulliver pers. comm.) (X); SE/6.7, Hovingham, specimen collected in 1871 by "M.T.", **herb. P. Burnett** (R. Gulliver pers. comm.) (X); Wiganthorpe Park and also Terrington Carr and adjoining area, recorded by Yorkshire Naturalists' Union in 1898 (X); SE/7.6 (or 7.7), Castle Howard district, old record "in dry stoney meadows" (X); St Ann's meadow, Castle Howard Park (X); SE/7.8, Gundale, possibly Gundale Slack (U); SE/8.8, Sandale, one plant in 1989 (I. Lawrence pers. comm.) (A).

Mid-W. Yorks., v.c. 64: SE/3.5, Knaresborough, east of Birkham Wood, the last sighting was in 1967 after which the site was ploughed, but a single flowering plant was re-found by J. Barker in 1988 nearby. Regrettably this was immediately dug up by an unknown person (A).

N.W. Yorks., v.c. 65: SD/9.8, Seata, Aysgarth, limestone pasture (A); SE/0.8, east of Aysgarth, two new small populations (A, A); SE/1.8, near Middleham, riverside pasture (A). (Note: In 1987 the author and S. Priest discovered a new locality in v.c. 65 on traditionally managed pasture. This is almost certainly the strongest surviving population in northern England (E). No details are given here as this is a very sensitive site, but relevant details are known to English Nature.)

Durham, v.c. 66: NZ/2.5, Urpeth in 1913, J. W. Heslop-Harrison (Graham 1988) (X).

Cumberland, v.c. 70: NY/5.4, Armathwaite, on west bank of the Eden north of the bridge. Last recorded in 1944 by F. Simpson (X).

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Urtica galeopsifolia Wierzb. ex Opiz (Urticaceae) in Wicken Fen (E. England)

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ABSTRACT

A plant resembling the common nettle, *Urtica dioica* L., but almost lacking stinging hairs, occurs in Wicken Fen, Cambridgeshire. It is here considered as a separate species *U. galeopsifolia* Wierzb. ex Opiz, which differs from the former by several morphological characters and also by ploidy level. Some suggestions about the possible hybrid origin of *U. dioica* are put forward.

INTRODUCTION

Many British botanists know the strange almost stingless form of the common nettle (*Urtica dioica* L.), which occurs within the National Trust's Wicken Fen nature reserve in Cambridgeshire, GR TL/55.70. These unusual plants grow in damp mesotrophic fen communities, in particular, at the margins of shrubby areas with other shade-tolerant herbs. Similar plants occur nearby, as at Chippenham Fen (Perring *et al.* 1964).

The variation of morphological characters of *U. dioica*, with special reference to this particular population, was intensively investigated by Pollard & Briggs (1982, 1984a). They explained that the difference of this plant from typical ones arose through a process of gene flow. An exact taxonomic recognition had not been made, but it was mentioned that, probably, the 'Wicken nettle' belongs to var. *angustifolia* Wimm. & Grab. or var. *subinermis* Uechtr. The *Flora of Cambridgeshire* (Perring *et al.* 1964) treats these plants as f. *angustifolia* (Wimm. & Grab.) Moss.

While studying the taxonomy of *Urtica* L. in the former U.S.S.R., I paid attention to the information published by Pollard & Briggs (1982). My assumption was that the "Wicken form of common nettle" seemed to belong to a separate species, *U. galeopsifolia* Wierzb. ex Opiz, which I have recognised for Eastern and Central Europe (Geltman 1986, 1992) or to some intermediate form between this species and *U. dioica*.

URTICA DIOICA AND *U. GALEOPSIFOLIA*

U. galeopsifolia was described from Hungary by F. M. Opiz, *Naturalientausch* **9**: 107 (1825), according to Domin (1943), and it differs from *U. dioica* mainly by characters of the leaf blades: they almost completely lack stinging hairs, but always possess a more or less dense indumentum consisting of simple (non-stinging) hairs. It is also differentiated by the location of its inflorescence; the lowest flowering branches of *U. galeopsifolia* appear on the level of the 13th–22nd node, and in *U. dioica* on the level of the 7th–14th node. Probably, this feature is linked to the period of flowering: *U. galeopsifolia* starts to flower later than *U. dioica*, approximately in mid-July (Geltman 1986).

Not infrequently *U. galeopsifolia* has somewhat longer and comparatively narrow leaves, but this character is unsatisfactory, as typical *U. dioica* with numerous stinging hairs may sometimes have such a leaf shape. It is necessary to stress that neither *U. galeopsifolia* nor *U. dioica* have such narrow leaves as the Asiatic species *U. angustifolia* Fisch. ex Hornem., which does not occur in Europe.

Unlike *U. dioica*, which is mostly tetraploid with $2n = 52$ or, probably, $2n = 48$ (there are only a few records of 2n = 26), *U. galeopsifolia* is presumably diploid (2n = 26) and only one specimen was determined as tetraploid (Geltman 1984).

U. galeopsifolia prefers a quite distinct type of habitat: damp woodlands, especially with *Alnus glutinosa* (L.) Gaertner, river banks and valleys, and eutrophic fens. I found a very clear example of the ecological separation of the two species in question in Central Ukraine, Cherkassy region. *U. galeopsifolia* occurred in *Phragmites* fen and *Alnus glutinosa* woodland, situated in deep valleys, bordered with hills, and *U. dioica* is found in more or less dry (at least, not swampy) *Carpinus betulus* L. woodlands on the hills, especially near roads and cattle paths.

In the former U.S.S.R., *U. galeopsifolia* is distributed in the European part to the south of latitude 60°N, and also in the southern regions of Siberia eastwards to the river Angara; some localities are also known from Caucasia. It should be widely distributed in Atlantic, Central and East Europe, but before I had visited some British herbaria, I had seen quite reliable specimens of this species only from Hungary, Czechoslovakia and the Netherlands (Geltman 1986).

In August 1991, I was fortunate to be able to visit Wicken Fen and to observe the local nettle population. In my view, the almost stingless plants which occur in the fen proper do not differ from *U. galeopsifolia*, as it occurs in Russia. So, *U. galeopsifolia* is a new species record for the British flora.

U. galeopsifolia, nevertheless, is not a 'completely good' species, especially in terms of the species concept adopted in *Flora Europaea* (Geltman 1992). Sometimes transitional forms to *U. dioica* may be found, such as forms without stinging hairs but with scattered simple ones (I usually refer such plants to *U. dioica*). So, probably, some botanists may prefer to treat this taxon as a subspecies; the corresponding combination *U. dioica* subsp. *galeopsifolia* (Wierzb. ex Opiz) Chrtek does exist (Chrtek 1981). But I consider that species rank is more appropriate for this taxon for the following reasons. It is correct to apply the rank of subspecies to allopatric taxa of widely distributed species. But in the case of *U. dioica* and related species we have, obviously, quite a different situation: *U. dioica* is, probably, a species of hybrid origin (Geltman 1990). The first of its ancestors might be *U. galeopsifolia* (or a species closely related to it) and the second, *U. sondenii* (Simm.) Avrorin ex Geltman, which occurs mainly in the taiga zone of West and Central Siberia and Northern Europe also. Detailed distribution characteristics with map are given in Geltman (1986). This species has completely glabrous leaf blades with neither stinging nor simple hairs; some scattered stinging and simple hairs are located on the nodes of stems and on the inflorescence axis. It grows in meadows and *Salix*-carrs in river valleys, near streams, in damp forests, etc. Like *U. galeopsifolia*, it is a diploid (2n = 26).

U. galeopsifolia was likely to be formed at least by the Pliocene period and might have penetrated to the British Isles at the time of existence of bridges with the continent. It survived the Pleistocene glaciations not far from the southern limits of the ice front. At the same time *U. sondenii* seems also to exist in the periglacial area, because the first migration of Siberian taiga species to Europe was possible at the end of Miocene, the next ones in the late Pliocene and in the interval between Dnepr and Moscow glaciations (Minyaev 1965)*. So, *U. galeopsifolia* and *U. sondenii* were likely to have opportunities for hybridisation. Probably, there were no ecological barriers, because the ecological niches of both species are similar.

As a result of hybridisation of diploid *U. galeopsifolia* and *U. sondenii*, a tetraploid 'primary' *U. dioica* could have been formed. These plants may have been very polymorphic in leaf shape and indumentum and had no stinging hairs on the leaf blades. Such 'primary' forms spread in Europe after the last glaciation and may also have appeared in Wicken Fen. Then, derived from these plants, the 'secondary', typical *U. dioica* with stinging hairs on leaf blades developed. The main selective factor might be a pressure from animals, including domestic ones. As Pollard & Briggs (1984b, p. 507) have shown, "grazing by large mammals could act as a strong selective force for higher stinging hair densities in nettles". So, the origin of typical *U. dioica* was, apparently, connected with human activity. "Response to the modification of the habitat by human settlement seems to be indicated by the nettle as early as the time of Mesolithic culture" (Godwin 1975, p. 242).

Intermediate forms between typical *U. dioica* with numerous stinging hairs and *U. galeopsifolia* are, in fact, mostly primary hybrid forms of *U. dioica*, which have survived to the present time.

* The interval between the Dnepr and Moscow glaciations seems to correspond with the Hoxnian stage (interval between Anglian and Wolstonian ice periods) in Britain.

Because there are no classical allopatric races in this case, I prefer to treat *U. dioica*, *U. galeopsifolia* and *U. sondenii* as separate species in the framework of an *U. dioica* aggregate or 'complex'.

After the most recent glaciation, *U. galeopsifolia* in Britain survived in damp territories, but in historic times it has become almost extinct due to drainage and now seems to be preserved only in protected wetland areas (like Wicken Fen). Forms intermediate between *U. galeopsifolia* and typical *U. dioica* may be found in various seminatural situations.

It is necessary also to mention *U. pubescens* Ledeb., described from the delta of the river Volga (Ledebour 1833). Sometimes this taxon (more frequently at the rank of the variety *U. dioica* var. *pubescens* (Ledeb.) Trautv.) has been recorded from various regions of Europe. In my opinion, this taxon is a separate species, closely related to *U. galeopsifolia*, but differing from it in some minor characters (Geltman 1986). *U. pubescens* occurs in special wetland territories, mainly in the Volga delta, and recently has been found in lower Dnepr. It may be a relict, which survived in such localities from Tethyan times.

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Short Notes

RUBUS BLOXAMII (BAB.) LEES (ROSACEAE) WITH RED STYLES

Rubus bloxamii, a widespread and locally abundant bramble of central southern England and the central Midlands, normally has styles that are yellowish-green. Towards the south-western limit of its English range, however, at the southern end of the border between N. Somerset, v.c. 6, and S. Wilts., v.c. 8, and abundantly along the Blackdowns astride the border between S. Devon, v.c. 3, and W. Somerset, v.c. 5, A. Newton and L. J. Margetts have respectively come across populations in which the styles are bright red (but which otherwise do not differ from the normal examples of the species in Britain in any significant respect).

On the opposite side of the Channel, in various parts of Normandy and (according to Sudre 1911) just to the south in dép. Sarthe, there is a common bramble which has long been known as *R. multifidus* Boulay & Malbranche. One place it occurs in particular profusion is the Forêt de St-Sauveur, 30 km south of Cherbourg, and specimens I collected there in 1991 have proved to match the red-styled *R. bloxamii* of England. A. Newton and H. Vannerom share my impression that except in this one character *R. multifidus* is not distinguishable from *R. bloxamii* and should accordingly be treated as conspecific, a conclusion reached earlier by Friderichsen (MS note by Rogers 1897 on **BM** sheet), Rogers (1900) and, ultimately, Watson (1958). The name nevertheless seems worth retaining at varietal level in view of the interesting difference in range, and the necessary new combination is accordingly now made:

Rubus bloxamii (Bab.) Lees var. **multifidus** (Boulay & Malbranche ex Corbière) D. E. Allen, **comb. et stat. nov.**

R. multifidus Boulay & Malbranche MS (Assoc. rub. exsicc.); Corbière, *Nouv. Fl. Normandie* 208 (1894); *R. menkei* subsp. *multifidus* (Boulay & Malbranche) Boulay in Rouy & Camus, *Fl. Fr.* **6**: 104 (1900); *R. menkei* microgene *multifidus* (Boulay & Malbranche) Sudre, *Rubi Eur.*, 160 (1911).

Corbière cites no fewer than ten numbers distributed by the Association rubologique as belonging to *R. multifidus*. The lectotype must clearly be chosen from the earliest of these (no. *36*: Forêt de la Londe, dép. Seine-Inférieure, 1873, *A. Malbranche*) and I designate as that the example of that number which I have examined in Paris (**P**).

It is worth adding that *R. bloxamii* var. *bloxamii* also occurs in Normandy, but appears to be much the rarer of the two there. In the North Cotentin (dép. Manche) I have so far seen it in only two places, in both cases just a bush or two. H. Vannerom informs me (in litt. 1992) that two of Letendre's specimens of '*R. multifidus*' from dép. Seine-Inférieure, Association rubologique nos. *656* and *772*, have yellowish styles too. In the Channel Isles, on the other hand, where *R. bloxamii* is locally common in Guernsey though scarce in Jersey, the populations consist of var. *bloxamii* exclusively.

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RUBUS CORBIERI BOULAY (ROSACEAE) IN THE BRITISH ISLES

In 1897 the then leading British authority on *Rubus*, W. Moyle Rogers, paid a first (and only) visit to the Channel Isles and on two of them encountered quantities of an unfamiliar bramble. While he found it "rather frequent" on Guernsey, on Sark it was "remarkably abundant" (Rogers & Rogers 1898), so much so that, in the words of his companion on that day, it "seemed to monopolise nearly the whole place" (Derrick 1898). And as subsequent batologists have found, these words are indeed no exaggeration: this large, coarse, white-flowered plant is one of the most dominant features of the island's landscape.

Rogers promptly sent a specimen to Focke, who considered it "very near" *R. schlechtendalii* Weihe ex Link (Rogers & Rogers 1898), an opinion Focke was later to refine to "maybe a form of *schlechtendalii*. Not typical", when G. C. Druce sent him a specimen he had brought back from Sark in 1906 (now in **OXF**). Although Rogers initially placed the plant under that name (Derrick 1898, Rogers 1899), within a year he had decided it was best regarded instead as a strong and highly glandular form of *R. macrophylloides* Genev. (Rogers & Rogers 1898). It was not that species, however, as Riddelsdell was eventually to note on one of Rogers' sheets (herb. Barton & Riddelsdell *8743*: **BM**) after study of Genevier's type and description. Nor was it *R. adscitus* Genev., as Watson first supposed on re-examining Druce's specimen in 1931 (a determination he subsequently abandoned for *R. boraeanus* Genev.) – although it is certainly closely related to that species, as A. Newton remarked of a further Sark specimen that was submitted to him by Lady Anne Brewis in 1973 (now in **STP**).

It has always seemed likely that the bramble would prove to be on the neighbouring French mainland; but as the *Rubus* flora of that area has not been much studied, it might well be one of the many species there as yet undescribed. Fortunately, however, the latter has not proved to be the case.

In 1987, on a first reconnaissance of the Cherbourg area, I came across a bramble growing in plenty round the north foot of Le Roule, the high crag which overlooks that city, that proved to match a panicle in **BM** collected by Corbière in 1889 from what are today the outskirts of Cherbourg and later distributed under the name Boulay bestowed on the bramble in his honour, *R. corbieri*. Corbière tended to interpret *Rubus* species over-broadly, and his determinations cannot be accepted uncritically; but the very distinctiveness of this particular plant taken together with his published description of *R. corbieri* (Corbière 1894) leave no room for doubt in this instance. Moreover, there is a further Cherbourg specimen of his so named in **P** (Association rubologique no. *894*) that clearly belongs to the same entity.

Subsequently I discovered that this Cherbourg plant was identical with a specimen in my herbarium that I had collected in Guernsey in 1978, in a deserted garden in the middle of St Peter Port. Because *R. corbieri* is rather variable, however, it was some time before I began to suspect that this might also be the bramble which occurs more widely in the north of that island and in such profusion on Sark. Fuller exploration of the north of the Cotentin Peninsula in 1991, bringing at the same time wider acquaintance with the variation exhibited by the species in the field, showed conclusively that that suspicion was well-founded. *R. corbieri* proved to occur conspicuously all along the coast to the west of Cherbourg (though apparently absent to the east), rising to abundance in the vicinity of Cap de la Hague, the headland facing Alderney, the northernmost of the Channel Isles. The comparable abundance of the species on Sark and its presence in much smaller quantity on Guernsey, which is situated farther out to the west, thus represents a natural prolongation, and gradual tailing-off, of its Cotentin range. I did not have an opportunity of following the coastline south from Cap de la Hague, but the discovery of a patch of *R. corbieri* just outside Carteret, some 40 km in that direction, suggests that the species may similarly prove to extend down to there. Most unusually for a *Rubus* species, it would appear to prefer the proximity of the sea, the coarseness of its foliage presumably rendering it well fitted to the rigours of that environment. Even so it noticeably avoids the most exposed situations, tending to occur on banks offering some shelter from the wind.

Unexpectedly, *R. corbieri* also turns out to occur in England. In the autumn of 1990, while going through **OXF** in search of Channel Isles *Rubus* material, I came across an unmistakable specimen of it collected on Corfe Common in south-east Dorset, v.c. 9, by L. Cumming in 1916 and distributed through both of the exchange clubs that year as a white-flowered form of *R. boraeanus* (as determined by Rogers). The sheet bears a later determination by Watson, confirming that name. In one of the published notes on the gathering (Rogers 1918) the plant was described as locally abundant in the locality in question, which encouraged the belief that it might still be present there; and a visit to the Common the following July quickly revealed that not only was that the case, but also that the population remains very extensive. Later the same day the species was encountered in a second locality in quite another part of Purbeck, along a lane crossing Studland Heath (GR SZ/01.84 and SZ/02.84). E. F. Linton has also since been found to have collected it in 1892 in a locality nearly midway from Corfe to Swanage, the specimen (**BM**) having been dismissed by Rogers and R. P. Murray as *R. bloxamii* × *vestitus*. In **CGE**, too, there turns out to be a gathering of it (no. *64/368*) by B. A. Miles as recently as 1964 from the south-west part of Rempstone Heath (GR SZ/983.840), in this case with no name hazarded. Possibly, therefore, the species may prove widespread in the south-east corner of v.c. 9. Although that has been relatively well worked by batologists in the past, the superficial resemblance of *R. corbieri* to the common *R. bloxamii* (Bab.) Lees could well have led to its being passed over as the latter.

Work on the *Rubus* flora of Hampshire, v.cc. 11 and 12, and the Isle of Wight, v.c. 10, in recent years has been sufficiently intensive to render it unlikely that so obtrusive a species has escaped notice in those neighbouring counties. Floristically, in any case, the affinity of their *Rubus* floras with that of the French coastal areas directly opposite appears to be but slight. At least the north end of the Cotentin Peninsula has a *Rubus* flora with a markedly more western facies than theirs, which makes the presence of *R. corbieri* in Dorset more congruous and Devon, v.cc. 3 and 4, the likeliest further English county in which the species may occur.

The descriptions of *R. corbieri* by Corbière (1894) and by Boulay (1900) – the latter of whom reduced the species to a 'Forme' of *R. multifidus* Boulay & Malbranche (a common Normandy bramble) and that in turn to a subspecies of *R. menkei* Weihe – are sufficiently detailed and accessible to render providing a further one unnecessary. It is nevertheless worth emphasising that the species, while unambiguously a member of Series *Vestiti* (Focke) Focke, varies considerably in the quantity of stalked glands present as well as in the size of the rachis prickles. In addition, the flowers tend to be pinkish on first opening or on plants growing in shade.

Sudre in his *Batotheca Europaea*, fasc. 10, no. 487, relegated *R. corbieri* to the synonymy listed on the printed label of the bramble he distributed as *R. fuscus* subsp. *retrodentatus* (Mueller & Lef.) Sudre. The latter, however, a specimen of Questier's from dép. Valois, is quite a different plant and it would seem that Sudre had a mistaken idea of the Cherbourg species.

Representative material from Dorset, the Channel Isles and the North Cotentin has been deposited in **BM**.

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A NEW SPIRAL VARIANT OF *JUNCUS EFFUSUS* L. (JUNCACEAE)

The Spiral Rush of gardens, *Juncus effusus* L. cv. 'Spiralis', was discovered as a single plant in Northern Ireland by David Bishop, Curator of the Botanic Garden, Belfast in 1869. It was brought into cultivation and has continued as a curiosity in gardens since then. It differs from the ordinary *J. effusus* in that the stems spiral upwards, often completing six to eight turns. James McNab, Curator at that time of the Royal Botanic Garden, Edinburgh and a most intelligent experimenter, obtained plants of the Irish discovery and sowed seeds from them. He reported that the seedlings all showed the spiral character (McNab 1873). There seems to be no other record of this variety in the wild.

In the autumn of 1988, I noticed on rough croft grazing above Big Sand, Gairloch, W. Ross (v.c. 105), areas of *Juncus* which at first sight had every appearance of having been flattened by animals lying on the plants. Some of the colonies were 1.3–1.9 m across. Closer examination showed that many of the stems were gently spiral and that all of them were only suberect in contrast to the strictly erect habit of normal *J. effusus* growing nearby. Plants were brought into cultivation. Seed from the 'spiral' plants at Big Sand germinated easily and all the seedlings were spiral and suberect. The Irish 'Spiralis' differs from the Scottish in that the stems in the Irish are quite erect and are much more obviously spiral six to eight turns as against two to three.

There are many other populations in N.W. Scotland between Plockton and Dundonnell: on the village green in Plockton, at Flowerdale, Gairloch, at Red Point, Gairloch, at Cove, Poolewe, on the Inverewe peninsula, Poolewe, along the roadside by Loch Tollie between Gairloch and Poolewe, at Slaggan west of Mellon Udrigle and by the roadside at Dundonnell. It has not been found in the eastern or central Highlands, although once known it can be spotted from a moving car. It usually occurs mixed with normal plants and the contrast between the two is quite striking.

There seem to be no previous records of this spiral rush on mainland Britain but there are specimens in **E** from the Northern Isles: Orkney, 1906, M. Spence; Ramsdale, Orphir, 1927, H. H. Johnston; Flotta, Orkney, 1932, J. Sinclair and all are similar to the West Ross plants rather than the Irish. I have also seen a photograph of an Orkney specimen collected by Linton in **LIV**. However, in 1991, it was evident that the variety had a wide and certainly long established distribution in the Outer Hebrides where I found it on the Island of Killegray (Harris) on the Shiant and Monach Isles just west of Loch Boisdale (Uist) and on Mingulay (Barra).

In view of its considerable occurrence as wild populations over a considerable area of N.W. Scotland it seems appropriate to treat it as a distinct variety of *Juncus effusus*:

Juncus effusus L. var. **suberectus** D. M. Henderson, **var. nov**.
Holotypus: Big Sand, Gairloch, W. Ross, v.c. 105, on rough croft land with var. *effusus*, 6 December 1988, *D. M. Henderson* (**E**).

A varietate typica culmis leniter spiralibus suberectis differt.

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CONTRIBUTIONS TO A CYTOLOGICAL CATALOGUE OF THE BRITISH AND IRISH FLORA, 2

The only recent, published summary of chromosome counts made on native material of British and Irish vascular plants is contained in Clapham *et al.* (1987). The source of many of these counts, however, is unlocalised material or untraceable. The present series of notes is intended to contribute to a properly documented cytological account of our flora (Wentworth *et al.* 1991). We present here chromosome counts of 102 flowering plant species from 122 populations. Only one plant from each population was studied, except where noted. All counts were made from squashes of root-tips, except where noted; supernumerary chromosomes are designated by the suffix 'S'. Voucher specimens have been placed in **LTR**.

Achillea millefolium L., 2n = 54: Caerns., v.c. 49, E. of Sarn, SH/24.32; Westmorland, v.c. 69, near Ulpha, c. 5 km N.E. of Lindale, SD/44.81.
Agrimonia eupatoria L., 2n = 28: W. Lancs., v.c. 60, Silverdale, Gait Barrows N.N.R., SD/48.77; W. Lancs., v.c. 60, Warton Crag, R.S.P.B. nature reserve, SD/49.72.
Agrimonia procera Wallr., 2n = 56: W. Lancs., v.c. 60, Warton Crag, R.S.P.B. nature reserve, SD/49.72.
Ajuga reptans L., 2n = 32: W. Lancs., v.c. 60, near Forton, SD/48.53.
Allium vineale L. var. *vineale*, 2n = 32 + 0–2S: W. Lancs., v.c. 60, near Carnforth, SD/49.71.

Anagallis tenella (L.) L., 2n = 22: Caerns., v.c. 49, Lleyn peninsula, W. end, SH/2.3.
Angelica sylvestris L., 2n = 22: W. Lancs., v.c. 60, near Lancaster, SD/47.59.
Anthriscus sylvestris (L.) Hoffm., 2n = 16: Leics., v.c. 55, Rutland, 4 km S. of Oakham, near Brooke, SK/85.06.
Apium graveolens L., 2n = 22: W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Apium nodiflorum (L.) Lag., 2n = 22: Dorset, v.c. 9, near Sydling St Nicholas, ST/63.00.
Arum maculatum L., 2n = 56: Leics., v.c. 55, Swithland Wood, SK/53.12.
Atriplex portulacoides L., 2n = 36: W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Barbarea vulgaris R.Br., 2n = 16: Caerns., v.c. 49, Tudweiliog, 1 km to W. on Tyd'dyn road, SH/22.36.
Blackstonia perfoliata (L.) Hudson, 2n = 40: Co. Durham, v.c. 66, coastal cliffs between Blackhall and Crimdon, NZ/47.38.
Centaurea scabiosa L., 2n = 20 + 3–8S: Co. Durham, v.c. 66, coastal cliffs between Blackhall and Crimdon, NZ/47.38.
Chelidonium majus L., 2n = 12: Caerns., v.c. 49, Llaniestyn, SH/26.33.
Chrysanthemum segetum L., 2n = 18: Caerns., v.c. 49, N. of Botwnnog, overlooking Cellar Farm, SH/26.32.
Chrysosplenium oppositifolium L., 2n = 42: Derbys., v.c. 57, Dovedale, SK/14.53.
Cichorium intybus L., 2n = 18: Co. Durham, v.c. 66, coastal cliffs between Blackhall and Crimdon, NZ/47.38.
Cirsium vulgare (Savi) Ten., 2n = 68: Caerns., v.c. 49, Botwnnog, above Cellar Farm, SH/26.32.
Clematis vitalba L., 2n = 16: Surrey, v.c. 17, Silent Pool, near Shere, TQ/06.48.
Conyza canadensis (L.) Cronq., 2n = 18: Leics., v.c. 55, Leicester University Botanic Garden glasshouse (spontaneous weed), SK/61.01.
Corylus avellana L., 2n = c. 22: Leics., v.c. 55, Swithland Wood, SK/53.12.
Deschampsia setacea (Hudson) Hackel, 2n = 14: Caerns., v.c. 49, Cilan, near Abersoch, SH/29.24.
Digitalis purpurea L., 2n = 56: W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57.
Euonymus europaeus L., 2n = 32: Westmorland, v.c. 69, Brigsteer Park, 2·5 km S. of Brigsteer, SD/48.87.
Eupatorium cannabinum L., 2n = 20: Dorset, v.c. 9, Hartland Moor N.N.R., c. 4 km S.E. of Wareham, SY/96.85; W. Norfolk, v.c. 28, Foulden Common, TL/76.99; W. Lancs., v.c. 60, near Carnforth, SD/49.71.
Filipendula ulmaria (L.) Maxim., 2n = 14: Leics., v.c. 55, Swithland Woods, SK/53.12; W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57.
Galeopsis bifida Boenn., 2n = 32: Caerns., v.c. 49, E. of Sarn, SH/24.32; Caerns., v.c. 49, N. of Botwnnog, overlooking Cellar Farm, SH/26.32.
Galium cruciata (L.) Scop., 2n = 22: W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Galium mollugo L., 2n = 44: W. Cornwall, v.c. 1, Goonhilly Earth Station, SW/73.21; E. Cornwall, v.c. 2, Rame, near church, SX/42.49.
Galium odoratum (L.) Scop., 2n = 44: Westmorland, v.c. 69, Brigsteer Park, 2·5 km S. of Brigsteer, SD/48.87.
Geranium dissectum L., 2n = 22: W. Lancs., v.c. 60, near Lancaster, SD/46.62.
Geranium lucidum L., 2n = 40: Westmorland, v.c. 69, near Meathop Moss, c. 3 km N.E. of Lindale, SD/44.81.
Geranium pratense L., 2n = 28: Derbys., v.c. 57, Milldale, SK/14.55; Co. Durham, v.c. 66, 2 km N. of Barnard Castle, NY/05.18.
Geranium sanguineum L., 2n = 84: Co. Durham, v.c. 66, coastal cliffs between Blackhall and Crimdon, NZ/47.38.
Geum urbanum L., 2n = 42: Derbys., v.c. 57, Milldale, SK/14.55.
Glaux maritima L., 2n = 30: W. Lancs., v.c. 60, W. of Cockerham, near Bank Houses, SD/42.53; W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Glechoma hederacea L., 2n = 36: Leics., v.c. 55, Rutland, Brooke, by the church, SK/85.06; W. Lancs., v.c. 60, Silverdale, E. of Thrang End Farm, SD/49.77.
Heracleum sphondylium L., 2n = 22: W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57.
Hippuris vulgaris L., 2n = 32: W. Lancs., v.c. 60, near Forton, by canal, SD/48.53.
Hydrocotyle vulgaris L., 2n = 96: Caerns., v.c. 49, Llanbedrog, valley W. of Penarwel, SH/32.32.

Hypericum hirsutum L., 2n = 18: W. Lancs., v.c. 60, near Carnforth, SD/50.70; Westmorland, v.c. 69, Ravens Lodge, S.E. edge of Whitbarrow, base of Whitescar, SD/46.85.
Hypericum perforatum L., 2n = 32: Surrey, v.c. 17, Silent Pool, near Shere, TQ/06.48.
Lathyrus nissolia L., 2n = 14: W. Lancs., v.c. 60, near Lancaster University, SD/48.56.
Limonium britannicum Ingrouille subsp. *celticum* Ingrouille var. *pharense* Ingrouille, 2n = 35: Caerns., v.c. 49, Bardsey Island, E. of Pen Cristin, Ogof y Gaseg, SH/12.21.
Lotus corniculatus L., 2n = 24: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/48.77.
Luzula pilosa (L.) Willd., 2n = 62: Co. Waterford, v.c. H6, Nier Valley, S/2.1.
Lycopus europaeus L., 2n = 22: Caerns., v.c. 49, Pwllheli, SH/37.34.
Lysimachia nemorum L., 2n = 16: Leics., v.c. 55, Swithland Wood, SK/53.12; W. Lancs., v.c. 60, near Barkin Bridge, SD/60.63.
Lythrum portula (L.) D. A. Webb, 2n = 10: Caerns., v.c. 49, Rhos Botwnnog, SH/26.32.
Medicago sativa L. subsp. *sativa*, 2n = 32: Co. Durham, v.c. 66, coastal cliffs between Blackhall and Crimdon, NZ/47.38.
Myosotis sylvatica Hoffm., 2n = 18: W. Lancs., v.c. 60, near Yealand Conyers, SD/50.74.
Oenanthe crocata L., 2n = 22: W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57.
Oenanthe lachenalii C. C. Gmelin, 2n = 22: W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Parietaria judaica L., 2n = 26: W. Cornwall, v.c. 1, Newbridge, near St Just, SW/42.31; W. Lancs., v.c. 60, near Silverdale, SD/45.74.
Paris quadrifolia L., 2n = 20: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/48.77.
Pedicularis sylvatica L. subsp. *sylvatica*, 2n = 16: W. Cornwall, v.c. 1, between Penzance and St Just, SW/39.31.
Phleum arenarium L., 2n = 14: Caerns., v.c. 49, Abersoch dunes, N. part of Porth Fawr, SH/31.27.
Pinguicula lusitanica L., 2n = 12: Dorset, v.c. 9, Slepe Heath, c. 2·5 km S.E. of Wareham, SY/94.86 (count made on integumentary tissue).
Plantago lanceolata L., 2n = 12: W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57.
Plantago media L., 2n = 24: Dorset, v.c. 9, Fontmell Down, c. 5 km S.S.E. of Shaftesbury, ST/88.18; W. Lancs., v.c. 60, near Lancaster, by dismantled railway, SD/46.62; Westmorland, v.c. 69, Helsington Barrows, c. 3 km S.E. of Kendal, SD/48.89.
Primula elatior (L.) Hill, 2n = 22: Cambs., v.c. 29 (no further details known).
Primula veris L., 2n = 22: Co. Durham, v.c. 66, coastal cliffs between Blackhall and Crimdon, NZ/47.38.
Prunella vulgaris L., 2n = 28: Co. Durham, v.c. 66, coastal cliffs between Blackhall and Crimdon, NZ/48.38; W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57.
Pulicaria dysenterica (L.) Bernh., 2n = 18: Dorset, v.c. 9, Hartland Moor N.N.R., c. 4 km S.E. of Wareham, SY/96.85.
Quercus petraea (Mattuschka) Liebl., 2n = 24: Leics., v.c. 55, Swithland Wood, SK/53.12.
Quercus robur L., 2n = 24: E. Norfolk, v.c. 27, Badley Moor, NT/00.11.
Radiola linoides Roth, 2n = 18: Caerns., v.c. 49, Cwmistir, near Edeyrn, SH/25.38.
Ranunculus auricomus L., 2n = 32: W. Lancs., v.c. 60, near Yealand Conyers, SD/50.74.
Ranunculus bulbosus L., 2n = 16: W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Ranunculus flammula L. subsp. *flammula*, 2n = 32: Westmorland, v.c. 69, Killington, SD/61.88.
Ranunculus omiophyllus Ten., 2n = 32: Caerns., v.c. 49, Garn Fadryn, SH/27.35.
Ranunculus sceleratus L., 2n = 32: W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Rhamnus catharticus L., 2n = 24: W. Norfolk, v.c. 28, Foulden Common, TL/76.99.
Ribes nigrum L., 2n = 16: Leics., v.c. 55, Swithland Wood, SK/53.12.
Ribes uva-crispa L., 2n = 16: W. Lancs., v.c. 60, Silverdale, E. of Thrang End Farm, SD/49.77.
Rubus chamaemorus L., 2n = 56: Derbys., v.c. 57, Snake Pass summit, N. side of car park, SK/08.92.
Salsola kali L., 2n = 36: N. Somerset, v.c. 6, near Berrow, ST/28.53.
Sambucus nigra L., 2n = 36: Leics., v.c. 55, Swithland Wood, SK/53.12.
Sanguisorba minor Scop. subsp. *minor*, 2n = 28: Westmorland, v.c. 69, Brigsteer Park, 2·5 km S. of Brigsteer, SD/48.87.
Sanguisorba officinalis L., 2n = 56: W. Lancs., v.c. 60, near Aldcliffe, SD/46.60.

Sanicula europaea L., 2n = 16: Leics., v.c. 55, Swithland Wood, SK/53.12; Westmorland, v.c. 69, Brigsteer Park, 2·5 km S. of Brigsteer, SD/48.87.
Scabiosa columbaria L., 2n = 16: Westmorland, v.c. 69, Helsington Barrows, c. 3 km S.E. of Kendal, SD/48.89.
Scrophularia nodosa L., 2n = 36: W. Lancs., v.c. 60, near Lancaster, SD/47.59.
Sedum telephium L., 2n = 24: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/47.77.
Senecio viscosus L., 2n = 40: W. Lancs., v.c. 60, near Carnforth, SD/49.71.
Solanum dulcamara L., 2n = 24: W. Lancs., v.c. 60, near Aldcliffe, close to estuary of River Lune, SD/45.60.
Spiranthes spiralis (L.) Chevall., 2n = 30: Caerns., v.c. 49, Abersoch Bay, below Marchros, on Abersoch golf-links, SH/31.26.
Stachys officinalis (L.) Trev., 2n = 16: W. Cornwall, v.c. 1, Chyenhal, SW/45.27.
Stellaria holostea L., 2n = 26: Leics., v.c. 55, Swithland Wood, SK/53.12.
Tanacetum vulgare L., 2n = 18: W. Lancs., v.c. 60, River Lune estuary, near Lancaster, SD/45.62.
Taxus baccata L., 2n = 24: Leics., v.c. 55, Swithland Wood, SK/53.12.
Teucrium scorodonia L., 2n = 32: Cheviot, v.c. 68, Ingram, River Breamish, NU/01.16.
Triglochin palustris L., 2n = 24: E. Norfolk, v.c. 27, Badley Moor, NT/00.11, (three plants counted).
Tussilago farfara L., 2n = 60: W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57; W. Lancs., v.c. 60, near Carnforth, SD/50.71.
Typha latifolia L., 2n = 30: W. Lancs., v.c. 60, Lancaster University grounds, SD/48.57.
Valeriana dioica L., 2n = 16: Leics., v.c. 55, Swithland Wood, SK/53.12.
Verbascum nigrum L., 2n = c. 30 + 4 (3–7)S: S. Hants., v.c. 11, near Winchester, SU/4.2.
Veronica serpyllifolia L. subsp. *serpyllifolia*, 2n = 14: Caerns., v.c. 49, Bardsey Is., Chapel garden, SH/12.22.
Vicia sepium L., 2n = 14: W. Lancs., v.c. 60, above Saltmire Bridge, SD/51.75; Westmorland, v.c. 69, Whitbarrow (S.E. edge), Raven's Lodge, underneath White Scar, SD/46.85.
Wahlenbergia hederacea (L.) Reichenb., 2n = 36: cultivated plant, originally from S. Devon, v.c. 3, Dartmoor, Newbridge near Hone (W. of Bovey Tracy), SX/71.70.

ACKNOWLEDGMENTS

We should like to thank English Nature and the R.S.P.B. for permission to collect plant material from their reserves.

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THE *ROSA* HERBARIUM OF A. H. WOLLEY-DOD

As far as is known, until last year Wolley-Dod's *Rosa* collection in **BM** had never been examined fully, and certainly had never in its entirety been examined critically, since Wolley-Dod himself. A few of the specimens have been remounted, but most are on Wolley-Dod's original sheets. Large numbers are unmounted, many of them between old and yellow sheets of newspaper dating from the 1920s. The author of this note was asked to go through the collection and label the specimens in the light of modern taxonomic opinion. He received the collection on loan early in 1990, and did most of the routine work himself, with the assistance of G. G. Graham where consultation or a second opinion seemed desirable.

The collection contains 3091 specimens. Of these, over 100 were indeterminate, in some cases because the specimens had deteriorated, but mainly because they were too immature or too scrappy for determination. A few in the latter category carried a caustic comment from Wolley-Dod, and as he had not attempted identification one wonders why he bothered to keep them. Pasted on to many of the sheets are comments by Sudre, whose reliability Wolley-Dod came to distrust, and more valuable comments by R. Keller, who wrote in a crabbed hand indiscriminately in English, German, French or Latin.

Besides the large numbers of specimens collected by Wolley-Dod himself, he had acquired considerable collections from others, many of them illustrious names in the history of the study of *Rosa*. These, in alphabetical order, are as follows: C. Bailey, J. G. Baker, W. Barclay, E. B. Bishop, C. E. Britton, R. & M. Corstorphine, E. M. Day, G. Claridge Druce, Rev. A. Ley, Rev. E. F. Linton, Rev. W. R. Linton, Rev. E. S. Marshall, Rev. H. J. Riddelsdell, Rev. W. Moyle Rogers, I. M. Roper and W. A. Shoolbred. There are also a few specimens from other well-known botanists such as Rev. A. Bloxam and A. R. Horwood.

Study of the localities from which collections were made would give a fair indication of the distribution of species from north to south. Otherwise, distribution maps compiled from the records would tend rather to show the chosen hunting grounds of the main collectors. Wolley-Dod collected mainly in Devon, Surrey, Derbyshire, Cheshire and the Lake District; Baker from around Thirsk in Yorkshire; Druce from Oxfordshire; Ley from Gloucestershire, Herefordshire and parts of Wales: Moyle Rogers from Devon and Gloucestershire. Other collectors also appear to have concentrated mainly on these same regions, with a plethora of records from Surrey and scattered records from elsewhere in England. Most of the collections in Scotland are from the Perthshire vice-counties, with outlying records by E. S. Marshall from Westerness and Wester Ross, Mrs Corstorphine from Angus and H. Halcro Johnston from Hoy and Mainland, Orkney. There are only about 30 records from Ireland, mostly collected by C. H. Waddell in County Down. The Channel Islands are represented by two specimens from Jersey.

There are a few specimens from Europe. The main interest of these lies in the only two specimens of *Rosa elliptica* Tausch, both from France. These show that Wolley-Dod knew and recognised this species, but presumably had not found it in Britain, which seems to corroborate the assumption that this is not a native British species (Graham & Primavesi 1990).

Allowing for the somewhat patchy distribution of records described above, there appears in general to have been little change in frequency of *Rosa* species and their hybrids throughout the country between the period during which the collection was made and the present day. Naturally, there are losses in some areas, principally where there has been expansion of the larger towns and cities. There are, for instance, a number of records which at first sight appear astonishing nowadays because the collections were made in what are now solidly built-up areas of Greater London. Only one species shows a marked change in frequency. This is *Rosa agrestis* Savi. There are about 20 specimens of this species in Wolley-Dod's collection, from scattered localities all over the southern part of England. Nowadays this appears to be a very rare species in England, though it is still frequent in parts of Ireland. What has caused this decline in frequency is not known. The other two sweet briar species, *R. rubiginosa* L. and *R. micrantha* Borrer ex Smith, appear to have undergone little or no change in frequency since Wolley-Dod's time.

In his *Revision of the British Roses*, Wolley-Dod (1930–31) repeatedly refers to this herbarium, but he did not re-label the specimens to conform with the nomenclature of that work. The names are those of the multiplicity of species described in his earlier works (Wolley-Dod 1908, 1910). The research which he undertook is reflected in additional comments attached to the sheets. As well as those of Sudre and Keller already mentioned, there are Wolley-Dod's own type-written or hand-written comments, and cuttings from Botanical Exchange Club reports. One cannot help feeling that in the light of modern opinion the work undertaken to elaborate all the Groups, varieties and forms described in *Revision of the British Roses* was an unprofitable expenditure of time that could have been more usefully employed. Indeed, Wolley-Dod himself later expressed doubt and dissatisfaction, stating that rarely in the field did one find specimens which corresponded closely or even remotely with the author's description of a named variety (Wolley-Dod 1936). Keller was more nearly on the right lines, as he frequently suggested the possibility of hybridity. It is a pity that

Wolley-Dod did not pay more attention to Keller's comments, but he would not recognize a *Rosa* hybrid unless the hips showed complete or partial sterility. In the course of the recent examination of this herbarium, we were able to label many specimens as definite hybrids between two species, a large number where there was plainly slight introgression of another named species, some where there was introgression of another indeterminate species, and a few which were such a mixture as to be impossible to determine. As regards the latter category it is not worth spending time on them; there are plenty of roses which can be determined and recorded. Many modern taxonomists allow inclusion of the second and third categories above as permissible variants of a named species (Stace 1975; Webb 1951). There are still unsolved problems in *Rosa* taxonomy and nomenclature, but the appalling difficulties which Wolley-Dod faced, and with his researches laid the foundations for later work, have now largely been overcome.

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ADDITIONAL RECORDS OF *SORBUS LANCASTRIENSIS* E. F. WARBURG (ROSACEAE)

Following documentation of the known sites of *Sorbus lancastriensis* E. F. Warburg (Rich & Baecker 1986), a number of additional populations have come to our attention, including two on Silurian rock, two about Grange-over-Sands, and one west of the Leven Estuary. This note lists the additional sites (we have visited all new localities in June 1991), and updates our previous list. Full details have again been lodged with the vice-county recorders, English Nature, the local Naturalists' Trusts and the Biological Records Centre, Monks Wood.

W. Lancs., v.c. 60:

Gait Barrows N.N.R. (SD/4.7). Three plants have now been found, with *Sorbus aria*, confirming the Ratcliffe (1977) record queried by Rich & Baecker (1986).

Westmorland, v.c. 69:

Farleton Knott, one plant on top of cliff (SD/5.7), and two plants on cliff face, about 300 m north of the above plant (SD/5.8). These confirm the Ratcliffe (1977) record not found in 1982.

Furness, v.c. 69b:

Birkrigg Common (SD/2.7). "One small tree in limestone pavement on summit", F. L. Woodman & K. A. Gunning, 27 May 1982 (**LANC**). This is the first known site west of the Leven Estuary; we have been unable to re-find the plant.

Kirkhead (SD/3.7). About 30–40 plants in scrubby woodland on the west side, with a few *Sorbus rupicola*. This is probably the same locality as found by C. Bailey in 1881 on "exposed limestone ridges near Wray's Holme Tower" (**CGE**, **BM**).

Old Park Wood (SD/3.7). We under-estimated the population size of this site; there are over 100 plants mixed with a smaller number of *S. rupicola* plants.

Grange-over-Sands (SD/4.7). One plant by B5277 at west edge of golf course.

Witherslack and Yewbarrow (SD/4.8). Isolated plants occur on roadsides, in hedges and on limestone rocks in at least six separate localities around the villages. One plant, to the N.E. of Witherslack, is in a shady hedge on Silurian baserock, a very atypical habitat.

Poolbank (SD/4.8). One small tree on woodland edge by roadside, first found by G. Halliday in 1974 (**LANC**). This is a second site on the Silurian slate; the soil pH is about 6–6·5, equivalent to the pH of many of the limestone soils on which it occurs.

Latterbarrow Nature Reserve (SD/4.8). At least four plants on the reserve, and about ten on the S.W. edge in woodland above the old A590. This is almost certainly the same locality as plants collected in 1937 by E. F. Warburg near The Derby Arms (**BM**).

Currently, there are thus approximately 2000 plants known from about 35 sites in eight 10-km squares, with one extinct population.

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Plant Records

Records for publication must be submitted to the appropriate Vice-county Recorder (see *B.S.B.I. Year Book for 1992*), 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 normally 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), from which the species' numbers are taken. Taxonomy and nomenclature follow the *New Flora of the British Isles* by C. A. Stace (1991), except for the genera *Rubus* and *Hieracium*. The Ordnance Survey national grid reference follows the habitat and locality; the 100-km square is given in alphabetical form at the start of the grid reference rather than as numerical co-ordinates. 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 are field records if no other source is stated.

Records from the following vice-counties are included in the text below: 1, 2, 4, 9, 11–15, 17, 22, 25, 26, 28, 29, 35, 36, 38, 39, 41–50, 52, 58, 59, 61–65, 67–71, 73, 75, 77, 79–81, 88, 93, 98, 99, 102, 111.

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/com. Diphasiastrum complanatum (L.) Holub *67, S. Northumb.: With *D. alpinum* under *Calluna*, William's Cleugh, NY/639.991. G. A. & M. Swan, 1988, **herb. G.A.S.**, det. A. C. Jermy as morphotype *decipiens*.

4/9 × 5. Equisetum arvense L. × E. fluviatile L. *46, Cards.: Disused railway verge, Pendinas, SN/581.801. A. O. Chater, 1991, **NMW**.

†13/cor. Blechnum cordatum (Desv.) Hieron. *98, Main Argyll: Rock exposures, Craignish Castle, NM/773.015. A. McG. Stirling & B. H. Thompson, 1991, **BM**, det. A. C. Jermy. Present since late 1970s.

15/8. Asplenium septentrionale (L.) Hoffm. *43, Rads.: S.-facing rock face, Yatt Wood, Dolyhir, SO/24.58. D. C. Boyce, D. R. Drewett & R. G. Woods, 1991.

21/6 × 7. Dryopteris carthusiana (Villars) H. P. Fuchs × D. dilatata (Hoffm.) A. Gray *80, Roxburghs.: Birch wood, Din Moss, Hoselaw, NT/805.316. R. W. M. Corner, 1991, **BM**, det. A. C. Jermy.

21/8. Dryopteris aemula (Aiton) Kuntze *93, N. Aberdeen: Wooded den, Tore of Troup, NJ/832.613. D. Welch, 1991, **ABD**.

25/cam. × int. Polypodium cambricum L. × P. interjectum Shivas *14, E. Sussex: Old walls of ruined Greyfriars Chapel, Winchelsea, TQ/905.170. L. B. Burt & M. Thomas, 1991, **BM**, det. R. H. Roberts.

†27/1. Azolla filiculoides Lam. *44, Carms.: Ornamental pond, Gellideg Farm, SN/423.105. T. S. Crosby, 1991. Inlet to lake, Sandy Water Park, Llanelli, SN/493.005. G. Hutchinson, 1991, **NMW**. 1st and 2nd records. **49**, Caerns.: Reservoir near Pistyll Church, SH/328.422. L. J. Larson, 1991, **NMW**. Only extant locality.

28/1. Botrychium lunaria (L.) Sw. **81**, Berwicks.: Basaltic outcrop, Hareheugh Craigs, NT/687.401. D. G. Long, 1991. 2nd extant locality.

46/7. Ranunculus sardous Crantz **46**, Cards.: Sandy field, Gwbert, SN/163.498. A. O. Chater, 1991, **NMW**. 1st localised post-1930 record.

46/9. Ranunculus parviflorus L. **35**, Mons.: Thin grass on bank, R. A. F. Caerwent, ST/467.919. T. G. Evans, 1991. 1st post-1930 record.

46/11. Ranunculus lingua L. ***98**, Main Argyll: Swamp, Lochan Iliter, NM/749.102. B. H. Thompson, 1991, **herb. B.H.T.**, conf. C. D. Preston.

46/19 × 22b. Ranunculus fluitans Lam. × R. peltatus Schrank ***68**, Cheviot: Whiteadder Water at Whiteadder Bridge, Corporation Arms, NT/959.522. J. M. Croft & C. D. Preston, 1991, **CGE**, conf. S. D. Webster.

46/22a × 21. Ranunculus aquatilis L. × R. trichophyllus Chaix ***50**, Denbs.: Farm pond, Penley, SJ/408.412. B.S.B.I. meeting, 1991, **CGE**, det. S. D. Webster. 1st Welsh record.

46/22c. Ranunculus penicillatus subsp. pseudofluitans (Syme) S. Webster var. pseudofluitans ***77**, Lanarks.: R. Clyde, Wolfclyde, NT/01.36. R. C. L. Howitt, 1979, **herb. P. Macpherson**, conf. N. T. H. Holmes.

†50/aqu. Thalictrum aquilegiifolium L. ***79**, Selkirks.: Railway embankment between Bowland and Galashiels, NT/4.3. E. P. Beattie, 1969, **E**. ***80**, Roxburghs.: Riverbank, Ettrick Water below Bridgeheugh, Selkirk, NT/476.307. E. Middleton, 1988, **E**, det. D. R. McKean.

57/1. Ceratophyllum demersum L. ***44**, Carms.: Lake, Sandy Water Park, Llanelli, SN/493.005. I. K. Morgan, 1991, **NMW**. **70**, Cumberland: Recently dug pond, Bowscar, NY/522.344. K. Raistrick, 1991, **LANC**. 2nd record.

58/3. Papaver dubium subsp. lecoqii (Lamotte) Syme ***44**, Carms.: Burnt cliff, Dolwen Point, SN/233.078. I. K. Morgan, 1991.

66/4. Fumaria bastardii Boreau ***67**, S. Northumb.: Waste ground, Mason, NZ/211.735. G. A. Swan, 1990, **herb. G.A.S.**, det. M. G. Daker.

†68/1. Erucastrum gallicum (Willd.) O. E. Schulz **70**, Cumberland: Forestry track. Spadeadam, NY/6.7. M. Gregory & J. Parker, 1991, **LANC**, det. T. C. G. Rich. 2nd record.

†71/1. Hirschfeldia incana (L.) Lagr.-Fossat ***50**, Denbs.: Kinmel Bay, SH/990.808. G. Battershall, 1991. ***59**, S. Lancs.: Railway siding, Fazakerley, SJ/388.983. V. Gordon, 1991.

79/3. Lepidium heterophyllum Benth. **26**, W. Suffolk: Farm track, Eriswell, TL/754.764. D. J. & Y. T. Leonard, 1991, **herb. E. & M. Hyde**, conf. T. C. G. Rich. Only extant locality.

†86/2. Capsella rubella Reuter ***38**, Warks.: Canal towpaths, Rowington, SP/187.699, and Kingswood, SP/187.708. J. C. Bowra, 1991, **WAR**, det. P. J. Copson. 1st and 2nd records.

88/4. Cochlearia scotica Druce ***81**, Berwicks.: St Abb's Head, NT/9.6. A. Craig-Christie, 1884, **E**, det. P. S. Wyse Jackson.

†92/1. Lobularia maritima (L.) Desv. **50**, Denbs.: Colwyn Bay, SH/846.782. G. Battershall, 1991. 2nd post-1930 record.

†97/rap. Cardamine raphanifolia Pourret ***49**, Caerns.: Bank of Afon Roe near Pont Gorswen, SH/762.714. R. Lewis, 1990, **NMW**, det. E. J. Clement & T. C. G. Rich.

102/4. Rorippa islandica (Oeder ex Murray) Borbás ***46**, Cards.: Flat rock by Afon Teifi below Cenarth bridge, SN/269.416. A. O. Chater, 1991, **NMW**, det. B. Jonsell & T. C. G. Rich. 1st Welsh record, and extension of range 250 km southwards.

102/5. Rorippa amphibia (L.) Besser ***44**, Carms.: Banks of Afon Llwchwr, Llanedi, SN/59.06. I. K. Morgan, 1984, **NMW**.

102/6 × 3. Rorippa austriaca (Crantz) Besser × R. sylvestris (L.) Besser ***58**, Cheshire: Edge of lane, Partington, SJ/733.914. A. Franks & P. Newton, 1990, det. T. C. G. Rich.

†108/3. Sisymbrium loeselii L. *25, E. Suffolk: Sandy bank behind Marina, Shotley Point, TM/252.343. E. M. Hyde, 1991, **herb. T. C. G. Rich**, det. T.C.G.R.

111/1. Descurainia sophia (L.) Webb ex Prantl †42, Brecs.: Roadside verge, Llangattock, SO/21.18. A. Newton & M. Porter, 1989. 1st post-1930 record. †48, Merioneth: Disturbed ground by golf links, Morfa Harlech, SH/5.3. P. M. Benoit & D. C. Lang, 1990, **NMW**. 1st record this century.

113/5 × 4. Viola reichenbachiana Jordan ex Boreau × V. riviniana Reichb. *44, Carms.: Roadbank, Garn Fach, SN/571.156. R. D. Pryce, 1985, **NMW**, det. D. M. Moore.

113/6 × 4. Viola canina L. × V. riviniana Reichb. *75, Ayrs.: Dune grassland, Lendalfoot, NX/129.898. A. McG. Stirling, 1991.

113/9b. Viola palustris subsp. juressii P. Fourn. *47, Monts.: Bare peat, Dovey Junction, SN/703.982. P. M. Benoit, 1989.

†113/10. Viola cornuta L. *77, Lanarks.: Woodland, Cleghorn Estate, NS/8.4. W. A. Scott, 1965.

123/1a. Silene vulgaris Garcke 93, N. Aberdeen: Disturbed roadside bank, Auchterless, NJ/706.411. D. Welch, 1991, **ABD**. 1st record since 1930.

123/14 × 13. Silene latifolia Poiret × S. dioica (L.) Clairv. *75, Ayrs.: Shingle shore, Pinbain, NX/136.913. A. McG. Stirling, 1991.

†124/cha. Lychnis chalcedonica L. *35, Mons.: Forestry track, Bishop Barnet's Wood, Godefroy, ST/516.938. T. G. Evans, 1989, **NMW**.

131/10. Cerastium diffusum Pers. †12, N. Hants.: Abundant on roadside verges, Aldershot military town, SU/870.517. C. R. Hall, 1991, **herb. A. Brewis**, det. F. Rose. 2nd record.

133/3. Stellaria pallida (Dumort.) Piré 81, Berwicks.: Basaltic outcrop, Hareheugh Craigs, NT/688.400. R. W. M. Corner, 1991, **herb. M. E. Braithwaite**. 2nd record.

143/2. Spergularia bocconii (Scheele) Graebner †*15, E. Kent: Roadside verge on chalky soil, Lower Bell near Maidstone, TQ/74.60. E. G. Philp, 1991, **MNE**, conf. J. Ratter.

144/1. Polycarpon tetraphyllum (L.) L. 9, Dorset: Sandy shingle, Ferrybridge, SY/667.756. S. M. Eden, 1991. Only extant locality, in area where first recorded in 1774.

146/1. Herniaria glabra L. †*77, Lanarks.: Bare ground, site of 1988 Garden Festival, Glasgow, NS/56.65 and 57.65. P. Macpherson, 1990, **herb. P.M.** Present in increased quantity in 1991.

149/1b. Montia fontana subsp. minor Hayw. 81, Berwicks.: Basaltic outcrop, Hareheugh Craigs, NT/687.399. R. W. M. Corner, 1991, **herb. M. E. Braithwaite**. 2nd record.

†152/1. Carpobrotus edulis (L.) N. E. Br. *25, E. Suffolk: Shingle beach, Landguard Common, TM/28.31. G. E. Steeds, 1990, det. C. D. Preston.

†153/bli. Amaranthus blitoides S. Watson *26, W. Suffolk: Sandy arable field, Icklingham, TL/768.735. E. Milne-Redhead, 1988, det. A. L. Grenfell.

154/14. Chenopodium rubrum L. †*43, Rads.: Dung heap near New Radnor Station, SO/219.605. D. C. Boyce, D. R. Drewett & R. G. Woods, 1991.

156/4 × pra. Atriplex glabriuscula Edmondston × A. praecox Hülph. *68, Cheviot: Saltmarsh, Goswick, NU/054.458. G. A. & M. Swan, 1991, **herb. G.A.S.**, det. J. R. Akeroyd.

160/2. Salicornia dolichostachya Moss 44, Carms.: Channel to dock, Llanelli, SS/499.988. G. Hutchinson, 1987, **NMW**, det. D. H. Dalby. 1st post-1930 record.

163/4. Malva neglecta Wallr. *75, Ayrs.: Car park and shore, Girvan, NX/182.975. A. McG. Stirling & A. Rutherford, 1991, **E**.

164/1. LAVATERA ARBOREA L. **50**, Denbs.: Kinmel Bay, SH/994.807. G. Battershall, 1991. 2nd record, 1st since 1859.

†165/2. ALTHAEA HIRSUTA L. **11**, S. Hants.: Short coastal turf on reclaimed land, North Harbour, Cosham, SU/643.050. R. A. Barrett, 1991. 1st record as established population since 1922.

168/12. GERANIUM ROTUNDIFOLIUM L. †***46**, Cards.: Waste ground and scrub, Llandbadarn Fawr, SN/598.810. S. P. Chambers, 1991, **NMW**.

169/1. ERODIUM MARITIMUM (L.) L'Hér. **14**, E. Sussex: Bare chalk on cliff top, Flagstaff Point, TV/538.967. R. M. Burton, 1991, **herb. P. A. Harmes**. Only extant locality. ***35**, Mons.: Grassy bank near R. Severn, Sudbrook, ST/50.87. T. G. Evans, 1978. Rock garden and drive, La Cuesta, Chepstow, ST/52.93. T. G. Evans, 1981, still present in 1991. Introduced with sand and now well established. 1st and 2nd records.

169/2. ERODIUM MOSCHATUM (L.) L'Hér. †**11**, S. Hants.: Short turf by pavement, Portsdown Hill Road (B2177), Widley, SU/668.064. D. P. J. Smith, 1991, **herb. R. P. Bowman**. 1st record of established population since 1924.

†170/3. OXALIS STRICTA L. ***46**, Cards.: Trackside in pasture, Glanrheidol, SN/663.792. A. O. Chater, 1990, **NMW**.

†170/exi. OXALIS EXILIS Cunn. ***46**, Cards.: Abundant in lawns, Carrog, SN/562.724. A. O. Chater, 1991, **NMW**.

†RHUS HIRTA (L.) Sudw. ***70**, Cumberland: Derelict industrial land, Mealsgate near Fletchertown, NY/201.423. M. Porter, 1991.

†183/2. LUPINUS ARBOREUS Sims ***75**, Ayrs.: Sandy ground near shore, Seafield, NS/328.205. A. McG. Stirling & A. Rutherford, 1991.

†184/alp. LABURNUM ALPINUM (Miller) Bercht. & J. S. Presl **70**, Cumberland: Damp bank E. of Kershopefoot, NY/481.827. R. E. Groom, 1986, **LANC**, conf. A. O. Chater. 2nd record.

187/3. ULEX MINOR Roth †***59**, S. Lancs.: Embankment of disused railway line, Culcheth, SJ/646.950. V. Gordon, 1990.

†191/4. MELILOTUS INDICUS (L.) All. **12**, N. Hants.: Disturbed sandy ground, Aldershot, SU/858.508. T. Dove & A. R. G. Mundell, 1990, **herb. A.R.G.M.** 2nd record.

200/3. ASTRAGALUS GLYCYPHYLLOS L. **35**, Mons.: Rough meadow, R.A.F. Caerwent, ST/483.917. T. G. Evans and C. & G. Titcombe, 1991. 2nd extant locality.

205/1. ONOBRYCHIS VICIIFOLIA Scop. †**70**, Cumberland: Bank near old railway, Maryport, NY/02.36. N. Botham, 1991, **LANC**. 1st record this century.

†206/6. VICIA VILLOSA Roth **12**, N. Hants.: Abundant in disturbed sandy ground, Aldershot, SU/858.508. T. Dove & A. R. G. Mundell, 1990, **herb. A.R.G.M.** 2nd record.

206/10. VICIA SYLVATICA L. **12**, N. Hants.: Wood W. of Appleshaw, SU/296.485. C. Chatters & I. Routh, 1991. 1st record since 1805.

†106/14 seg. VICIA SATIVA subsp. SEGETALIS (Thuill.) Gaudin ***77**, Lanarks.: Grassy verge, Busby near Glasgow, NS/57.56. E. L. S. Lindsay & P. Macpherson, 1984, **herb. P.M.**, conf. A. McG. Stirling.

206/16. VICIA LATHYROIDES L. ***1**, W. Cornwall: Dry, stony soil on bank, Pendennis Castle, SW/824.317. R. J. Murphy & P. E. Tompsett, 1991, conf. R. M. Walls.

207/2. LATHYRUS NISSOLIA L. †**46**, Cards.: Railway embankment, Eglwys-Fach, SN/67.96. W. M. Condry, 1968, 1972. 2nd record. †***59**, S. Lancs.: Weed amongst planted bushes, Risley Moss, SJ/668.928. V. Gordon, 1991.

†ARUNCUS DIOICUS (Walter) Fern. *70, Cumberland: Lakeshore, Ullswater E. of Lyulph's Tower, NY/410.203. F. J. Roberts, 1991, **LANC**.

211/11/32. RUBUS BRITANNICUS Rogers *29, Cambs.: Woodland margin, Warren Hill, TL/ 660.637. A. L. Bull, 1989, **herb. A.L.B.**, conf. A. Newton.

211/11/51. RUBUS GLANDULIGER W. C. R. Watson *11, S. Hants.: Edge of clearing, Buckland Wood, Lymington, SZ/31.97. D. E. Allen, 1990, **BM**, conf. A. Newton.

211/11/74. RUBUS SILVATICUS Weihe & Nees *12, N. Hants.: Wood margin, Sydmonton Common, SU/49.62. D. E. Allen & F. H. Brightman, 1986, **herb. D.E.A.**, conf. A. Newton.

211/11/81. RUBUS ALBIONIS W. C. R. Watson *12, N. Hants.: Birchwood, Mount Pleasant, Tadley Common, SU/60.62. D. E. Allen, 1990.

211/11/83. RUBUS CRUDELIS W. C. R. Watson *11, S. Hants.: Wood and heath margin, Chark Common, SU/57.02. D. E. Allen, 1990, **BM**, conf. A. Newton.

211/11/107. RUBUS PAMPINOSUS Lees *12, N. Hants.: Wood margin, Hawley Common, SU/ 83.57. D. E. Allen, 1984, **herb. D.E.A.**, conf. A. Newton.

211/11/121. RUBUS CISSBURIENSIS W. C. Barton & Riddelsd. *4, N. Devon: Plantation verge, Challice's Plantation, Eggesford, SS/68.09. L. J. Margetts & W. H. Tucker, 1991, det, A. Newton.

†211/11/139. RUBUS PROCERUS Müller *81, Berwicks.: Rough bank in village, Coldingham, NT/904.662. D. P. Earl, 1991.

211/11/158. RUBUS CINEROSIFORMIS Rilstone *9, Dorset: Heathy common, Lambert's Castle Hill, SY/363.987. L. J. Margetts, 1991, **RNG**.

211/11/198. RUBUS AHENIFOLIUS W. C. R. Watson *12, N. Hants.: Roadside verges near Pamber End, SU/60.58. D. E. Allen, 1990, **BM**, conf. A. Newton. *22, Berks.: Roadside, Silchester Common, SU/62.62. D. E. Allen, 1990.

211/11/329. RUBUS RILSTONEI W. C. Barton & Riddelsd. *9, Dorset: Forestry rides, Champernhayes Plantation, Wootton Hill, SY/355.970. L. J. Margetts, 1991, **RNG**.

212/3. POTENTILLA STERILIS (L.) Garcke **93**, N. Aberdeen: Rocky ground by waterfall, Turriff, NJ/712.511. D. Welch, 1991, **ABD**. 1st post-1930 record.

†212/7. POTENTILLA RECTA L. *77, Lanarks.: Grassy waste ground, Glasgow, NS/56.64. P. Macpherson, 1991, **herb. P.M.**

†220/3/12. ALCHEMILLA MOLLIS (Buser) Rothm. *50, Denbs.: Waste ground by farm lane, north-east of Llanrwst, SH/837.655. R. Lewis, 1990, **NMW**. This record was erroneously attributed to v.c. 49 in *Watsonia* **18**: 425 (1991).

†223/2. SANGUISORBA MINOR subsp. MURICATA (Gremli) Briq. *44, Carms.: Llandybie, SN/ 610.145. R. D. Pryce, 1987. Carway, SN/455.067. F. H. Webb, 1991, det. R. D. Pryce. Both records from hedgebanks on restored opencast sites. 1st and 2nd records. *50, Denbs.: Roadside, Redbrook, SJ/508.412. K. Watson, 1991.

†224/inc. ACAENA INERMIS Hook.f. *77, Lanarks.: Stabilised shingle near Culter Water, Coulter, NT/03.33. D. J. McCosh, 1981, **herb. D.J.McC**. Known here for at least 20 years.

225/8 × 7. ROSA CANINA L. × R. STYLOSA Desv. *46, Cards.: Hedge, Mwldan valley, Penparc, SN/197.486. A. O. Chater, 1991, **NMW**, det. G. G. Graham.

225/cae. ROSA CAESIA subsp. GLAUCA (Nyman) G. G. Graham & Primavesi **50**, Denbs.: Hedge, Plas-yn-rhos, SJ/169.480. K. Watson, 1991. 2nd record.

225/cae. × 8. ROSA CAESIA subsp. GLAUCA (Nyman) G. G. Graham & Primavesi × R. CANINA L. *29, Cambs.: Hedge, Fowlmere Watercress Beds R.S.P.B. reserve, TL/405.458. A. Asher, P. H. Oswald & C. D. Preston, 1991, det. A. L. Primavesi. *46, Cards.: Hedge, Gwaryfelin, SN/595.794. A. O. Chater, 1991, **NMW**, det. G. G. Graham.

225/8 × 14. Rosa canina L. × R. rubiginosa L. *64, Mid-W. Yorks.: Hedge, Micklefield, SE/445.336. P. P. Abbott, 1990, det. G. G. Graham.

225/8 × 15. Rosa canina L. × R. micrantha Borrer ex Smith *48, Merioneth: Side of track, Arthog, SH/6.1. P. M. Benoit, 1991, **NMW**, conf. A. L. Primavesi.

225/10. Rosa obtusifolia Desv. *46, Cards.: Roadside verge S. of Glanrheidol, SN/663.789. A. O. Chater, 1991, **NMW**, det. G. G. Graham.

225/13 × 12. Rosa mollis Smith × R. sherardii Davies *46, Cards.: Hedge, Coed Cwmhwylog, Nanteos, SN/622.778. A. O. Chater, 1991, **NMW**, det. G. G. Graham.

225/15. Rosa micrantha Borrer ex Smith *69, Westmorland: Limestone scrub, Heathwaite, SD/451.768. M. Baecker, 1991, **LANC**, det. G. G. Graham.

225/17. Rosa agrestis Savi **11**, S. Hants.: Scrub woodland, South Charford Drove, Breamore Down, SU/139.207. R. P. Bowman, 1991, **herb. R.P.B.**, det. A. L. Primavesi. 1st record since 1891 record at this site.

225/17 × 15. Rosa agrestis Savi × R. micrantha Borrer ex Smith *11, S. Hants.: Scrub woodland, South Charford Drove, Breamore Down, SU/139.207. R. P. Bowman, 1991, **herb. R.P.B.**, det. A. L. Primavesi.

†226/7. Prunus laurocerasus L. *12, N. Hants.: By cricket ground, Amport, SU/304.438. M. F. Wildish, 1991.

†227/3. Cotoneaster horizontalis Decne. *12, N. Hants.: Water meadows, Winnall Moors N.R. near Winchester, SU/48.30. M.S.C. team, 1986. Chalk cutting on old road, Weyhill, SU/304.462. M. F. Wildish, 1991. 1st and 2nd records.

†227/atr. Cotoneaster atropurpureus Flinck & Hylmoe *77, Lanarks.: Scrubby waste ground, Cambuslang, NS/649.602. P. Macpherson, 1987. Old industrial site, Cambuslang, NS/646.605. P. Macpherson, 1988. Both **herb. P.M.**, det. J. Fryer & J. R. Palmer. 1st and 2nd records.

†227/hje. Cotoneaster hjelmqvistii Flinck & Hylmoe *77, Lanarks.: Bank of R. Clyde, Glasgow, NS/58.64. P. Macpherson, 1989, **herb. P.M.**, det. J. Fryer.

†227/tra. Cotoneaster transens Klotz *11, S. Hants.: Edge of ride in conifer plantation, Hurn Forest, SU/106.018. R. M. Walls & R. P. Bowman, 1985, **herb. R.P.B.**, det. J. Fryer. Published as *C. affinis* Lindley in *Watsonia* **17**: 471 (1989).

229/1. Crataegus laevigata (Poiret) DC. **50**, Denbs.: Edge of lane, Isycoed Farm, SJ/413.519. P. Day, 1990. 2nd record. *63, S.W. Yorks.: Hedge S.W. of Cawthorne, SE/273.062. P. P. Abbott, 1991.

229/1 × 2. Crataegus laevigata (Poiret) DC. × C. monogyna Jacq. *38, Warks.: Hedge, Hampton in Arden, SP/199.829. S. M. Apted, 1991, **WAR**, det. P. J. Copson & J. C. Bowra.

232/5/1 × 1. Sorbus aria (L.) Crantz × S. aucuparia L. †*59, S. Lancs.: Field edge, Rimrose valley, Waterloo, Crosby, SJ/327.985. V. Gordon, 1991.

232/5/7. Sorbus rupicola (Syme) Hedlund *102, S. Ebudes: Bagh Uamh Mhor, Beinn na Capull, Jura, NR/67.99. D. J. McCosh, 1991, **E**, det. A. McG. Stirling.

†232/cro. Sorbus croceocarpa Sell **44**, Carms.: Open oakwood, Llety-yr-ychen Fawr, Burry Port, SN/455.015. I. K. Morgan, 1991, **NMW**, det. P. J. M. Nethercott. 2nd record. *77, Lanarks.: Scrubby wood, Shieldhall, Glasgow, NS/53.65. Laneside, Shieldhall, Glasgow, NS/53.66. Both P. Macpherson, 1990, **herb. P.M.**, det. P. J. M. Nethercott. 1st and 2nd records.

235/2a. Sedum telephium L. subsp. telephium †*77, Lanarks.: Roadside west of East Kilbride, NS/59.52. A. C. & P. Macpherson, 1984, **herb. P.M.**, conf. D. R. McKean.

235/10. Sedum forsterianum Smith †*39, Staffs.: With *S. album* on limestone rocks, Milldale, S. of Alstonefield, SK/132.549. B. R. Fowler, 1991, **herb. B.R.F.**

†237/hel. Crassula helmsii (Kirk) Cockayne 2, E. Cornwall: Shallow pool near Lamledra Farm, SX/011.410. R. E. Lees & R. J. Murphy, 1991. 2nd record. *64, Mid-W. Yorks.: Edge of gravel pit, Ben Rhydding, SE/146.476. Yorkshire Naturalists' Union meeting, 1991.

239/6 × 5. Saxifraga hirsuta L. × S. spathularis Brot. †*77, Lanarks.: Woodland in old estate, Hartwood, NS/84.59. P. Macpherson, 1975, **herb. P.M.**, det. C. A. Stace.

†240/1. Tellima grandiflora (Pursh) Douglas ex Lindley *79, Selkirks.: Riverside, island at confluence of Ettrick and Yarrow Waters, NT/447.273. D. Methven *et al.*, 1988, **herb. R. W. M. Corner**.

†241/1. Tolmiea menziesii (Pursh) Torrey & A. Gray *47, Monts.: Edge of R. Vyrnwy, Pont Llogel, SJ/033.154. R. G. Woods, 1991.

†Darmera peltata (Torrey ex Benth.) Voss ex Post & Kuntze *69, Westmorland: Laneside N. of Endmoor, SD/537.855. C. E. Wild, 1989, still present in 1991, G. Halliday, **LANC**.

†246/4. Ribes sanguineum Pursh *49, Caerns.: Naturalized in woodland near Gwydyr Castle, Llanrwst, SH/792.611. R. Lewis, 1991, **NMW**.

†246/odo. Ribes odoratum Wendl.f. *77, Lanarks.: Bank of R. Clyde, Hutchesontown, NS/59.63. P. Macpherson, 1988, **E**, det. D. R. McKean.

253/1. Ludwigia palustris (L.) Elliott †14, E. Sussex: Dew pond, South Hill Barn, Seaford Head, TV/505.980. P. D. L. Maurice, 1991, det. J. Wheatley. 1st record since c.1876.

254/†6 × 3. Epilobium ciliatum Raf. × E. montanum L. *42, Brecs.: Disused railway, Llanhamlach, SO/08.27. M. Porter, 1987, det. T. D. Pennington. *46, Cards.: Waste ground, Tal-y-bont village, SN/654.893. A. O. Chater, 1990.

254/†6 × 7. Epilobium ciliatum Raf. × E. tetragonum L. *44, Carms.: Rank vegetation in flood zone of stream, Pentre-cwrt, SN/390.386. G. Hutchinson, 1991, **NMW**, det. G. D. Kitchener & B. Wurzell. 1st Welsh record.

256/†2 × †1. Oenothera glazioviana Micheli ex C. Martius × O. biennis L. *38, Warks.: Waste ground, Emscote, SP/298.654. J. C. Bowra, 1988, **WAR**.

259/4. Myriophyllum alterniflorum DC. 61, S.E. Yorks.: Pond, Thornton Elers, Thornton, SE/73.45. D. R. Grant, 1990. Only extant locality.

†259/aqu. Myriophyllum aquaticum (Vell. Conc.) Verdc. *28, W. Norfolk: Pond, Burnham Market, TF/826.418. G. Beckett, 1989, still present in 1991. *44, Carms.: Dafen Pond, Llanelli, SN/531.015. I. K. Morgan, 1991, **NMW**, conf. G. Hutchinson.

262/3. Callitriche obtusangula Le Gall *67, S. Northumb.: Ditch near Healeywood, NZ/232.849. G. A. Swan, 1991, **herb. G.A.S.**, det. Q. O. N. Kay.

†Aucuba japonica Thunb. *99, Dunbarton: Wooded streamside, Millig Burn, Helensburgh, NS/29.82. A. Rutherford, 1985.

268/1 hib. Hedera helix subsp. hibernica (Kirchner) D. McClint. †*77, Lanarks.: Bank of North Calder, Maryville, NS/68.62. A. McG. Stirling, 1986. 1st record of naturalized population.

285/4. Apium inundatum (L.) H. G. Reichb. 80, Roxburghs.: Side of Woo Burn, Ashkirk, NT/461.178. R. W. M. Corner, 1991, **herb. R.W.M.C.** 2nd extant locality.

287/1. Sison amomum L. 44, Carms.: Edge of path, Penclacwydd Wildfowl Centre, SS/530.986. B. Stewart, 1991, det. I. K. Morgan. 1st record since 1840s.

319/5. Euphorbia hyberna L. †*46, Cards.: Well established in scrub on slope, Llanbadarn Fawr, SN/598.810. S. P. Chambers, 1991, det. A. O. Chater.

320/1/3. Polygonum rurivagum Jordan ex Boreau *25, E. Suffolk: Roadside verge, Tunstall, TM/35.54. A. L. Bull, 1991, **herb. E. & M. Hyde**, conf. B. T. Styles.

320/1/are. Polygonum arenastrum Boreau *75, Ayrs.: Turf paths, Ardneil Bay, NS/18.48. A. Somerville, 1903, **CGE**, det. B. T. Styles.

320/2. Polygonum oxyspermum subsp. raii (Bab.) D. Webb & Chater **28**, W. Norfolk: Shingle beach, Snettisham, TF/646.329. M. Keene, 1991, conf. K. A. & G. Beckett. 2nd record.

†320/7. Persicaria amplexicaulis (D. Don) Ronse Decraene **64**, Mid-W. Yorks.: Road verge, Wetherby, SE/406.475. P. P. Abbott, 1991. 2nd record.

320/14. Persicaria minor (Hudson) Opiz **44**, Carms.: Mud in old oxbow of R. Tywi, Bishop's Pond, Abergwili, SN/443.209. I. K. Morgan, 1991, **NMW**, det. G. Hutchinson. 1st record this century. **58**, Cheshire: Edge of Oakmere, SJ/575.678. A. Franks, 1991, **herb. G. M. Kay**, det. J. R. Akeroyd. 2nd extant locality. ***75**, Ayrs.: Stoney margin of Loch Maberry, NX/286.759. A. McG. Stirling & A. Rutherford, 1991, **E**.

320/†19 × †20. Fallopia japonica (Houtt.) Ronse Decraene × F. sachalinensis (F. Schmidt ex Maxim.) Ronse Decraene ***4**, N. Devon: Hedge, Philham, SS/259.234. W. H. Tucker, 1991, **herb. W.H.T.**, conf. L. J. Margetts. ***77**, Lanarks.: Trackside in wood, Bothwell, NS/69.59. P. Macpherson & E. L. S. Lindsay, 1991, **herb. P.M.**, conf. D. H. Kent.

†320/22. Persicaria campanulata (Hook. f.) Ronse Decraene ***48**, Merioneth: Edge of stream near Egryn Abbey, SH/5.1. P. M. Benoit, 1991.

325/2 bif. Rumex acetosa subsp. biformis (Lange) Valdes-Berm. & Castroviejo. ***46**, Cards.: With *Crithmum* on sea cliffs W. of New Quay, SN/373.595. A. O. Chater, 1988. Coastal grassland S.W. of Aberaeron, SN/426.607. A. O. Chater, 1991, det. P. D. Sell. 1st and 2nd records.

325/11 × 12. Rumex crispus L. × R. obtusifolius L. ***50**, Denbs.: Arable field, Penley, SJ/408.407. D. Tinston, 1991, **NMW**.

325/15 × 13. Rumex conglomeratus Murray × R. pulcher L. ***2**, E. Cornwall: Footpath S.W. of Pentire Farm, SW/934.800. G. D. Kitchener, 1989, det. J. R. Akeroyd.

343/2 × 1. Salix alba L. × S. pentandra L. ***59**, S. Lancs.: Disused railway line, Culcheth, SJ/640.956. V. Gordon, 1991, **herb. V.G.**, conf. R. D. Meikle.

343/2 × 4. Salix alba L. × S. fragilis L. ***77**, Lanarks.: Waste ground, Braehead, Glasgow, NS/52.67. P. Macpherson, 1987, **herb. P.M.**, det. R. D. Meikle.

343/6. Salix purpurea L. **35**, Mons.: Sandy bank of R. Usk, Llanllowell, ST/387.983. T. G. Evans & D. Lewis, 1991, **herb. T.G.E.** Only extant locality.

†351/1. Gaultheria shallon Pursh ***44**, Carms.: Edge of conifer plantation, Gelli Aur, SN/597.197. I. K. Morgan, 1991, **NMW**.

†352/1. Gaultheria mucronata (L.f.) Hook. & Arn. ***46**, Cards.: Dry roadside bank, Eglwys Fach, SN/685.952. A. O. Chater & C. D. Preston, 1991, **NMW**.

†370/5. Lysimachia punctata L. ***79**, Selkirks.: Steep bank, Clovenfords, NT/452.367. R. W. M. Corner, 1991, **herb. R.W.M.C.**

372/1. Anagallis tenella (L.) L. **81**, Berwicks.: Flush in heather moor, Wheel Burn, NT/565.515. M. E. Braithwaite, 1991, **herb. M.E.B.** 2nd record, 1st since 1853.

382/1. Centaurium pulchellum (Sw.) Druce ***67**, S. Northumb.: Dune slack, Hadston Links, NZ/273.990. G. A. Swan, 1991, **herb. G.A.S.**, det. F. Ubsdell.

387/1. Nymphoides peltata Kuntze †***69**, Westmorland: Old clay pit, Barrow-in-Furness, SD/194.703. P. Burton, 1991, **LANC**. †***98**, Main Argyll: Backwater of R. Awe at Fanans, NN/033.293. D. Dugan, 1985, still present in 1991, B. H. Thompson, **herb. B.H.T.**, conf. C. D. Preston.

†Phacelia tanacetifolia Benth. ***41**, Glam.: Railway cutting, Wingfield Road, Whitchurch, ST/152.795. G. Hutchinson, 1991, **NMW**, det. R. G. Ellis. 2nd Welsh record.

392/6. Symphytum tuberosum L. †**11**, S. Hants.: Edge of wood, Hedgemoor Copse, West Tytherley, SU/265.313. R. P. Bowman, 1966, **herb. R.P.B.**, still present in 1988. 1st record since 1929. †**59**, S. Lancs.: Hedge bank, Formby, SD/308.086. V. Gordon, 1990. 2nd record.

†392/7. Symphytum grandiflorum DC. ***77**, Lanarks.: Edge of wood, Carmunnock, NS/60.57. P. Macpherson, 1991, **herb. P.M.**

400/3. Myosotis stolonifera (DC.) Gay ex Leresche & Levier ***63**, S.W. Yorks.: Acidic flush, Hordron Clough, Langsett, SK/175.994. P. P. Abbott, 1991. Southerly extension of range. **80**, Roxburghs.: Wet flush, The Schil, NT/866.215. R. W. M. Corner & B. H. Thompson, 1991, **herb. R.W.M.C.** 2nd record.

406/1 ros. Calystegia sepium subsp. roseata Brummitt †***46**, Cards.: Railway embankment, Eglwys Fach, SN/673.962. A. O. Chater & W. M. Condry, 1991, **NMW**. Hedgebank, Tresaith, SN/279.514. A. O. Chater, 1991, **NMW**. 1st and 2nd records.

†416/3. Verbascum phlomoides L. **46**, Cards.: Disused railway, Felin-y-mor, Aberystwyth, SN/581.804. A. O. Chater, 1977, **NMW**, det. I. K. Ferguson. Still present in 1990.

[416/4 × 1. Verbascum lychnitis L. × V. thapsus L. **46**, Cards.: Delete record published in *Watsonia* **12**: 173 (1978) specimen in **NMW** is *V. phlomoides* L., det. I. K. Ferguson, 1990].

416/7. Verbascum nigrum L. †***42**, Brecs.: Garden weed, Gilwern, SO/24.14. S. G. & A. Marshall, 1989, det. M. Porter. 1st localised record.

†420/5. Linaria dalmatica (L.) Miller ***64**, Mid-W. Yorks.: Verge of old A65 road south of Settle, SD/813.620. E. Shorrock, 1991, det. N. Frankland.

424/2. Scrophularia auriculata L. **71**, Man: Pasture by R. Dhoo, Glenlough, SC/343.779. J. Lamb & P. A. Sayle, 1991, conf. D. E. Allen. 2nd record, 1st as an undoubted native.

†425/cup. × 1 × 2. Mimulus cupreus Dombrain × M. luteus L. × M. guttatus DC. ***41**, Glam.: R. Rhymney between Llechryd and Rhymney, SO/1.0. T. G. Evans, 1989, **NMW**, det. A. J. Silverside.

426/1. Limosella aquatica L. **75**, Ayrs.: Edge of North Craig Reservoir, NS/437.414. R. L. Griffith, 1991, **herb. R.L.G.** 2nd record. ***93**, N. Aberdeen: Mud by dune slack, Sands of Forvie, NK/01.26. J. J. Barkman & C. H. Gimingham, 1990, **ABD**. Northerly extension of range.

430/2 × 3. Veronica anagallis-aquatica L. × V. catenata Pennell ***36**, Herefs.: Disused gravel pit, Bodenham, SO/52.51. J. M. Croft & C. D. Preston, 1991, **CGE**.

†430/25. Veronica crista-galli Steven **46**, Cards.: Waste ground by Church Hall, Llanbadarn Fawr, SN/598.810. A. O. Chater, 1991, **NMW**. 2nd record.

†430/aus. Veronica austriaca subsp. teucrium (L.) D. Webb ***39**, Staffs.: Limestone spoil on railway sidings, Waterhouses, SK/072.492. B. R. Fowler, 1991.

[434/3. Melampyrum pratense L. **29**, Cambs.: Delete record published in *Watsonia* **18**: 429 (1991); specimen in **CGE** is *Stellaria holostea* L.]

435/1/19 × 13. Euphrasia rostkoviana Hayne × E. nemorosa (Pers.) Wallr. ***35**, Mons.: Floor of disused limestone quarry, Blackcliff, ST/533.984. T. G. Evans, 1988, **herb. T.G.E.**, det. A. J. Silverside. 1st Welsh record.

440/2. Orobanche purpurea Jacq. **26**, W. Suffolk: Lakenheath, TL/72.82. M. G. Rutterford, 1990, conf. F. W. Simpson. 1st post-1930 record. **45**, Pembs.: Dunes over limestone west of Manorbier Church, SS/06.97. M. Higgins, 1991. Only extant locality.

440/4. Orobanche alba Stephan ex Willd. †***17**, Surrey: On *Thymus* in garden, host planted 20 years ago and not disturbed for at least 10 years, Abinger Hammer, TQ/098.460. P. Verrall, 1991, conf. F. J. Rumsey.

442/2. Utricularia australis R. Br. ***80**, Roxburghs.: Branxholme Wester Loch, NT/42.110. M. E. Braithwaite, 1991, **herb. R. W. M. Corner**.

†464/rus. Phlomis russeliana (Sims) Benth. *70, Cumberland: Railway embankment, Langwathby, NY/575.324. F. Lawson, 1957, **CLE**, and R. W. M. Corner, 1990, **LANC**, both specimens det. G. Halliday.

472/1 int. Plantago major subsp. intermedia (Gilib.) Lange *35, Mons.: Black Rock Point, ST/51.88. A. O. Chater, 1987, **NMW**.

472/5. Plantago coronopus L. †*43, Rads.: Close-grazed turf on roadside bank, Llannerch Cawr, SN/900.616. M. Porter, 1991, **NMW**.

†475/5. Campanula persicifolia L. **80**, Roxburghs.: Railway cutting, Long Newton, NT/587.277. R. W. M. Corner, 1991, **herb. R.W.M.C.** 2nd record.

485/3 × 4. Galium mollugo L. × G. verum L. *93, N. Aberdeen: Roadside bank, Auchterless, NJ/706.411. D. Welch, 1991, **ABD**.

485/6. Galium pumilum Murray **12**, N. Hants.: Isle of Wight Hill, SU/245.373. P. Wilson, 1991. 2nd record.

485/10. Galium uliginosum L. **46**, Cards.: Fen, Banc-y-mwldan S.S.S.I., Penparc, SN/197.483. W. Fojt, 1987, conf. A. O. Chater.

494/2. Valerianella carinata Lois. **50**, Denbs.: Colwyn Bay, SH/845.782. G. Battershall, 1991. 2nd record. *81, Berwicks.: Rock outcrop, Muckle Thairn, Girrick, NT/665.374. M. E. Braithwaite, 1991, **E**, det. D. R. McKean. Northerly extension of range.

†502/3. Bidens frondosa L. **44**, Carms.: Witchett Pool, Laugharne, SN/28.07. V. Gordon, 1956, **NMW**, det. G. Hutchinson. 2nd record.

506/†4 × 7. Senecio squalidus L. × S. viscosus L. *58, Cheshire: By gravel track, Alsager, SJ/796.548. G. M. Kay, 1990, **herb. G.M.K.**

506/†4 × 8. Senecio squalidus L. × S. vulgaris L. *45, Pembs.: Waste ground, Goodwick Harbour, SM/95.38. J. W. Partridge, 1988, **NMW**, det. C. Jeffrey.

506/6. Senecio sylvaticus L. **111**, Orkney: Eroded bank at top of beach, Rackwick Bay, ND/197.990. B. H. Thompson, 1991. Only extant locality.

†509/3. Petasites japonicus (Siebold & Zucc.) Maxim. **2**, E. Cornwall: Roadside bank, Lower Woon, SX/035.623. B. Molland, 1991, det. R. J. Murphy. 2nd record. **49**, Caerns.: Tidal mudbank, Afon Ro near confluence with Afon Conwy, SH/77.69. R. Lewis, 1991. 2nd record. *79, Selkirks.: Side of R. Tweed below Yair Bridge, NT/462.325. D. Methven, 1991.

513/1. Pulicaria dysenterica (L.) Bernh. *99, Dunbarton: Ditch bank, Bannachra Muir, Helensburgh, NS/33.83. K. Futter, 1991, **E**, conf. A. McG. Stirling.

†518/2. Solidago canadensis L. **50**, Denbs.: Kinmel Bay, SH/990.808. G. Battershall, 1991. 2nd record.

†518/3. Solidago gigantea subsp. serotina (O. Kuntze) McNeill *38, Warks.: Disused quarry, Little Compton, SP/270.291. J. C. Bowra, 1980, **WAR**, det. C. Jeffrey & D. H. Kent.

†519/8. Aster lanceolatus Willd. *46, Cards.: Tidal river bank, Afon Rheidol, Glanyrafon, SH/612.804. Waste ground near railway, Aberystwyth, SN/589.811. Both A. O. Chater, 1990, **NMW**, det. P. F. Yeo. 1st and 2nd records.

†519/9. Aster × salignus Willd. *46, Cards.: Tidal river bank, Afon Leri, Borth, SN/616.898. Railway embankment, Glandyfi, SN/696.976. Both A. O. Chater, 1990, **NMW**, det. P. F. Yeo. 1st and 2nd records.

†522/1. Conyza canadensis (L.) Cronq. *77, Lanarks.: Waste ground near R. Clyde, Glasgow, NS/56.65. P. Macpherson, 1991, **herb. P.M.**

538/3. Arctium minus subsp. pubens (Bab.) Arenes *46, Cards.: Disturbed ground by caravan site, Ystrad Teilo, Llanrhystud, SN/546.695. A. O. Chater, 1991, **NMW**, conf. F. H. Perring.

544/3. Centaurea cyanus L. **61**, S.E. Yorks.: Roadside verge, Bursea Lane, SE/803.342. F. E. Crackles, 1991. Only extant locality. **70**, Cumberland: Grass verge, lane off Linefoot-Broughton Moor Road, NY/075.341. N. Botham, 1972. Only extant locality.

552/2 × 1b. Tragopogon porrifolius L. × T. pratensis subsp. minor (Miller) Wahlenb. *25, E. Suffolk: Roadside verge, Tunstall, TM/35.54. P. G. Lawson, 1991.

554/1. Lactuca serriola L. *58, Cheshire: Embankment and ditchside, Helsby, SJ/489.774. G. M. Kay & T. C. G. Rich, 1991.

558/1/3. Hieracium speluncarum Arv.-Touv. *77, Lanarks.: Spoil heaps amongst scrub near Bishopbriggs Golf Course, NS/59.71. D. J. McCosh & K. J. Watson, 1991, **GLAM**.

558/1/45. Hieracium lasiophyllum Koch *44, Carms.: Dry rocks above Troed-rhiw-rudd-wen, Rhandirmwyn, SN/7.4. I. M. Vaughan, 1972, **NMW**, det. J. Bevan.

558/1/99. Hieracium grandidens Dahlst. *93, N. Aberdeen: Dyke along shelter belt, Oyne, NJ/671.262. D. Welch, 1989, **ABD**, det. D. J. McCosh & P. D. Sell.

558/1/136. Hieracium caesiomurorum Lindeb. *93, N. Aberdeen: Rock ledge by waterfall, Craig, NJ/472.247. D. Welch, 1990, **herb. D.W.**, det. D. J. McCosh.

558/1/222. Hieracium salticola (Sudre) Sell & C. West *41, Glam.: Grassy waste ground, Cardiff Docks, ST/205.743. G. Hutchinson, 1986, **NMW**, det. J. Bevan.

558/1/223. Hieracium vagum Jordan *41, Glam.: Disused railway line, St Fagans, ST/117.768. G. Hutchinson, 1990, **NMW**, det. J. Bevan.

558/1/mem. Hieracium memorabile Sell & C. West **88**, Mid Perth: Rocky ledges, N. Coire, Beinn Heasgarnich, NN/41.38. D. J. Tennant, 1991, **herb. D.J.T.** 1st record since 1891 specimen from this site.

†571/1. Lagarosiphon major (Ridley) Moss *39, Staffs.: Canal N. of Brownhills, SK/046.071. J. P. Martin, 1990, **K**, det. D. A. Simpson.

577/11. Potamogeton friesii Rupr. *80, Roxburghs.: Branxholme Easter Loch, NT/43.11. P. Macpherson, 1991, **herb. P.M.**, det. C. D. Preston.

577/16. Potamogeton trichoides Cham. & Schldl. *12, N. Hants.: Pond by R. Blackwater, Hawley, SU/855.595. C. R. Hall, 1991, **herb. A. Brewis**, det. N. T. H. Holmes & C. D. Preston. *36, Herefs.: Recently cleared section of Hereford & Gloucester Canal E. of Skew Bridge, Monkhide, SO/61.43. J. M. Croft & C. D. Preston, 1991, **CGE**.

579/1. Ruppia cirrhosa (Petagna) Grande *69, Westmorland: Old mine shaft frequently inundated by sea, Blacks Pond, Askam in Furness, SD/207.763. P. Burton, 1991, **LANC**, conf. C. D. Preston.

601/1. Muscari neglectum Guss. ex Ten. †*70, Cumberland: Quarry, Catlands, NY/2.4. M. Porter, 1991.

602/1. Colchicum autumnale L. †*73, Kirkcudbrights.: Mill Island, R. Cree, NX/409.662. J. McCleary, 1989.

†605/2. Juncus tenuis Willd. *67, S. Northumb.: Grassy track, W. bank of R. Allen opposite Plankey Mill, NY/795.622. G. A. Swan, 1972, **herb. G.A.S.** First recorded in NY/7.6 in 1955; still present in 1991. Waste ground near Albert Edward Dock, NZ/348.671. D. N. Mitchell, 1988, **herb. G.A.S.** 1st and 2nd records.

605/4. Juncus compressus Jacq. **35**, Mons.: Wet hollow, White House Farm, SO/42.14. P. C. & J. Hall, 1991, **NMW**, det. P. C. H. & T. G. Evans. Only extant locality. *58, Cheshire: Boggy area by pool, Middlewich, SJ/699.669. J. H. Clarke, 1991, **herb. G. M. Kay**, det. C. A. Stace.

605/12. Juncus filiformis L. *59, S. Lancs.: Exposed shore of Earnsdale Reservoir, TM/669.221. P. Jepson, 1991.

607/6. Allium oleraceum L. 26, W. Suffolk: Roadside verge, Shaker's Lane, Bury St Edmunds, TL/86.64. P. G. Lawson & E. Milne-Redhead, 1991. 2nd extant locality.

†616/2. Iris versicolor L. 70, Cumberland: Amongst *Juncus* by lakeside between Fawe Park and Lingholm, Derwentwater, NY/254.224. E. Sterne, 1985, **LANC**, det. B. Mathew. 2nd record.

628/2. Listera cordata (L.) R. Br. **46**, Cards.: Moorland N. of Cwm Ystwyth, SN/812.778. A. Jones, 1991. 2nd record.

640/3. Ophrys sphegodes Miller **26**, W. Suffolk: Open grassland, Lakenheath, TL/7.8. L. Farrell, 1991, conf. J. J. Wood. 1st record since 1793.

643/1 × 3b. Dactylorhiza fuchsii (Druce) Soó × D. incarnata subsp. pulchella (Druce) Soó *62, N. E. Yorks.: Calcareous flush, Dalby Forest near Thornton Dale, SE/8.8. F. Horsman, 1991.

643/1 × 5. Dactylorhiza fuchsii (Druce) Soó × D. purpurella (Stephenson & T. A. Stephenson) Soó *46, Cards.: Dune slack, Ynys-las Dunes N.N.R., SN/611.938. F. Horsman, 1991.

643/3b. Dactylorhiza incarnata subsp. pulchella (Druce) Soó **65**, N.W. Yorks.: Marsh, Combe Scar, SD/679.875. F. Horsman, 1991. 2nd record.

643/3a × 2b. Dactylorhiza incarnata (L.) Soó subsp. incarnata × D. maculata subsp. ericetorum (Linton) P. Hunt & Summerh. *46, Cards.: Fen, Mwldan valley N.N.E. of Penparc, SN/201.489. F. Horsman, 1991.

643/4. Dactylorhiza praetermissa (Druce) Soó **62**, N.E. Yorks.: Streamside, Keysbeck, Stape, SE/798.953. P. Sykes, 1991, det. F. Horsman. Only extant locality.

643/6 cam. Dactylorhiza majalis subsp. cambrensis (Roberts) Roberts **46**, Cards.: Fen near Cardigan, SN/1.4. F. Horsman, 1991. 2nd record.

643/6 cam. × 5. Dactylorhiza majalis subsp. cambrensis (Roberts) Roberts × D. purpurella (Stephenson & T. A. Stephenson) Soó *46, Cards.: Dune slack, Ynys-las Dunes N.N.R., SN/609.939. D. C. Lang & A. P. Fowles, 1990.

643/7. Dactylorhiza traunsteineri (Sauter ex Reichb.) Soó *11, S. Hants.: Flushed marshy clearing, Exbury, SU/4.0. R.P. Bowman, 1984, det. F. Rose.

†646/1. Acorus calamus L. **50**, Denbs.: Marchwiel, SJ/355.468. P. Goodhind, 1991. 2nd record. **80**, Roxburghs.: Side of R. Teviot below Roxburgh Castle, NT/713.337. J. M. Croft, C. D. Preston & O. M. Stewart, 1991, **herb. R. W. M. Corner**. Only extant locality.

†647/1. Calla palustris L. *47, Monts.: Roadside marsh, Meifod, SJ/160.126. H. Webster, 1989. Known for over 20 years but now almost overwhelmed by *Petasites japonicus*. 1st Welsh record.

†648/1. Lysichiton americanus Hultén & H. St John **46**, Cards.: Stream bank, Tyglyn, SN/498.598. R. N. Stringer, 1991. 2nd record.

650/4. Lemna gibba L. **44**, Carms.: Ditch north of Glanrhyd Farm, Pembrey, SN/406.043. I. K. Morgan, 1991, **NMW**, conf. G. Hutchinson. 1st record since 1840s. Garden pond, Towy View near Ffairfach, SN/640.225. I. K. Morgan, 1991. 2nd extant locality.

650/min. Lemna minuta Kunth *44, Carms.: Ditch between Bury Port and Pwll, SN/462.012. Reed swamp E. of Bury Port, SN/458.010. Both I. K. Morgan, 1991, **NMW**, det. G. Hutchinson & A. Orange. 1st and 2nd records. 3rd and 4th Welsh records.

653/2 × 1. Typha angustifolia L. × T. latifolia L. *13, W. Sussex: Ponds, Chichester Gravel Pits, SU/872.032. G. H. Forster, 1991. *14, E. Sussex: Ditch in pasture near R. Ouse, Lewes, TQ/428.055. T. C. G. Rich, 1991, **LANC**.

654/3. ERIOPHORUM LATIFOLIUM Hoppe **81**, Berwicks.: Calcareous flush, Lamberton Moor, NT/955.582. M. E. & P. F. Braithwaite, 1991, **herb. M.E.B.** 2nd extant locality.

655/11. ISOLEPIS CERNUA (Vahl) Roemer & Schultes **47**, Monts.: Saltmarsh, Dovey Junction Station, SN/695.984. P. M. Benoit, 1989. Only extant locality; last seen here in 1939.

656/6. ELEOCHARIS UNIGLUMIS (Link) Schultes ***17**, Surrey: Old sand filter bed, Barn Elms waterworks, TQ/228.774. M. Mullin, 1991.

658/1. CYPERUS LONGUS L. †**59**, S. Lancs.: By dried-up reservoir, Pilsworth, SD/755.086. A. Franks. 1991. 2nd record.

659/1. SCHOENUS NIGRICANS L. **81**, Berwicks.: Calcareous flush, Lamberton Moor, NT/955.582. M. E. & P. F. Braithwaite, 1991, **herb. M.E.B.** 2nd extant locality.

663/23. CAREX STRIGOSA Hudson ***63**, S. W. Yorks.: Damp ditch in wood, Margery Wood, Cawthorne, SE/278.095. P. P. Abbott, 1991, det. W. A. Sledge.

663/28. CAREX LIMOSA L. **50**, Denbs.: Soligenous flush, Pentrevoelas, SH/890.545. J. A. Green, 1991. 2nd record.

663/60. CAREX DISTICHA Hudson ***48**, Merioneth: *Phragmites* swamp near Llanaber, SH/5.1. P. M. Benoit, 1991, **NMW**.

663/61. CAREX ARENARIA L. †**77**, Lanarks.: Waste ground behind High Street Railway Station, Glasgow, NS/59.65. J. H. Dickson, 1989, **GL**. 2nd record.

663/81. CAREX DIOICA L. ***43**, Rads.: *Molinia* flush below Craig y Bwlch, SN/900.619. D. Reed, 1991, **NMW**, conf. R. G. Woods.

667/1 aru. MOLINIA CAERULEA subsp. ARUNDINACEA (Schrank) K. Richter ***58**, Cheshire: Roadside ditch, Goostrey, SJ/797.729. G. M. Kay, 1991, **herb. G.M.K.**

†ERAGROSTIS CURVULA (Schrader) Nees ***11**, S. Hants.: Side of disused railway near Mayflower Park, Southampton, SU/416.111. E. J. Clement & A. L. Grenfell, 1989, **herb. R. P. Bowman**, det. T. A. Cope.

†670/6 meg. FESTUCA RUBRA subsp. MEGASTACHYS Gaudin ***25**, E. Suffolk: Earth bank, Landguard Common, TM/28.31. A. Copping, 1987, det. C. A. Stace. ***29**, Cambs.: Roadside verge, Little Shelford, TL/446.513. P. J. O. Trist, 1991, **herb. P.J.O.T.**

670/7. FESTUCA ARENARIA Osbeck ***44**, Carms.: Shingle at foot of calcareous cliff, Llansteffan, SN/3.0. I. M. Vaughan, 1967, **NMW**, det. A. K. Al-Bermani.

670/9. FESTUCA FILIFORMIS Pourret ***47**, Monts.: On hummocks in boggy field near Llanfihangel-yng-Ngwynfa, SJ/09.15. P. M. Benoit, 1989.

670/10. FESTUCA VIVIPARA (L.) Smith **50**, Denbs.: Rocky outcrop at 450 m, Migneunt, SH/778.425. G. Battershall, 1991. 2nd record.

671/†2 × 1. LOLIUM MULTIFLORUM Lam. × L. PERENNE L. ***38**, Warks.: Farm track, Upper Shuckburgh, SP/486.603. J. C. Bowra, 1991, **WAR**, det. P. J. Copson.

672/5. VULPIA CILIATA subsp. AMBIGUA (Le Gall) Stace & Auq. ***48**, Merioneth: Low hummocks in dune grassland, Aberdyfi golf links, SN/5.9 and 6.9. P. M. Benoit, 1991, **NMW**. 1st Welsh record.

673/2. PUCCINELLIA DISTANS (Jacq.) Parl. ***48**, Merioneth: Embankment, Mawddach estuary at Garth Isaf, SH/6.1. P. M. Benoit, 1991, **NMW**.

673/5. PUCCINELLIA RUPESTRIS (With.) Fern. & Weath. **2**, E. Cornwall: Abundant on mud on sides of Millbrook Pond, SX/425.523. R. W. Gould, 1991, conf. L. J. Margetts. 1st record since 1917.

676/11. POA ANGUSTIFOLIA L. **2**, E. Cornwall: Penlee Battery, Rame peninsula, SX/440.493. R. W. Gould, 1991, **herb. R. J. Murphy**, conf. L. J. Margetts & R. J. M. 2nd record.

†680/2. Briza minor L. *13, W. Sussex: Halsey's Farm, Chichester Harbour, SZ/871.975. G. H. Forster, 1991.

683/1. Bromopsis erecta (Hudson) Fourr. *43, Rads.: Grassland in base of old quarry, Stanner Rocks, SO/26.58. R. G. Woods, 1988, **NMW**, det. T. G. Evans. One plant.

†683/4. Bromopsis inermis (Leysser) Holub *14, E. Sussex: Edge of Sports Field, Bevingdean Hospital, TQ/331.061. A. Spiers, 1990, **herb. P. A. Harmes**. Chalk downs, Castle Hill, Brighton, TQ/367.070. G. Steven, 1991, det. P. J. O. Trist. 1st and 2nd records.

†683/13. Bromus lepidus O. Holmb. *44, Carms.: Forestry rides, Pembrey Forest, SN/3.0. I. M. Vaughan, 1965, **NMW**.

†683/19. Ceratochloa carinata (Hook & Arn.) Tutin *2, E. Cornwall: Roadside verge, Saltermill, SX/430.637. T. Atkinson, 1991. *11, S. Hants.: Sandy roadside verge, Belvidere, Northam, SU/430.129. P. D. Stanley, 1991, **herb. R.P. Bowman**, det. R. P. B. & P. J. O. Trist.

684/2. Brachypodium pinnatum (L.) P. Beauv. *52, Anglesey: Pine plantation on sand dune, Newborough Forest, SH/398.637. N. H. Brown & R. H. Roberts, 1990, **NMW**.

687/1. Hordeum secalinum Schreber †73, Kirkcudbrights.: Field track E. of Castlecreavie, NX/726.488. O. M. Stewart, 1991, **E**, det. P. J. O. Trist. 1st record since 1910.

687/jub. Hordeum jubatum L. **49**, Caerns.: Sandy beach, Pontlyfni, SH/433.532. L. J. Larsen, 1989, **NMW**, det. R. G. Ellis.

689/1. Koeleria macrantha (Ledeb.) Schultes **44**, Carms.: Limestone grassland near Llandyfan, SN/647.176. D. Grey & S. Gouch, 1989. 2nd extant locality. *48, Merioneth: Calcareous dune grassland, Aberdyfi golf links, SN/6.9. P. M. Benoit, 1991, **NMW**.

700/1. Calamagrostis epigejos (L.) Roth **111**, Orkney: Tall herb community on cliff top, Hoxa, S. Ronaldsay, ND/40.93. E. R. Bullard, 1989, det. P. J. O. Trist.

700/3. Calamagrostis stricta (Timm) Koeler *59, S. Lancs.: Old pool, Charles St, Darwen, SD/690.227. P. Jepson & N. P. Symonds, 1991, det. H. J. M. Bowen.

701/2b. Agrostis vinealis Schreber *44, Carms.: Cerrig Cyffion, SN/68.46. R. Walls, 1988, **NMW**.

†701/8. Polypogon viridis (Gouan) Breistr. *52, Anglesey: Disused limestone quarry, Benllech, SH/51.81. J. E. Hawksford, 1991, det. R. H. Roberts.

†702/1. Apera interrupta (L.) P. Beauv. *77, Lanarks.: Canal towpath, Maryhill, NS/57.68. K. Watson, 1988, **GL**. Princes Dock, Glasgow, NS/56.64. A. McG. Stirling, 1988, **GL**. 1st and 2nd records.

707/4. Phleum phleoides (L.) Karsten *25, E. Suffolk: Chalky hollow on golf course, Stuston Common, TM/136.786. S. Hooton, 1991, conf. A. Copping.

719/2. Digitaria sanguinalis (L.) Scop. *2, E. Cornwall: Pavement weed, Saltash, SN/432.587. S. C. & P. S. Madge, 1990.

Book Reviews

Wild plants of Glasgow. Conservation in the city and countryside. J. H. Dickson, with paintings by Elspeth Harrigan and photographs by T. N. Tait. Pp. 208, including black and white illustrations, maps and tables, and 30 pp. in colour. Aberdeen University Press, Aberdeen. 1991. Price £14.95 (ISBN 0–08–041200–9).

This book is the first fruits of the Flora of Glasgow survey which has been taking place over the last decade. It is aimed at the general reader, and will be followed later by a more detailed and technical publication. It is an extremely attractive book, which describes some of the extraordinary range of plants, native and introduced, growing in the Glasgow area, including something of their history and ecology, and the problems of conservation.

The book is divided into three sections. The first deals with the background and objectives of the survey, and gives an insight into how the data are analysed. Dot maps are used to illustrate some of the different distribution patterns which have been identified, and annotated site lists to indicate the characteristics of different plants.

The second and largest section of the book takes a more detailed look at nine contrasting habitats, and at some of the plants typical of each. These include some amazing finds, such as the wild Fig on the Clyde, and the 'extinct' Mudwort in a dried-up reservoir, as well as more common plants and some interesting hybrids. The final section consists of a chapter on conservation, and is followed by an extensive bibliography, and notes on Field Guides and Societies to join. In short it is a popular book which also succeeds in being scholarly.

Since it is intended for a general audience, popular English plant names are used throughout. Latin names are included for all the plants which receive detailed attention, but not in the captions to the illustrations, which I think is a pity. Personally I like to see both Latin and English used at first appearance even in more technical literature, but this would have made the text too unwieldy in places. Latin plant names are included in the Index (though one or two plants on the site lists have been missed).

But these are quibbles. The whole volume is a work of art and beautifully produced on expensive paper; the colour photographs are excellent, and some of the individual flower paintings are quite stunning. In his Introduction Dr Dickson bemoans the unattractiveness of the books available to him as a youngster, when he first took an interest in botany: he has made sure that no future generation of Glaswegians will be able to make a similar complaint. Let us hope he can pull off a double with the more technical publication still to come.

J. Muscott

The wild flowers of Luton. J. G. & C. M. Dony. Edited by C. Boon. Pp. 64, with maps. Privately published, Luton. 1991. Price £3.50 (inc. postage), available from P. Ellison, 90 Beverley Road, Ruislip, Middx., HA4 9AS.

This, the last work by Dr J. Dony in a line of distinguished books on his local flora, is announced as "an account of the wild flowers known to grow in the immediate past in Luton". Having already accounted in detail for the flora of Bedfordshire in general in two books, we might be excused for thinking that this could not be anything new. We would be wrong. In fact, it is two accounts in one, and breaks new ground in several ways. About a third of the book consists of an annotated check-list of the flora of Luton Borough and its immediate environs, covering some 4,803 ha, an area with a remarkable range of habitat types considering its size. The main body of the book, however, consists of a series of concise 'site reports' of places which "had a vegetation worthy of record". Some 23 sites are dealt with in detail, each having a description, historical notes, grid reference, and a list of specially selected species recorded between 1987 and 1990. These selected species are those found in 128 or fewer tetrads in Bedfordshire as a whole (i.e. less than 33%). A special innovation is the use of these species lists to construct a 'plant rarity factor' for each site, the higher the resulting score, the greater overall botanical rarity represented by the site. These accounts are rounded off neatly with a clear site map for each site, and there is a coloured general map of the area in the centre spread which can be used both to identify specific sites and to see the extent and location of surviving semi-natural vegetation.

Just as Dr Dony's earlier Floras had pioneered the use of discrete 'habitat studies' as a way of providing a factual base-line for describing the typical vegetation of specific habitats, so this takes the process one step further, to provide an outline assessment, in botanical terms, of the conservation value of sites. The result is a mini conservation review of Luton Borough, based on sound facts. Many a consultancy would be incapable of producing such a document for a local authority's 'green audit', so much the current fashion. Luton has one virtually for nothing.

T. J. James

Fern names and their meanings. A glossary for the fern grower and collector. J. W. Dyce. Pp. iv + 31. British Pteridological Society, London. 1988. Price £3 (ISBN 0–9509806–1–7).

'What do they mean'? 'Why do botanists keep changing them?' This small booklet is an attempt to answer, at least for "the amateur grower of British ferns and their varieties and cultivars", the first of those questions so frequently asked about Latin plant names. The second problem is also addressed briefly but passionately in the introduction.

The booklet has four main parts: an introduction, sections on the etymology of the names of British fern genera, and on the meaning of Greek and Latin word elements commonly found in fern varietal names, and the heart of the book, the main glossary of varietal names. The latter runs to 18 sides and includes over 700 entries, all listed in the neuter form.

The author indicates in his introduction that his basic source of information is the glossary of fern names prepared by Dr F. W. Stansfield and Rev. Canon Kingsmill Moore and published in the *British Fern Gazette* between 1919 and 1921. What he does *not* say is that his glossary is almost entirely a simple re-ordering of Stansfield & Moore's work (where the varietal names were arranged under each species) into a single alphabetical sequence, but in nearly all cases keeping their original definitions verbatim. One or two of Stansfield & Moore's own, rare, errors have however been corrected: their picturesque definition of *gemmatum* ('decked with gems') has been changed to the prosaic but more accurate 'provided with buds'. Some epithets are misspelt or malformed; in some instances this is obviously due to error on the part of the original fern grower or author (*gracilissimum* should be *gracillimum*, as indicated by Stansfield & Moore) but others (e.g. *minum* and *majum* which should be *minus* and *majus*) show faulty understanding of Latin.

In spite of its deficiencies, this is an admirably useful little book. It makes Stansfield & Moore's work available once again in a handy, accessible and inexpensive form to a new generation of fern growers and collectors who may not have the early volumes of *British Fern Gazette* at their disposal.

R. R. Mill

Atlas Florae Europaeae: Distribution of vascular plants in Europe. Vol. 9, Paeoniaceae to Capparaceae. Edited by J. Jalas & J. Suominen. Pp. 110, 155 maps. Committee for Mapping the Flora of Europe and Societas Biologica Fennica Vanamo, Helsinki. 1991. Price FIM 350 (ISBN 951–9108–08–4).

Volume 9 of *Atlas Florae Europaeae* is of particular interest to British botanists because, in covering mainly the Papaveraceae, it deals with genera such as *Papaver*, *Fumaria* and *Corydalis* (sensu lato) which have species with rapidly changing distributions in this country. *Fumaria parviflora*, for example, is in decline throughout Central Europe and is hardly known north of 50°N except in Britain where it reaches 57°N, and the same seems to be true of *Papaver hybridum*, now apparently extinct in Belgium and Holland.

Many of the 24 British species mapped in this part are introductions but their treatment is somewhat arbitrary. *Chelidonium majus* is accorded native status throughout its range here whilst all records of *Berberis vulgaris* are regarded as introductions, whereas both are probably best regarded as 'doubtfully native'. Although a map of *Eschscholzia californica* is included, no British localities are shown, though it is said by Stace in his *New Flora of the British Isles* (1991) to be naturalised and perennating on dunes, walls and cliff tops in Guernsey and in quarries and by railways in Kent. There is no map of the ever-spreading Oregon-grape, *Mahonia aquifolium*. This variable treatment is doubtless a reflection of our own uncertainty and it is an area to which the B.S.B.I., with its wide network of recorders, could surely contribute in advance of future parts.

Members may also be able to contribute useful information from visits abroad. I was surprised to find the native status of *Laurus nobilis* in Majorca questioned: I saw it in February 1991 on a cliff at the mouth of the Torrent de Pareis where it was recorded in my 1880 Flora.

The maps in this *Atlas* will be even more fascinating when put alongside the results of the Monitoring Scheme when they are published. Comparison with that scheme will not be as easy as could be wished because some of the recent name changes are long and unattractive. *Corydalis* has been split into *Pseudofumaria* and *Ceratocapnos*, whilst with *Fumaria*, *F. martinii* has been lumped with the more widespread *F. reuteri*, and orthographic research has decided that *F. muralis* now has a subsp. *boroei* rather than subsp. *boraei*. There are times when one would like to recommend that taxonomists be paid a negative productivity bonus.

With this volume the number of maps published since the project began in 1966 has reached 2109 and perhaps 15% of the task is completed. Now is surely a time to salute the efforts of those two botanists from Helsinki, Jaakko Jalas and Juha Suominen, who have masterminded the project as organisers and editors over the 25 years since it began.

F. H. Perring

Wild orchids of Dorset. M. N. Jenkinson. Pp. 120, with drawings, maps and 63 colour plates. Orchid Sundries, Gillingham, Dorset. 1991. Price £17.95 hardback (ISBN 1–873035–01–2); £13.95 paperback (ISBN 1–873035–02–0).

This book, by a police officer, is said to be "directed not so much at the committed orchid enthusiast, but seeking to find new converts to the faith". Indeed much enthusiasm for the field study of orchids is engendered here, even though the perils of looking for *Hammarbya paludosa* are made abundantly clear.

Short introductory sections refer to the objectives of the book, the structure of the orchid flower, the geology of Dorset, the main habitats of orchids in the county (listed under five categories), and the nature reserves. Much of the book is devoted to accounts of some 28 species of orchids which occur regularly. For each species information is given on status, habitat, flowering period, distribution and distinctive features, but there is no overall key. The distribution maps, based mostly on records made during the last ten years, provide more information than previously available, presence being shown within 1-km squares. Although readers are repeatedly reminded not to pick flowers, the wisdom of the publication of such detailed distributions of uncommon species is questionable.

Notable features are the full treatment of the helleborines (including the recent discoveries of *Epipactis purpurata*) and of the dactylorchids, both subjects of special study by the author. In the dactylorchids, nomenclature departs from *Flora Europaea*, and "a newly identified form, var. *bowmanii* Jenkinson" (not validly published) is included under *Dactylorhiza majalis* subsp. *traunsteinerioides*. This form, found also in Hampshire, is robust, has a rather dark flower colour and a fairly narrow, very deeply three-lobed labellum. Hybrids are not prominently treated, but the features of the labellum of many forms of the marsh orchids are illustrated.

There are a few unfortunate statements, e.g. "physiological" features of the landscape, *Epipactis* *palustris* spreading by underground "runners, or elongated roots", and one may doubt whether there would ever be "climax pine forest" in the New Forest. However, the valuable points for field identification, and details of the phenology and occurrence, together with the original colour photographs (for each species a general view and a close-up of flowers, mostly of good quality), make this a useful and attractive book, particularly for those exploring the unspoilt countryside of Dorset.

A. J. WILLIS

The Chelsea gardener: Philip Miller 1691–1771. H. Le Rougetel. Pp. 212, illustrated in black and white and colour. Natural History Museum Publications, London. 1990. Price £14.95 (ISBN 0–565–01101–4).

Philip Miller is, without doubt, the most celebrated English gardener of the eighteenth century. He was a self-educated man, and what he could not learn from his father or other gardeners he learnt from books. Having set up his own nursery in Southwark, he was already established in the small circle of elite gardeners, when, in 1722, he was appointed Gardener (in today's terminology, Curator) of the Society of Apothecaries' Physic Garden at Chelsea. He was soon to put the garden on to a sound footing and to establish over the next 48 years an institution of international repute.

This is a book not just about Philip Miller and his achievements at Chelsea; it is a masterly analysis of Miller's influence on gardening and horticulture – and they were by no means synonymous in those days. The author has arranged her account in 20 interlocking chapters, the first three giving background, others discussing Miller's links with botanists abroad, in Europe and North America, with eminent gardens and gardeners, plant illustrators and the like. His links with Cambridge and the effects his views were having on forestry and agricultural policy are reviewed; and the importance of Philip Miller's published works to botany at large is discussed in Chapter 20 by William Stearn. His most important work, the *Gardeners' Dictionary*, which went through eight editions between 1731 and 1768, contained cultural information for the kitchen, flower and fruit garden, and much descriptive botanical material beside. The last edition appeared after the publication of Linnaeus' *Species Plantarum* in which binomial nomenclature was introduced, and Miller followed the convention and thereby validated many pre-Linnaean genera he had used in earlier editions.

Miller was also a field botanist and a teacher, collecting in many parts of England from the Cheviots to his home county of Kent. He was able to find the Deptford Pink (*Dianthus armeria*) in Deptford, *Aquilegia vulgaris* in Bexley and *Narthecium ossifragum* on Putney Heath.

This book is a 'must' for anyone interested in the history of botany or gardening and the kind of book that will be referred to time and time again. Hazel Le Rougetel is to be congratulated in giving us such a delightful, concise account of what must have been many years of fascinating research.

A. C. JERMY

Shamrock, botany and history of an Irish myth. E. C. Nelson. Pp. xiv + 200 with 5 colour plates and numerous black and white photographs and illustrations. Boethius Press, Aberystwyth & Kilkenny. 1991. Price IR£28 (ISBN 0–86314–200–1 hardback); IR£14 (ISBN 0–86314–199–4 paperback without bibliography, pp. xiv + 158); now only available from the author, 14 Connaught Parade, Dublin 7; p&p extra.

The curtain rises on a sentimental discourse of the importance of shamrock to the Irish, resolving to strip away the facts from the fiction.

Act I opens on an Ancient Briton, St Patrick, himself of whom little is known, and who certainly has nothing to do with shamrock! Indeed as we pass through the centuries nothing is heard of this blessed plant in Latin, Irish or English, until we realise that shamrock is the anglicised version of *seamróg* meaning a young clover. Variations on *scothsheamrachor* or clover-flowered thus abound in mediaeval manuscripts. The first time the word shamrock made its appearance was in Edward Campion's *The first boke of the histories of Irelande* (1577) where he stated that shamrocks were eaten by the Irish!

By Act V we have caught up with the Herbalists where in 1571 Matthias de l'Obel wrote a strange passage about the Irish passion for a meal of clover or meadow trefoil. This was followed by John Gerard in 1597 who understood that Shamrock was clover and that *seamróg* covered both the red and white clovers. By the early 1600s, it was the accepted view in England that shamrock was eaten daily by the Irish or only in times of dire necessity (depending on the authors' own prejudices).

Some decades later, *seamróg* was being defined as wood sorrel in an Irish dictionary. It was not until 1726 that an Englishman, the Rev. Dr Caleb Threlkeld, set the record straight, recognising the tradition around St Patrick and the shamrock as an explanation of the Holy Trinity, and also that *seamróg* were clovers. He was also the first to record the now renowned ritual of drowning the shamrock with alcohol and food.

By Act XI, the shamrock was beginning to be worn not just on 17 March but as a sacred political badge throughout the year. The Volunteers were the first to use it in 1779, followed by the United Irishmen in 1791. The shamrock motif was seen on flags, belts, cockades, glassware and seals, even in a weekly journal *The Shamroc* and in verse 'The Wearing of the Green'.

With the dawning of a new century, the romantic, mawkish image of the shamrock blossomed forth. At the same time the 'Age of Reason' brought the actual botanical identity of the shamrock into question. The first scientific survey of what plant was worn in Irish buttonholes was undertaken by James Britten in the 1870s. He discovered that the plant mostly in use as the true shamrock was *Trifolium minus* (now called *T. dubium*). Unfortunately, not many people took note of his systematic findings. Indeed, ten years later, one Nathaniel Colgan added to the confusion by establishing all the above plants as rivals, plus the red clover (*T. pratense*).

When the Currency Commission of 1926 decided to ban the shamrock motif from the new coinage there was a mass uproar and by the time the Irish Post Office issued the first definitive stamps and one commemorative one in 1933–4, each one had shamrocks in the design.

And so we finally come to the late 1980s, when Charles Nelson attempted to assess the present day status of the shamrock in Ireland by means of modern communications. In fact *Trifolium dubium* was revealed as the most commonly regarded true shamrock, while black medick (*Medicago lupulina*), red clover, and wood sorrel (*Oxalis acetosella*) accounted for only a few gatherings. The curtain closes on the fact that "shamrock is a young clover, nothing more, nothing less". That is what it always meant "and what it will mean until the end of time."

Had this book been written by anyone else, it might have been both boring and pedantic, but Dr Nelson's sparkling dry wit and wicked sense of humour comes through again and again. Accompanied by some delightful colour plates by Bridget Flinn and a hilarious and irreverent forward by Bernard Loughlin, this book deserves to be read by a wide audience. *Vivat trefolium*!

S. Andrews

The Burren. A companion to the wildflowers of an Irish limestone wilderness. E. C. Nelson & W. Walsh. Pp. 343, with 100 colour and several black and white illustrations. Boethius Press, Aberystwyth, and The Conservancy of The Burren. 1991. Price IR£32 (ISBN–86314–213–3 hardback); IR£19 (0–86314–214–1 paperback); available from 14 Connaught Parade, Dublin 7; p&p extra.

The Burren of north-western Co. Clare is Ireland's premier botanical attraction. Remarkably, it was first explored in detail only in 1851, the year that T. H. H. von Heldreich revealed Greece's Mt Olympus in remotest Thessaly to the botanical world. The two areas are actually very comparable, for they are both karstic landscapes of bare limestone, subterranean water and few human inhabitants, making travel difficult in the days before motorised transport. Each has a rich and diverse flora and is amongst the most precious gems of Europe's natural heritage. My own view (coloured by my affection for Connemara) had long been that the Burren received too much attention from botanists, especially those visiting from Britain, to the detriment of the study of other regions of Ireland. However, reading *The Burren* has successfully prodded me to take a positive view of the region, the book stirring up as it does images of low, mysterious, grey hills, pastures bright with Spring Gentians in May, and the massed flowering of Mountain Avens, Bloody Cranesbill, Hoary Rockrose and other species in the native rock garden that the Burren presents to the visitor in summer.

Charles Nelson sets out an eloquent, enthusiastic and erudite portrait of a landscape and its plants. He provides background information to the flowers that make the Burren so special, gleaned from a wide variety of sources, whilst maintaining an unobtrusive personal touch by allusions to his childhood in Co. Fermanagh, his interest in tropical drift-seeds and the genus *Fuchsia*, and his knowledge of Irish garden history. The style is discursive, the text packed with observational sketches, anecdotes and quotations from the literature of botany, folklore and Irish history. This is not a new Flora of the Burren: there are many references to David Webb and Maura Scannell's *Flora of Connemara and the Burren* (1983) – reviewed in *Watsonia* **15**: 148–9 (1984). Nor is it a guidebook; for topographical information the reader is encouraged to refer to Tim Robinson's excellent annotated map, *The Burren, a map of the uplands of North-West Clare, Éire* (1977). It is indeed a companion, a book, in the author's words, to be read by the fireside when "a westerly gale hurls stair-rods of rain horizontally across Cappanawalla". It will certainly be a useful item in one's hotel or 'bed-and-breakfast' during a visit. I readily forgive the author for ignoring the mundane plants that excite feeble minds like my own – there is, for example, no mention of any docks or knotgrasses!

The author defines the region more or less on the basis of the (limestone) geology, although he is sensibly a bit vague about the eastern limits around Kinvarra and Gort, where one can still see a 'good' Burren flora. The text is beautifully set out, the words interspersed with water-colour illustrations by Wendy Walsh, deliberately conceived in a sketch format to give a sense of immediacy. There are also black and white topographical scenes and some portraits. I should have been happier with numbers as well as titles at the head of each chapter. Nor am I am at home with the Irish word *scailp* to describe the deep crevices in the limestone; in Yorkshire, where my family came from, they are *grykes* (as they are in Scandinavia).

Charles Nelson has done us all a considerable favour by his distillation of fact and experience, and I urge the many lovers of the Burren to buy this fairly priced book, not least because all proceeds will go to support the work of The Conservancy of The Burren. The future of this special place is uncertain, the worst threat being increased pressure from tourism, notably the proposal to erect a superfluous and environmentally insensitive 'visitor centre', and it is up to botanists above all to promote its conservation. This book is a beginning.

J. R. AKEROYD

The northwest European pollen flora, Volume 6. Edited by W. Punt & S. Blackmore. Pp. v + 275, with 103 black and white plates. Elsevier, Amsterdam. 1991. Price D.Fl. 240 (ISBN 0–444–891641–1).

This latest volume in the northwest European pollen flora project continues to document systematically the pollen morphology of all families of vascular plants indigenous to, or regularly naturalized in, northwest Europe. In this volume the families covered are Selaginellaceae, Oleaceae, Geraniaceae, Juglandaceae, Cornaceae, Globulariaceae, Buxaceae and Ranunculaceae, with the last family occupying more than half of the book. Each family account contains detailed descriptions of pollen types (i.e. the morphologically discernible groups of pollen species) together with keys to their identification, and is accompanied by excellent scanning electron and light micrographs.

The arrangement of the survey is taxonomic and its clearest aim is to provide taxonomic information on the range of form of pollen within families. But pollen identification has become an important aspect of the work of many other plant scientists in disciplines as varied as allergy studies, forensic science and the reconstruction of past vegetation and hence past environments. Palynologists with these interests will look to the *Pollen Flora* as a valuable source of data on pollen morphology, but the material contained in these volumes has to be used with caution in these areas. The palaeopalynologist, for example, when faced with an unknown pollen grain, does not normally have the assurance that it belongs to a particular family. A spiny trilete spore, such as that of *Selaginella kraussiana* (G. Kunze) A. Braun as described in this volume, could also belong to a bryophyte, such as *Anthoceros* or *Riccia*. Some pollen grains belonging to members of the Oleaceae are very similar to those of certain Cruciferae; but such similarities cannot, of course, be dealt with in a systematically arranged account.

The book will be of greatest value to those concerned with pollen identification when detailed information and illustrations are needed to confirm identity or to provide greater taxonomic resolution in important groups. The Ranunculaceae is of particular note here because most general pollen keys provide limited taxonomic detail, yet distinction between ranunculaceous groups can be of profound ecological value for the palaeoecologist. The '*Ranunculus acris* type' pollen recognized by most palynologists, for example, covers a multitude of ecologically varied species, and the information provided here for more precise identification will be very welcome.

The keys are generally robust, though some expressions are loose and ambiguous, such as the distinction between "reticulum relatively coarse" and "reticulum fine" in the distinction between *Olea* and *Phillyrea*. This could have been improved by providing a count of lumina density across the mesocolpium, which permits very adequate separation. I remain unconvinced whether some of the fine distinctions, such as that between *Erodium moschatum* and other members of the genus, can be effected by light microscopy alone. In the identification of fossil pollen using conventional phase contrast microscopy, the work described in this valuable collection of papers will prove useful, but must clearly be applied with great caution and always with the assistance of reference material.

P. D. Moore

New Flora of the British Isles. C. A. Stace. Pp. xxx + 1226, illustrated. Cambridge University Press, Cambridge. 1991. Price £24.95 (ISBN 0–521–42793–2).

This eagerly awaited and reasonably priced book fulfils almost all expectations and is essential for anyone with a serious interest in the British and Irish floras. It is a manual for identification rather than a descriptive Flora, and so needs to be judged for its usefulness rather than just the information it contains. I make no apology for repeating the words 'helpful' and 'useful' rather often in this review.

Everything in the Flora, from the taxa included (especially non-native taxa) to the nomenclature and the construction of the keys has clearly been worked out afresh. Taking on trust its claim to contain 2990 keyed and numbered species, it thus contains nearly half as many again as the 2030 that are in the 3rd edition of the *Flora of the British Isles* by Clapham, Tutin & Moore (CTM). This gives some idea of the amount of unfamiliar materials made available by Stace. Most of the extra species are aliens, and in some genera the result is quite startling, *Cotoneaster* containing 45 keyed and numbered taxa (five in CTM), *Crocus* containing nine (two in CTM) and even *Trifolium* 32 (22 in CTM). There are 90 more grasses in Stace. His criteria for inclusion of non-native taxa are eminently helpful, the aim being "to include all taxa that the plant-hunter might reasonably be able to find 'in the wild' in any one year. Any such plant, whether native, accidentally introduced or planted, affects wild habitats and is part of the ecosystem, and botanists and others might be expected to need or want to identify it". He thus includes a number of plants that persist rather than regularly naturalise, as well as a wide range of non-persistent but recurrent casuals.

The dichotomous keys seem to work well, and many are quite original. The *Carex* key, for example, broken up into sections like all long keys, differs in many ways from previously available ones, often uses quite different characters, and works at least as well. I personally dislike the layout of the keys, with alternately indented couplets, but one soon gets used to it. Multi-access keys are often provided, but in only a few cases (notably *Epilobium*) are they the only sort available. The ones in *Sorbus*, and in the novel account of the cultivars of *Populus* × *canadensis*, are especially useful. The species descriptions are mostly less than 30 words, and have a limited value for confirming identifications. As so many unfamiliar species are included for which fuller descriptions will be unavailable to most readers, this does create problems. The drawings, mentioned later, do however somewhat compensate for this. With more familiar species, too, the brevity of the descriptions can be worrying. Is there, for example, no mention of the hairs at the junction of leaf-blade and sheath in *Poa humilis (P. subcaerulea)* because the author considers them not to be diagnostic, or because there is just not the room to include this character?

Abbreviations are few and easily understood. The text in general contains an immense amount of useful comment. Unnumbered and unkeyed "other genera" and "other species" are frequently included, but I cannot help feeling that, as in most other Floras, they do more to salve the author's conscience than to help the reader. They stand out here because the rest of the *Flora* is so helpful. Crop species are especially well treated and up-to-date. *Red Data Book*, scheduled, and Rare species (in fewer than 100 10-km squares) are indicated. English names, many of them new, are provided for all the numbered species. The bibliography is very brief, and it is perhaps a pity that no direct references to more detailed accounts are given anywhere in the text.

The taxonomic stance of the book is a good balance between expert and consensus opinion. It is comforting to find one's doubts about identifying segregates of such species as *Galium mollugo, Rhinanthus minor* and *Sedum telephium* confirmed, but I am sorry to see the subspecies of *Pilosella officinarum* so briskly dismissed (many of us record them, even though we may doubt whether they are worth subspecific status). For once in a British Flora though, subspecies are generally very fully treated. Varieties are rarely and rather unpredictably included. In the case of *Fumaria* the key would probably have worked better if varieties *had* been included (as P. D. Sell, *BSBI News* **41**: 16 (1985) recommends), and this is one of a number of cases where recourse to the *Plant Crib* is still essential. All hybrids known to occur in Britain and Ireland are included. More are keyed and described than in our other Floras, but inevitably, alas, the great majority are not. Here, as elsewhere, the continuing need for a comprehensive critical and descriptive Flora of Britain and Ireland is highlighted. Of the apomictic groups, *Rubus, Hieracium* and *Taraxacum* are treated only in outline, but *Sorbus* and *Euphrasia* are treated in full.

Physically the book is about the same size as the 2nd edition of Clapham, Tutin & Warburg's *Flora*. The binding is sewn, and the cover is pliable plastic. My copy is still in perfect shape after two months' daily use. It is printed from camera-ready copy produced by a word-processor, and the type is large and easy to read (though lacking such refinements as accents and italics). Traditional typesetting would probably have reduced the number of pages by about a third and made the book more suitable for the rucksack, but, as the author remarks, would even so have increased the price. Errors of any sort are minimal. Main Argyll is given for *Rorippa* × *hungarica* instead of *R.* × *armoracioides*. *Veronica hederifolia* should be cross-referenced to the illustrations instead of *V. serpyllifolia*. The drawings of *Ledum* and *Vaccinium uliginosum* are labelled the wrong way round. *Salsola* is missing from the index. The second half of dichotomy 8 on p. 564 should lead to 17 not 16. Otherwise there seem few errors likely seriously to mislead the reader. Even the cm scale inside the front cover is only 1% out. The brevity of the distributional information occasionally leads to slight inaccuracy, but this is almost inevitable and detail of this sort is not what one will chiefly come to this *Flora* for.

There are some 150 pages of illustrations, and it is here that my only serious criticisms of the book lie. The line drawings are mostly by Hilli Thompson and include excellent series of crucifer, umbellifer and *Rumex* fruits. Her habit drawings of unfamiliar aliens are especially helpful and compensate a good deal for the brevity of the description. Most give a good impression of the jizz of the plants but some, for example those of *Cotoneaster*, are curiously diagrammatic, and several of the series of drawings of leaves are unsatisfactory. In a few cases poor choice of specimens rather than quality of drawing means that they fail to show, or even contradict, the diagnostic characters, for example the number of intercalary leaves and angle of branching of *Odontites vernus* subsp. *serotinus*, the leaf-lobes of *Ranunculus omiophyllus*, or the apical leaf-lobes of the *Veronica hederifolia* subspecies. Other artists have also contributed valuable drawings, such as those of *Dactylorhiza* labella by R. H. Roberts and *Oenothera* flowers by J. Zygmunt. The many light photographs often seem to suffer from very poor reproduction, and it is difficult to see why the blurred *Potamogeton* leaf-apices were not drawn instead. The *Euphrasia* silhouettes are too small and murky to be of much use, but those of *Sorbus* are excellent. There are also many scanning electron micrographs (S.E.M.). Those of *Epilobium* seeds and *Isoetes* megaspores are good, and the latter for once show that the sculpturing is not as easily diagnostic as most descriptions imply, but most of the rest are unsatisfactory. Even the very clear ones of *Montia* seeds, by the very nature of the process, omit the diagnostic shininess or otherwise of the coats. Those of *Tripleurospermum* achenes fail to show even the oil-glands, let alone their diagnostic shapes, and the complete series of *Carex* utricles includes many unrecognisable and often shrivelled examples. S.E.M. pictures are generally unhelpful as identification aids for botanists with a lens or light microscope, and with an artist of Thompson's ability and versatility to hand it is a mystery why they were used.

The *New Flora* was prepared in close consultation with D. H. Kent who was simultaneously compiling a new nomenclatural check-list of British and Irish plants. Thus the nomenclature, like every other aspect of the *Flora*, is uncompromisingly up-to-date according to current knowledge, resulting in a large number of changes to familiar names. These will best be reviewed when the check-list itself is published. Meanwhile the reader's dismay at them should be largely offset by the fact that they are an integral part of an authoritative and user-friendly Flora that will be our standard for taxonomy, nomenclature and identification for some time to come.

A. O. Chater

Pleistocene palaeoecology of central Norfolk – a study of environments through time. R. G. West. Pp. ix + 110, with 44 figures. Cambridge University Press, Cambridge. 1991. Price £40 (ISBN 0–521–40368–5).

This book continues the Pleistocene history of East Anglia from the author's earlier book *The pre-glacial Pleistocene of the Norfolk and Suffolk coasts*, concentrating on a part of the catchment of the River Wensum near East Dereham. Within this area, sections exposed by commercial sand and gravel workings over a period of c. 20 years have provided "an extraordinary wealth of evidence" on environmental changes from the time of the first major glaciation of East Anglia. The presentation of this evidence is organised chronologically. Five chapters deal with the local succession of deposits identified as belonging to the Anglian, Wolstonian and Devensian cold stages and the Hoxnian, Ipswichian and Flandrian temperate stages. The geological evidence and palaeobotanical analyses produced by Professor West's intensive studies are presented in meticulous detail in the form of many clear sections (related to aerial photographs as well as maps), pollen diagrams, and tables of fossil identifications. These numerous sections include glacial tills and gravels and overlying fluviatile deposits with limnic sediments formed in depressions. His synthesis of this evidence supports – through the relative positions of deposits identified by their palaeobotany – the succession of Middle and Upper Pleistocene stages originally proposed for East Anglia by Professor West and co-workers. At the same time he reiterates his caution that it remains possible that additional stages may yet be identified in the terrestrial record.

The form of the book is that of an extended scientific paper. It furnishes an excellent example of how primary data of the highest scientific value have been gathered, processed and synthesized to provide the basis for reconstruction of past environmental – including climatic – changes. Not only does this treatment fulfil the author's claim that "the observations have led to a much better understanding of the Pleistocene in Norfolk and are indeed relevant to the wider understanding of the British Pleistocene" but it provides for the more general reader an insight into the methods by which primary data are obtained and used to reconstruct climatic changes in the past. These reconstructions can then be of use in comparison with models of possible climatic change in the future. This book is indeed, as claimed on the fly-leaf, "a unique 'case study' of an investigation of past climatic change".

Throughout the work there is a new emphasis on the importance to the palaeobotanist of thorough acquaintance with the processes involved in accumulation of each sediment type, in order to reach sound conclusions as to the *taphonomy* of fossil plant assemblages, whether pollen, spores or larger fossils. The influence of this on the relationship between the fossil assemblage and the vegetation from which it was derived is considered throughout. The presentation of the chronologically arranged botanical evidence is followed by two chapters on stratigraphic questions, related especially to periglacial conditions during the cold stages and to inferred changes in water levels. A further chapter discusses, in a review of the history of the Whitewater, Blackwater and Wensum valleys, the aggradation of the Beetley Terrace during a non-glacial post-Hoxnian cold stage. This preceded the Ipswichian and therefore seems to coincide in time with the Wolstonian. The final very concise chapter placing the work at Beetley "in the context of the East Anglian Pleistocene" should be required reading for all students of the British Quaternary.

The reference list is of a realistic length to encourage further study. Hopefully the work as a whole will stimulate others to undertake this kind of devoted fieldwork and patient study-in-depth in promising areas.

W. Tutin

Obituaries

ADRIAN LEONARD GRENFELL
(1939—1991)

Adrian Grenfell was born on 6 April 1939 and died, aged only 52, on 17 November 1991. It was a great shock to hear from Adrian's wife, Diana, that my good friend had died of a heart attack whilst jogging. We had all known that he was not in the best of health, but none of us realised just how ill he must have been.

He and I have known each other for many years. We both attended the same Grammar School together, although at that time Adrian was not interested in botany. He left school to start a career with the Gas Board, later on changing to become an industrial chemist with a major Bristol company. Redundancy in the early 1980s allowed him to become a self-employed printer and later he moved into publishing. During the last seven years his expertise in printing and publishing was put to good use on behalf of the Bristol Naturalists' Society, the Wild Flower Society and the Botanical Society of the British Isles.

He became interested in plants in about 1972 (reference to the B.S.B.I. list of members shows he joined in 1976). At the same time he joined the Wild Flower Society and the local Bristol Naturalists' Society. He was keenly interested in mammals as well as plants and would often attend meetings of the Mammal Section of the Bristol society. In the early days alien plants became his main interest, brought on possibly by his friendship with Eric Clement, and Adrian became what is known as a 'Tip Man'. He and I, often in the company of other botanists including Clive Lovatt and Trevor Evans, would frequently visit such sites as Brislington Tip, Bedminster Tip, Avonmouth, Newport and Sharpness Docks, and other localities where aliens were to be found. Reference to the 'Bristol Botany' section in *Proceedings of the Bristol Naturalists' Society* and *B.S.B.I. News* shows the many interesting finds made during that period. He had to wait a long time to get into the now Portbury Docks – so jealously was it watched. We were making comparisons all the time with N.Y. Sandwith's 1933 adventive plant list from the Port of Bristol – at one time Adrian intended to publish an updated check-list.

On the local scene botanists eagerly looked forward to Adrian's walks in the Bristol area. He would lead us round such famous localities as the Avon Gorge, Leigh Woods, Brean Down and the Mendip Hills. He was always pleased to help both the 'starters' and the more experienced botanists with determinations. Adrian's hybrids caused some amusement: so often, however, they were confirmed by the correct authority. He truly had a remarkable eye for the unusual.

In the early 1980s Adrian and I were to enjoy several trips abroad to look at plants, sample local wine, etc. I can always remember Adrian one evening dropping off to sleep in a chair after a hard day's collecting and then determining in Portugal, with a volume of *Flora Europaea* in his lap and a glass of wine in his hand. After that we decided that after one bottle in the evening all determinations were suspect! We enjoyed trips to Crete, the Algarve, Mallorca and Scotland; later on Adrian went to Zakinthos and Mt Olympus in Greece, the Alps (where he led B.S.B.I. excursions), the Seychelles and Australia. All the time he was looking for interesting plants and would always bring back something, usually grasses for his friends Ron Payne and Eric Clement.

From April 1983 Adrian took over the Alien News section in *B.S.B.I. News* from Eric Clement, editing it for eight years (see *B.S.B.I. News* **32–57**). Adrian would look forward to his mail and would eagerly open packages of carefully pressed specimens and examine the soggy contents of polythene bags to see what was new. Many of these specimens have been kept and are preserved in his herbarium. Adrian was at the same time helping the Society in other ways. In 1983 he was on the Meetings Committee and helped to organize the A.G.M. in Bristol, arranging accommodation and the field excursions to the Mendips and Sand Point in Somerset, a very memorable day. In April 1991, his successor as editor of Aliens and Adventives, Brian Wurzell, thanked Adrian for his valuable contribution and wished him a speedy recovery from the illness which caused him to resign from the work. Sadly, Adrian only lived a further six months.

In 1979, one year after Early Star-of-Bethlehem (*Gagea bohemica*) was confirmed as occurring at

Stanner Rocks in Radnorshire, Adrian, Trevor Evans and myself went to the site, on a wintry February day with snow in the air, and were rewarded by the sight of two flowers of this plant new to the British flora. We knew that the next weekend Mary Briggs and a party of eminent botanists were to visit the site – so new was it to the British flora. Adrian decided to leave a note addressed to Mary under a stone to record that we had been there and to advise where the flowering plants were to be seen. Mary found the note. Adrian later remembered this occasion when he found the same plant high up above the Samaria Gorge in Crete.

In 1987, Adrian wrote a paper on the notable alien flora of the Avon Gorge, which was included in *The Avon Gorge*, Special Issue No. 1 of *Proceedings of the Bristol Naturalists' Society*. This was elegantly produced by Grenfell Publications and offered for sale to B.S.B.I. members. Other publishing ventures included several editions of the *Proceedings*, the *Supplement of the Flora of Gloucestershire* by S. C. Holland, H. M. Caddick and D. S. Dudley-Smith (1986) and *The difficult and critical plants of the Lizard District of Cornwall* by L. J. Margetts (1988). Every year Adrian would send Professor A. J. Willis, the Bristol Botany recorder, many interesting records – all these can be found in the *Proceedings* or in *B.S.B.I. News*. In the autumn of 1991, Adrian and I had just finished an article on Bristol street trees, which will be published in the *Proceedings* in due course. We had great fun driving up and down the streets of Bristol, identifying, collecting and determining material of a vast range of trees.

There is one plant that will always remind me of Adrian. It is not an alien but the British native, Autumn Lady's-tresses (*Spiranthes spiralis*). It was found by him growing on Eric Clement's Gosport lawn – and Eric had never seen it. Adrian always said with a grin that it would have to be flat or mounted on a sheet for Eric to notice it!

On the basis of his work on alien plants, Adrian was elected a Fellow of the Linnean Society of London in 1982. His private herbarium will be transferred to Bristol City Museum (**BRISTM**) and kept there alongside those of other distinguished Bristol botanists such as I. W. Evans and J. W. White.

Over the years Adrian built up a tremendous number of friends, many of whom stayed with him when they visited the Bristol area. He was always willing to help in any way that he could. Adrian's warm friendship and dry humour will be missed by us all, particularly when we revisit a site where he had shown us a speciality. We extend our sympathies to Diana and his son James.

T. Titchen

WILLIAM ARTHUR SLEDGE
(1904—1991)

Arthur Sledge was a Leodiensian. He was born in Leeds on 14 February 1904 and died there on 15 December 1991, having lived there all his life. He was educated at Leeds Grammar School and graduated from the Botany Department of Leeds University in 1926. He gained his Ph.D. in 1928, the year he joined the staff of the department as a Demonstrator. He was appointed as a Lecturer a year later and eventually became a Senior Lecturer. After his official retirement in 1969 he retained a room in the department and continued his work there as Honorary Research Fellow, usually walking the 3 km from his home in Headingley. A severe heart attack two years ago restricted his physical activities but he bore the resulting debilities uncomplainingly and with fortitude.

His interest in botany was triggered at his junior school by a pressed flower competition, which, of course, he won. While he was out collecting specimens, his vasculum was spotted by Frank Palmer who was taking part in a similar senior school competition. Frank and his father subsequently introduced the young Sledge to the joys of botanising on the Permian Magnesian Limestones a few kms east of Leeds. From this was born an awareness of habitat and an interest in ecology and he was later to become a founder member and council member of the Yorkshire Naturalists' Trust (now the Yorkshire Wildlife Trust).

Whilst still in his early teens, Dr Sledge had found F. A. Lees' *Flora of West Yorkshire* (1888) in the library and, learning that Dr Lees lived quite nearby, he became a frequent visitor to his home, armed with eggs from his mother's hens and a vasculum of plants for identification. In 1941, *A Supplement to the Yorkshire Floras by the Late F. Arnold Lees*, edited by C. A. Cheetham and W. A. Sledge, was published.

In 1920 Dr Sledge was introduced to Leeds Naturalists' Club by the blind botanist, John Wilkinson. Active members of the club at that time, who all helped to further Dr Sledge's interest, included such famous names as J. H. Priestley, Professor of Botany at Leeds, W. H. Pearsall, Edward Percival, R. W. Butcher, and the bryologist, W. H. Burrell.

It was standard practice at Leeds Naturalists' Club to report on Yorkshire Naturalists' Union meetings and Dr Sledge was inspired to join the Union. All the most knowledgeable naturalists in the county belonged to the Union and from them much was gleaned. Later he more than repaid what he had gained. In the field he was the ultimate authority who could be relied upon to give a correct identification to all but the most esoteric of critical plants, along with interesting comments on habitat and plant associations. His memory for sites of interest was unfailing, even those he had not visited for 40 years and, when he felt there was good reason to give directions to them, these directions were precise and accurate. All of us were in awe of him, but those who showed an intelligent interest and desire for knowledge were subsequently greeted with a warm smile and questions were answered fully, with quiet enthusiasm. In addition to sharing his experience in the field, Dr Sledge edited the Union's scientific publication, *The Naturalist*, from 1943 to 1975. His dedication and skill resulted in *The Naturalist* being read and respected nationally and internationally and, in spite of his modest, unassuming manner, his pride in it and his paternalism towards it were evident.

He joined the B.S.B.I. in 1924 and was appointed Recorder for South-east, South-west and Mid-west Yorkshire in 1949. He relinquished South-east Yorkshire to Eva Crackles in 1969 and continued with South-west and Mid-west until 1987, when failing eyesight made him realise he would not be able to cope with the Monitoring Scheme. In 1987 he was made an Honorary Member of the Society for his "long and valuable service to Yorkshire botany and to the Society as Recorder and Editor". He had edited the Distributor's Report (Exchange Section), which was a supplement to the Society's *Year Book*, in the late 1940s. With our present emphasis on conservation this aspect of the Society's activities has developed into Plant Records.

Dr Sledge was very much a Yorkshireman but he was by no means parochial. During his undergraduate days, much of his travel outside the 'Broad Acres' was by bicycle, accompanied by R. W. Butcher. This included visits to East Anglia, the Gower, the Avon Gorge and Dorset in search of their special plants. In those days specimens were picked and contributed to Dr Sledge's enormous and excellent herbarium. The British sheets were donated several years ago to Bradford Museums Service and they now reside in Cartwright Hall Museum (**CMM**) along with those of Lees. The foreign material is widely distributed internationally.

Dr Sledge was one of those lucky individuals able to combine his interest with his career. His first publication was a contribution to the report of the British Association meeting which was held in Leeds in 1927, for which he wrote sections on the flora of Fountains Abbey, Wharfedale, Nidderdale and Malham. This was followed a year later by his Ph.D. thesis on the rooting of woody cuttings. He travelled widely in Europe and, for research purposes, visited New Zealand, Madeira, Sri Lanka and Samoa. His work was concerned mainly with systematics and, following his first visit to Sri Lanka, he untangled the difficult taxonomy of the native ferns. His paper, written in association with the late Professor Irene Manton, entitled *Observations on the cytology and taxonomy of the Pteridophyte Flora of Ceylon*, published in 1954, remains a classic. Other papers on the taxonomy of tropical ferns followed, as well as numerous articles on aspects of the Yorkshire flora. All his work was carried out with meticulous care and his clear systematic presentation made him a first-class teacher. Even during his period of ill-health, Dr Sledge continued to work. He recently completed an excellent historical review for the forthcoming *West Yorkshire Plant Atlas* to be published by the West Yorkshire Ecological Advisory Service, and he was still collaborating with Professor R. E. Schultes, formerly of Harvard University, on a Symposium to commemorate the centenary of the death of Richard Spruce (1817–1893) pioneer botanist in the Amazon and Andean regions. Professor Schultes and Dr Sledge shared a deep respect for this little-known Yorkshire botanical explorer and they were instrumental in having a commemorative plaque put on the cottage in the Castle Howard estate where Spruce had lived.

We in Yorkshire have lost our most outstanding contemporary botanist, and one of the best in Britain, and we mourn him along with Marjorie, his wife, who has supported him wonderfully since their marriage in 1939. We offer sincere sympathy to her and to their son, Christopher, and his family.

P. P. Abbott

INSTRUCTIONS TO CONTRIBUTORS

Scope. Authors are invited to submit Papers and Short Notes concerning the taxonomy, biosystematics and distribution of British and Irish vascular plants, as well as topics of a more general or historical nature.

Manuscripts must be submitted *in duplicate*, typewritten on one side of the paper, with wide margins and double-spaced throughout.

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 separate sheets and attached at the end of the manuscript.

Figures should be drawn in black ink and identified in pencil on the back with their number and the author's name. They should be drawn no more than three times final size, bearing in mind they will normally be reduced to occupy the full width of a page. Scale-bars are essential on plant illustrations and maps. Lettering should be done with transfers or high-quality stencilling, although graph axes and other more extensive labelling are best done in pencil and left to the printer. Photographs can be accepted if they assist in the understanding of the article.

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 of Papers, Short Notes, Book Reviews or Obituaries.

Submission of manuscripts

Papers and Short Notes: Dr B. S. Rushton, Department of Biological and Biomedical Sciences, University of Ulster, Coleraine, Co. Londonderry, N. Ireland, BT52 1SA.

Books for Review: Dr J. R. Edmondson, Botany Department., Liverpool Museum, William Brown St, Liverpool, L3 8EN.

Plant Records: the appropriate vice-county recorder, who should then send them to C. D. Preston, Biological Records Centre, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, PE17 2LS.

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B. S. Rushton

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Patron: Her Majesty Queen Elizabeth the Queen Mother

Applications for membership should be addressed to the Hon. General Secretary, c/o Department of Botany, The Natural History Museum, Cromwell Road, London, SW7 5BD, from whom copies of the Society's Prospectus may be obtained.

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Book Reviews, J. R. Edmondson

Obituaries, J. R. Akeroyd

*Receiving editor, to whom all MSS should be sent (see inside back cover).

Watsonia, **19**, 169–179 (1993)

Presidential Address, 1992

P. MACPHERSON

COLONISATION OF THE GLASGOW GARDEN FESTIVAL SITE THREE YEARS ON: IMPLICATIONS FOR RECORDING

I have been asked for how long I hesitated before accepting the honour of Presidency of this Society, bearing in mind the custom of there being a Presidential Address. My reply was, "not half a second – at the time, I had completely forgotten this responsibility". Once the revelation dawned, search for an appropriate subject became a recurring thought.

I felt that the occasion merited original work and, being an amateur field botanist, that had to be amateur field botany. By profession I have been a neuroradiologist, specialising in depth in a small branch of medicine. My inclination was therefore to do the same for this address and during last summer it gradually became apparent to me that an intensive study of the flora then colonising the site of the Glasgow Garden Festival was the most appropriate review that I could undertake. While doing so, I realised that this raised general issues of plant recording.

THE FESTIVAL SITE

To set the scene, the Festival was held in 1988 in abandoned dockland and quayside on the south side of the River Clyde (Fig. 1). The main area had been the very active Prince's Dock with a Canting Basin, the latter used by the ships to swing round to enable entry to an individual dock or return to the river. The extension of the site to the east took over the Mavisbank Quay.

When the dock complex became redundant it was taken over and the docks filled in with a view to housing, but temporarily let as the site of the Garden Festival. The area is just within v.c. 77 (Lanarkshire), for which I am Recorder.

The brochure stated that the Festival was part of a process of regeneration which was transforming the South Side of Glasgow. One million trees and flowering shrubs formed the backdrop to an ever-changing floral carpet of bedding displays and themed gardens. There were six theme sectors in the main section, arranged like the petals on a flower, interlinked by winding pathways and formal avenues. The effect was also likened to a Persian carpet.

There were gardens set up by commercial organisations, the National Trust for Scotland, botanic gardens and wildlife groups, and a series of ten International Friendship Gardens from as far apart as Finland, China, New Zealand and Mexico. The Canting Basin was used extensively for water-related activities and referred to in one of the maps as Princes Harbour.

Above all however, the Festival was about family fun with concerts, street theatre, exhibits, viewing tower, vintage trams and trains and play areas. The Director called it a festival in a garden rather than a garden festival (Fig. 2).

Immediately the Festival closed, work was begun in preparation for the further development of this 48 ha site. Some plants were sold, and others taken to form the basis of continuing feature gardens elsewhere. The bulldozers moved in again and although there were a few residual, almost intact borders and remnants, by 1990 practically all trace of the Festival had been removed and looking at the site in 1991 when the main area had largely returned to being waste ground, one could hardly imagine that it had ever been. In addition little hollows looked as though they had been like that for centuries with Compact, Hard, Soft and Jointed Rushes. (I was once told by a professional horticulturist that he wished I would stop pronouncing the scientific names of plants as though they were diseases!)

I did not record plants which were at the site of original planting or had simply spread in the neighbourhood. An example is that related to the waterfall which is still bordered by the planted material and the little pond at its base containing such species as Fringed Water-lily (*Nymphoides*

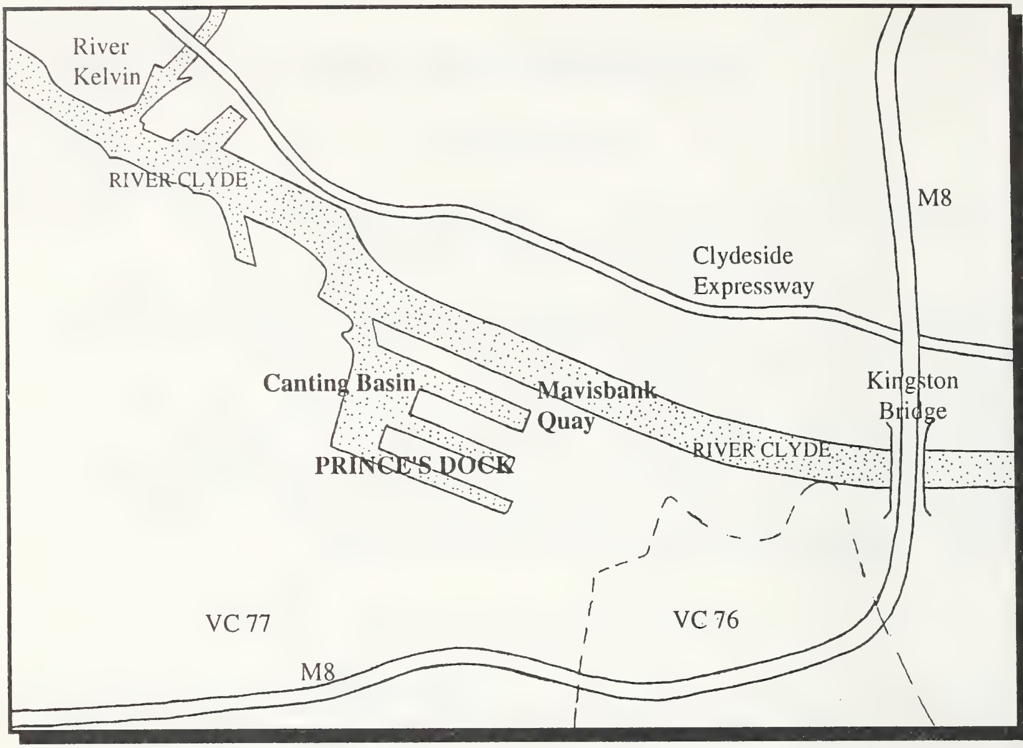

FIGURE 1. The site and environs of the Glasgow Garden Festival in its pre-festival state. V.c. 77, Lanarks.; v.c. 76, Renfrews.

peltata), Water-plantain (*Alisma plantago-aquatica*) and Bulrush (*Schoenoplectus lacustris*). From the waterfall a stream had been constructed which ran through a series of small ponds to the Canting Basin; again with residual plants such as Wild Angelica (*Angelica sylvestris*), Yellow Loosestrife (*Lysimachia vulgaris*) and Reedmace (*Typha latifolia*).

I was surprised to see the size of fish that local lads were catching in the ponds. They were very pleased to be photographed and asked if their photos would be in the papers. I said, "No, but I am writing an article about the site and might show the pictures in London". One asked, "Are you a famous author we should have heard about?"!!

There will be no point in any of you asking me afterwards what kind of fish these were. My family will tell you that I have a two-track mind, neuroradiology and field botany, and I do appreciate the great honour of being President of the two relevant national societies at the same time. The British Society of Neuroradiology, although a smaller organisation, presents their president with a medal and I take this opportunity of suggesting that you might so honour future Presidents with a badge of office that can be worn at the Annual and Exhibition Meetings and other Conferences.

THE PLANT RECORDING

As a result of intensive recording the total number of species came to 325, which I have divided into six groups (Fig. 3).

PLANTS ON THE SCOTTISH FIELD CARD

With regard to those plants which are on the Scottish Field Card (194 species), these in the main are those that might have been expected to have arrived by natural dispersal. However, some could

FIGURE 2. Schematic layout of the Glasgow Garden Festival.

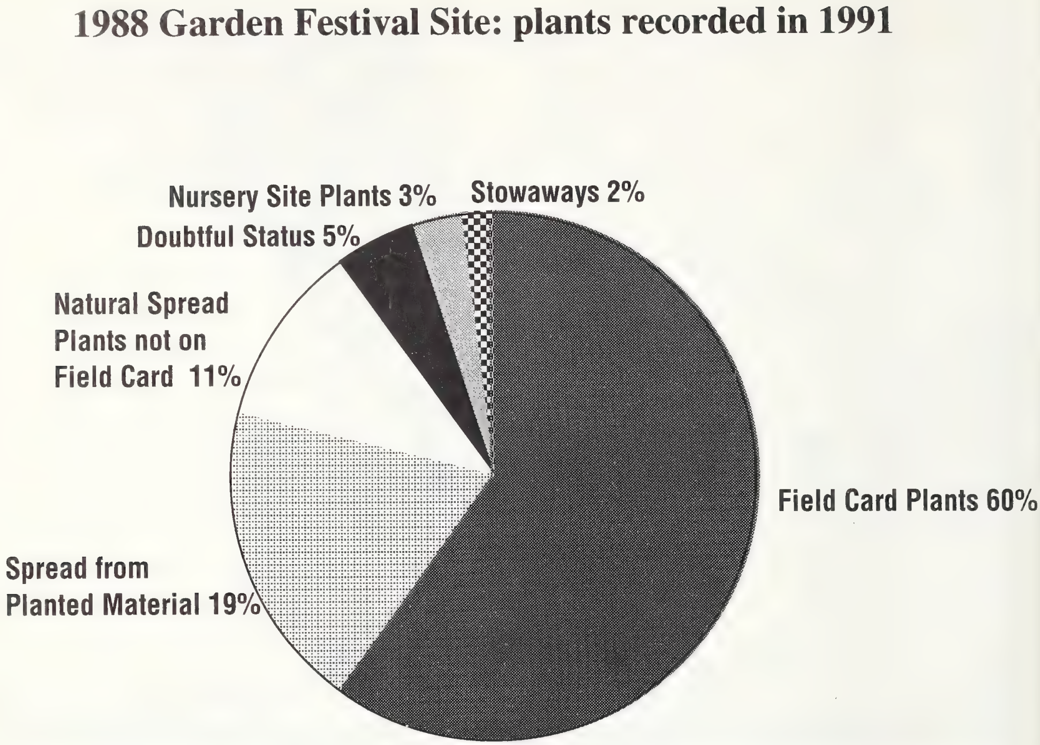

FIGURE 3. The results of plant recording in 1991 on the Glasgow Garden Festival site. 325 taxa were recorded in all.

perhaps more appropriately have been placed in one of the other categories. As examples of spread from planted or presumed planted material, I cite Hemp-agrimony (*Eupatorium cannabinum*) and Marjoram (*Origanum vulgare*), which, although common in other parts of the British Isles, are relatively unusual in the area. Perring & Walters (1962) give only one definite v.c. 77 record for each. When I tell you that on a bank were about ten plants of Greater Spearwort (*Ranunculus lingua*), you may well raise your eyebrows. Greater Spearwort had been planted in and by the pond at the base of the waterfall, i.e. diagonally about 100 m away, with a tree border between. How did it get to the bank? Water Dock (*Rumex hydrolapathum*) growing happily on the pebbly shore of the Canting Basin was almost certainly a feature of the planting along the stream, the seeds floating down. There is only one other site for this plant in the Glasgow area.

Although Tormentil (*Potentilla erecta*) and Hare's-tail Cottongrass (*Eriophorum vaginatum*) are common in the neighbourhood, they obviously arrived at the site with peat.

PLANTS WHICH ARRIVED BY NATURAL SPREAD BUT ARE NOT ON THE FIELD CARD

By natural spread, at this stage, I simply mean plants not on the Scottish Field Card, which have colonised from the vicinity of the Festival Site or whose introduction has nothing directly to do with the Garden Festival.

Of the 36 plants in this category some have been wind-blown, like Butterfly-bush (*Buddleja davidii*) and five species of Hawkweed (*Hieracium*). I was told by a referee not to bother coming down to the riverside at Kew, but to look for *Rumex obtusifolius* var. *transiens* in Glasgow – and at the site I made my first record.

Other plants have been bird-sown, such as five species of *Cotoneaster*.

Dense Silky-bent (*Apera interrupta*) was actually present at another part of the site while the area was still dockland and may have persisted, while Fodder Vetch (*Vicia villosa*) has been present for six years across the river and one square down. Large Trefoil (*Trifolium aureum*) keeps appearing and disappearing at various sites in Glasgow.

The rarest species were Canadian Fleabane (*Conyza canadensis*) and Least Pepperwort (*Lepidium virginicum*) growing on otherwise bare, gravelly ground and both new v.c. records.

DEFINITE OR PRESUMED SPREAD FROM PLANTED MATERIAL

The complete list of 62 species is given in Table 1.

In the main the spread had been wind-blown on to bare ground produced by bulldozing or with soil shifted by the bulldozers.

There was only a single plant of some taxa such as *Achillea millefolium* 'Cerise Queen', *Anchusa azurea* and *Artemisia stelleriana* growing on bare ground and *Saxifraga paniculata* on a stony path.

Between two and five plants were noted of most species such as *Artemisia ludoviciana* and *Armeria maritima* growing on bare ground. What was Thrift doing in the centre of Glasgow unless from planted material? So although *Armeria maritima* is on the Field Card I have not crossed it off, recording it only as a cultivar. Milk Thistles (*Silybum marianum*) were on a soil heap; *Eryngium planum* was on a bank; one plant of *Hemerocallis* was on a soil heap and another was at the sheltered edge of a bare open patch; Japanese Wineberry (*Rubus phoenicolasius*) was at the edge and extending down on to the shore of the Canting Basin.

There were over 50 plants of Pearly Everlasting (*Anaphalis margaritacea*) scattered widely and about 50 also of Yellow Chamomile (*Anthemis tinctoria*) but with a more local distribution. By far

TABLE 1. DEFINITE OR PRESUMED SPREAD FROM PLANTED MATERIAL ON THE GLASGOW GARDEN FESTIVAL SITE

Taxa (62 in all) not on the field card.

Achillea millefolium 'Cerise Queen'	*Hyssopus officinalis*
Achillea ptarmica	*Lamiastrum galeobdolon* subsp. *argentatum*
Alchemilla mollis	*Lamiastrum galeobdolon* subsp. *galeobdolon*
Anaphalis margaritacea	*Leucanthemum* × *superbum*
Anaphalis margaritacea var. *revoluta*	*Lychnis coronaria*
Anchusa azurea	*Lythrum salicaria* cv.
Anthemis tinctoria	*Melissa officinalis*
Armeria maritima cv.	*Mentha* × *villosa*
Artemisia absinthium	*Narcissus pseudonarcissus* cv.
Artemisia ludoviciana	*Narcissus tazetta*
Artemisia stelleriana	*Nepeta* × *faassenii*
Astilbe cf. *japonica*	*Phalaris arundinacea* var. *picta*
Berberis sp.	*Polygonum bistorta* 'Superbum'
Borago officinalis	*Potentilla fruticosa* hybrid
Campanula medium	*Pulmonaria officinalis*
Campanula persicifolia	*Ribes sanguineum*
Carex pendula	*Robinia pseudoacacia*
Cornus sericea	*Rubus phoenicolasius*
Cotoneaster salicifolius	*Saxifraga paniculata*
Cotoneaster × *suecicus*	*Senecio cineraria*
Dianthus barbatus cv.	*Silybum marianum*
Elaeagnus angustifolia	*Spiraea douglasii* × *S. salicifolia*
Eryngium planum	*Spiraea* sp.
Festuca brevipila	*Symphoricarpos* cf. × *chenaultii*
Geranium endressii × *G. versicolor*	*Symphoricarpos albus*
Geranium macrorrhizum	*Tellima grandiflora*
Geranium sanguineum	*Tolmiea menziesii*
Geranium × *magnificum*	*Verbena rigida*
Geum cv.	*Vinca major*
Hemerocallis sp.	*Viola lutea* cv.
Hippophae rhamnoides	
Hosta sp.	

TABLE 2. TAXA OF DOUBTFUL STATUS ON THE GLASGOW GARDEN FESTIVAL SITE

Angelica archangelica	*Oenothera biennis* × *O. glazioviana*
Aster sp.	*Phalaris canariensis*
Cotoneaster conspicuus	*Rosa rugosa*
Ligustrum ovalifolium	*Rubus cockburnianus*
Linum usitatissimum	*Salix alba* × *S. fragilis*
Lysimachia punctata	*Salix discolor*
Mimulus cupreus × *M. luteus* × *M. variegatus*	*Solidago gigantea*
Myosoton aquaticum	

the most common plant in this category was Purple Loosestrife (*Lythrum salicaria* cv.) which had been a feature of water-side planting but had spread to most parts of the site regardless of soil or moisture.

DOUBTFUL STATUS

Some of those on this list (Table 2) might have been from planted material but their introduction could equally well have been from other categories. 15 species were of doubtful status.

Japanese Rose (*Rosa rugosa*), White-stemmed Bramble (*Rubus cockburnianus*) and Early Goldenrod (*Solidago gigantea*) have been growing for many years in the neighbourhood. With regard to two plants of Garden Angelica (*Angelica archangelica*) growing well in from the river one can speculate fancifully. The plants grow on top of all the wooden piles near the mouth of the nearby River Kelvin (Macpherson 1984). The docks at the Festival Site were partly filled in with dredgings from the river. However as the seeds are more likely to float than sink to the bottom, then perhaps two were picked up as a bucket broke the surface!

Water Chickweed (*Myosoton aquaticum*) surprised me; one plant in a stony hollow at the edge above the Canting Basin, but then it can be an import and flourish on dry ground, as in London (Burton 1983). The *Mimulus cupreus* × *M. luteus* × *M. variegatus* was less than 2 cm high – the name being much longer than the plant! Flax (*Linum usitatissimum*) and Canary-grass (*Phalaris canariensis*) possibly came from bird seed.

'STOWAWAYS'

Plants whose introduction I presume to have been in soil round plants brought for display. I have excluded plants which are on the Field Card, such as those brought in with peat as mentioned above, or with woodland planting such as Wood Speedwell (*Veronica montana*) which leaves seven species (Table 3).

Although there was much planting in and along the waterfall and stream I cannot imagine that Orange Foxtail (*Alopecurus aequalis*) was brought intentionally, but there it was, one plant on the muddy edge – from whence did it come?

Free access was available to only one tiny part of the site in 1990 and on part of a bare trodden pathway there were six plants of Smooth Rupturewort (*Herniaria glabra*). 40 m farther on (in the next 1 km square) there were a further nine. In 1991 there were more than 50 plants. This species is even rarer than the *Alopecurus* in the British Isles.

I assume that Spiny Restharrow (*Ononis spinosa*) came with seed for sowing the grassy bank near the waterfall. Like the two mentioned above and Sulphur Cinquefoil (*Potentilla recta*), also in this group, this plant has not been recorded before in the vice-county.

TABLE 3. 'STOWAWAYS' ON THE GLASGOW GARDEN FESTIVAL SITE

Alopecurus aequalis
Geranium pyrenaicum
Herniaria glabra
Melilotus indicus
Ononis spinosa
Potentilla recta
Rumex acetosella var. *tenuifolius*

FIGURE 4. A personal 'Access' card designed by the author.

NURSERY SITE

In addition to the actual Garden Festival Site itself there is an adjacent area, connected by a short tunnel under the intervening road, in which plants were stored, either in containers or shoved into the ground while their sites were being prepared, or in some cases as substitutes to provide flowering colour throughout the season. It is an area of 3.5 ha.

It is still fenced off, but like most such pieces of ground, at least in Glasgow, if one searches one is bound to find a gap where someone has cut a way in!

With regard to the main site, the Security Officer became interested in my survey and kept asking if I had been to such and such a part where he had seen flowers – as opposed to weeds! At the Norfolk Recorders' Conference I suggested that we be issued with a card and that seemed to meet with general approval, but as none was forthcoming I designed my own (Fig. 4). Of course it has no official standing but never fails to impress.

I have included the Nursery Site (Table 4) because it was very much part of the festival complex as far as plants were concerned and had eleven additions to what were seen elsewhere. *Agrostis scabra* we see in hundreds, if not thousands each year in Glasgow. *Crepis setosa* reached Glasgow in 1984 but as a casual only (Macpherson 1990). In both 1990 and 1991 there were at least 40 plants on the bank of the track as it dipped down to go under the road, with two plants having crept into the Garden Festival site. *Genista hispanica* had definitely spread from planted material as presumably had the *Hosta*.

I had nipped in during 1990 and the most interesting plant was a tufted, reddish sedge identified for me as *Carex buchananii*, a native of New Zealand and possibly new to Britain as a wild plant. In 1990 one flowering plant was present. In 1991, the colony had increased to four (Macpherson & Macpherson 1992) and a recent check showed that there had now been a further increase to six. This plant plus one small Sensitive Fern (*Onoclea sensibilis*), more or less hidden away among a group of *Cornus* which had been left over near the boundary wall, would qualify for my 'Stowaway' category.

TABLE 4. TAXA IN THE NURSERY AREA ON THE GLASGOW GARDEN FESTIVAL SITE

Agrostis scabra	*Hosta* cf. *nakaiana*
Carex buchananii	*Medicago sativa*
Cichorium intybus	*Mentha* × *villosonervata*
Cotoneaster sternianus	*Onoclea sensibilis*
Crepis setosa	*Solidago canadensis*
Genista hispanica subsp. *occididentalis*	

DISCUSSION

So now that I have all these records – what are the implications? What do I do with them?

With regard to those which have arrived by what could be natural dispersal I have no problem. I stroke off the Field Card and put a dot on my index card. However I cannot simply accept all that are printed on the Field Card without comment as some are very rare or absent from my vice-county, and had probably spread from deliberate planting, e.g. Marjoram and Hempagrimony.

The next 'acceptable group' is comprised of those not on the Field Card, but which I assume have not been deliberately brought to the site. Some are actually reasonably common in Glasgow and could have spread on to any suitable ground. These I have no hesitation in recording without comment e.g. *Brassica rapa*, *Heracleum mantegazzianum*, *Senecio squalidus*. With regard to rarities such as Canadian Fleabane and Least Pepperwort, which I assume 'fell off the back of a ship', I have noted the facts, done a drawing of their location and will monitor to see how long they persist as was the case with *Agrostis scabra* which we first saw as a single plant in 1973 and for which I now have eleven personal 1 km^2 records (Macpherson & Stirling 1988).

The other group not deliberately introduced are my 'stowaways'. I already know that *Herniaria glabra* and *Carex buchananii* are spreading and could easily become established if given a chance.

Of the vast majority of planted material, there is now no trace. With regard to the recording of those which have spread or been spread from Garden Festival planting there is more room for argument. I have filled out a card for those such as *Anchusa azurea*, and even added a dot. These should at least therefore always be available for reference.

What of these so-called aliens? How are they to be regarded?

For reference I selected books from my bookshelves more or less at random. In no sense is this an exhaustive review:

"Human borne seedlings do not seem to me to deserve much consideration. I am not convinced that we ought not to advocate definite action to prevent their settlement" (Raven 1953). A critical comment taken a little out of context, but which one might argue could apply at least to the Giant Hogweed (*Heracleum mantegazzianum*).

Or with disdain: "I almost immediately excluded aliens because they are coming and going in an endless stream, occasionally leaving a mark on our landscape as in the case of *Senecio squalidus*, but more often waifs and strays, left to perish on a dunghill" (Meikle 1953).

Or an intermediate view: "The alien flora is of little importance but must be accounted for as many of the familiar plants of the countryside had their introduction either as aliens or as garden escapes" (Dony 1976).

Or more tolerantly: "The British flora is changing whatever we do but all changes are not always for the worst, some constituting interesting additions to the British flora and not necessarily undesirable" (Brenan 1983).

A few years ago I met a fellow Scottish Recorder and reported that I had v.c. records of Chinese Ragwort (*Sinacalia tangutica*) and Peach-leaved Bellflower (*Campanula persicifolia*), both well established, and which I would pass on. I was told not to bother as they would go straight into the waste-paper basket. *Campanula persicifolia* is also present at the Garden Festival Site, so do I consign the record, specimen and slide to the bin?

For some time I have had a certain reputation for recording 'non-natives' which can brighten up dull routine recording (Dickson 1991), and so appreciate the contents of the *New Flora of the British Isles* which states that "The aim is to include all taxa that the plant hunter might reasonably be able to find in the wild in any one year" (Stace 1991).

I do appreciate that there is a pecking order:

Native – whatever that is! Swann (1977) stated that no two botanists will ever agree about what constitutes a native species. It has been variously defined as: a species believed to have been in the country before man (Lousley 1953; Ellis 1983); part of the natural vegetation for a long time (Briggs 1990); in a natural locality to which it has spread by natural means from a natural source (Dunn 1905); immigrated without the aid of man (Lousley 1953; Ellis 1983; Dickson 1991; Stace 1991); arisen de novo in the country (Lousley 1953; Ellis 1983).

Non-native – unintentional introductions may be regarded as more interesting than those brought in intentionally. Some authors regard alien and introduction as synonymous while others limit introduction to deliberate acts.

Alien plants have been defined as species introduced by the intentional or unintentional agency of man (Lousley 1953; Ellis 1983; Crackles 1990); species introduced by man and now more or less established (Clapham *et al.* 1962).

Introduced alien – deliberately brought to the area for whatever reason (Dickson 1987).

Invading alien – unintentionally brought to the area or arriving in the area by natural means (Dickson 1987).

There is then the question of Naturalised vis-à-vis Established. Some authors make a distinction and regard Naturalised as a more important category: a species naturalised in natural habitats (Hyde & Wade 1934); species naturalised in a natural or semi-natural habitat (Lousley 1953). Others regard them as synonymous: a species which has become self-perpetuating (Stace 1991); an alien plant which has become completely established. Those who differentiate define Established Alien as persisting only in a man-made habitat (Hyde & Wade 1934; Lousley 1953); or in absence of competition from native species (Crackles 1990). The criteria have been widened to include an annual which persists or is repeatedly introduced (Ellis 1983).

Both Naturalised and Established are regarded as more important than Casual (Temporary; Ephemeral; Visitors). There is more unanimity regarding the definition of Casual, the general view being that it refers to a species which does not persist (Lousley 1953; Clapham *et al.* 1962; Ingram & Noltie 1981; Ellis 1983; Crackles 1990; Graham 1988). The terms Ephemeral Alien (Jermyn 1974) and Adventive (Fitter & Fitter 1967) have been used as synonyms for casual.

How long does a plant have to persist before it can be regarded as Naturalised/Established? The plants that I have recorded have persisted for two to three years. Lousley (1953) had suggested 25 years. I am unlikely to persist that long, so when may I put them into Plant Records?

What is an Escape and are all escapes equal? An escape has been defined as: of cultivated origin but not naturalised (Clapham *et al.* 1962; Ingram & Noltie 1981); originally from seed or plants thrown out with garden rubbish (Jermyn 1974); spread vegetatively or by seed from a garden (Stace 1991).

I present a classification of introductions in what could be regarded as a pecking order (Fig. 5).

Other terms used in the literature include:–

Indigenous – native born; originating or produced naturally in a country; opposite of exotic (Kirkpatrick 1983); Exotic – introduced from a foreign country; alien; not native to a country as a plant, etc; romantically – strange, rich or showy (Kirkpatrick 1983); Denizen – doubtful native in a

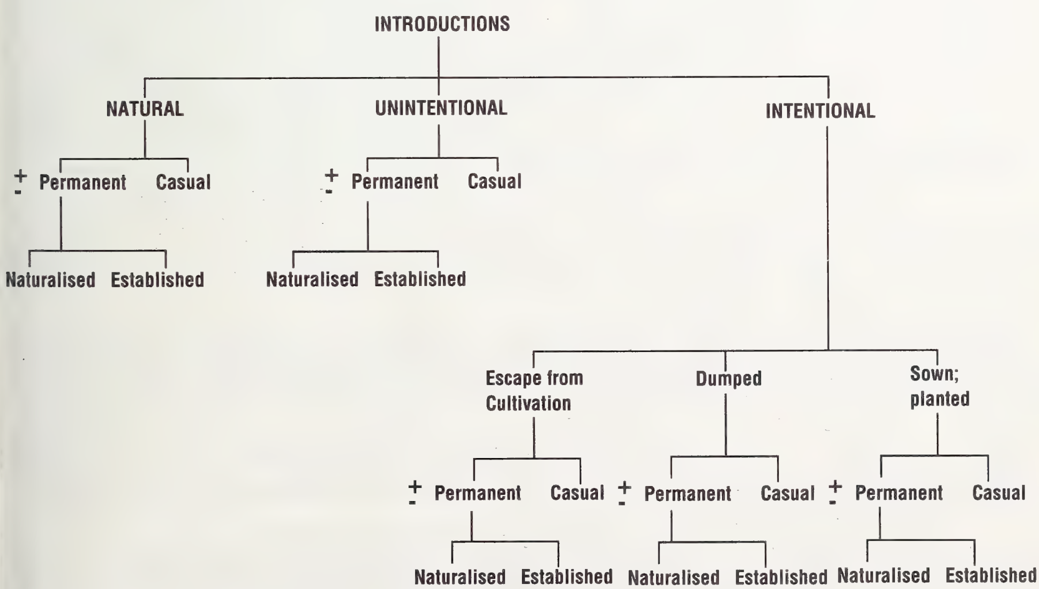

FIGURE 5. Different modes of introduction and permanency in (arguably) decreasing importance from left to right.

natural habitat (Watson 1870; Lousley 1953); an alien species growing in a natural or semi-natural community (Lousley 1953); species growing wild but originally introduced as cultivated crop or herb (Graham 1988; Crackles 1990); native elsewhere in Britain but not in the area (Hall 1980); Adventive – a plant growing unaided but not yet permanently established (Hyde & Wade 1934); not deliberately introduced (Crackles 1990); self-sown or bird-sown garden plant (Briggs 1990) or even Colonist, a category implied in the title of this address – doubtful native in a man-made habitat (Lousley 1953); native elsewhere in Britain but not in the area (Whitehead 1976); species which grows only on man-maintained habitat (Lousley 1953; Graham 1988); alien which is established (Jermyn 1974); synonym of Adventive which is a synonym of Casual (Fitter & Fitter 1967).

So is Pineappleweed (*Matricaria discoidea*) more acceptable, having been brought in unintentionally, than Oxford Ragwort (*Senecio squalidus*) which was actively brought to this country; and that in turn more acceptable because it escaped over the garden wall than Dotted Loosestrife (*Lysimachia punctata*) which was thrown out and is now all over the West of Scotland? It has been recorded in 70 of the 90 *Flora of Glasgow* tetrads. All three plants are on the Garden Festival Site. If I stop to think about it, yes, I agree with the pecking order, but while recording never give it a thought.

I wish to make a comparison. After the Ice-age Britain was:–

a. wholly or mainly a bare area available for colonisation by plants (Heslop-Harrison 1953); and
b. a land available for colonisation by people.

As there were no people initially in the British Isles all here now are descendants of those who were native elsewhere. The British Isles have been populated by waves of tribes: Iberians, Celts, Picts, Angles, Saxons, Normans and so on. In the eyes of the Iberians the Celts were invasive intruders, in the eyes of the Celts the Anglo-Saxons were incomers and so it went on. There is even the question of being alien to a district. In the cities people are more readily absorbed into the community but in the Highlands it is often said that families need to remain for a couple of generations before they cease to be Incomers! There is also antipathy in parts of Wales to 'white settlers'. In contrast many people in England more or less regard Great Britain as synonymous with England and therefore include the Scots and Welsh as English! In spite of the above no-one would quibble if most if not all of us claim to be natives of the British Isles. I feel that this may have something to tell us about our attitude to plant status.

With regard to plant distribution within the British Isles some Floras define Alien as not native to the area under discussion, although it may be native in other parts of the British Isles. What are the geographical limits to which this would apply? If a plant is gradually extending into Scotland from England by natural dispersal, are the offspring which cross the border into Scotland to be regarded as aliens? Or, to narrow it down, if a plant arises from seed blown on to suitable ground in Glasgow from a neighbouring so-called native habitat are we allowed to call it Native in Glasgow, in the *Flora of Glasgow*. Certainly 'Alien' would not seem to be appropriate. In other words are the boundaries not rather arbitrary? Even if the term Alien is acceptable for the newly arrived, in general, after one or two generations of people, or rather more in the case of plants, the term is not appropriate.

There is therefore an obvious diversity of opinion regarding the definition of terms or even of their acceptability. "The various terms are not easily, precisely defined as different botanists use them in different ways" (Briggs 1990). "In assessing the status of many species, no two botanists would ever agree, judgement is so much a matter of personal opinion and many of the terms used are themselves arbitrary" (Petch & Swann 1968).

As a further example of differing terminology I present these definitions of Introduced Plant – brought accidentally or intentionally (Clapham *et al.* 1962); deliberately sown or planted (Fitter & Fitter 1967); deliberately brought for whatever reason (Dickson 1987); deliberately sown or planted or garden escape (Graham 1988); brought by man but apparently naturalised (Ingram & Noltie 1981).

Some Presidential Addresses end with such statements as: Further work along the lines of my talk would be a suitable project for the Society (and that is usually the last one hears of it – like my access card and possible Presidential Medals!).

I am going to be more positive and ask if I may set up a little sub-committee with a view to producing agreed unambiguous British Terminology. It should be less controversial than the *English Names of Wild Flowers* which, although many in Scotland object to, I have, with two exceptions (did you notice one in my address?) been prepared to accept for the overall good.

The requirement for clear knowledge of status without ambiguity is clearly indicated by the story of the young man from the West of Scotland who went into a London establishment that he would not have patronised had he known its reputation. He chatted to a young lady for some time and eventually she leant forward, touched his arm and said "You do realise that I am a Call Girl?" He leant back – "Now is that not a co-incidence – I'm from Tiree".

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The correct Latin names for the Primrose and the Oxlip, *Primula vulgaris* Hudson and *P. elatior* (L.) Hill

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ABSTRACT

The correct Latin names for the Primrose and the Oxlip are maintained as *Primula vulgaris* Hudson and *P. elatior* (L.) Hill (Primulaceae), despite recent assertions that the Primrose should be called *P. acaulis* (L.) L. and that a question hangs over *P. elatior*. Additional evidence of Linnaeus's intentions in his *Flora Anglica* is provided in different printings of this work which have been previously overlooked.

INTRODUCTION

It may seem surprising and unfortunate that there should still be disputes over the correct Latin names of the Primrose and the Oxlip after three centuries or more of the study of the European flora and well over two centuries of the adoption of Linnaean binomial nomenclature. However, Greuter (1989a) resurrected the name *Primula acaulis* (L.) L. for the Primrose. This has been adopted in the *Med-Checklist* (Greuter, Burdet & Long 1989), and new subspecific combinations have been published by Greuter & Burdet (Greuter 1989b). It has also been maintained that unless the arguments for this are accepted it is impossible to maintain the name *P. elatior* for the Oxlip. The decisions depend largely on interpretation of Linnaeus's *Flora Anglica* (1754), a dissertation defended by his student Grufberg. During preparation of the account of Primulaceae for the *Flora of Cyprus* (Meikle 1985), we looked into this question and were satisfied that there was no threat to the well-established *P. vulgaris* Hudson, and we maintain this position now. Re-examination of the facts has brought to light an overlooked significant variation in the typography of the 1754 *Flora Anglica*, which reinforces our opinions.

THE LATIN NAME OF THE PRIMROSE

In *Species Plantarum* (1753), Linnaeus did not provide a specific binomial for the Primrose because he adopted a broad species concept, recognising the Cowslip, Oxlip and Primrose as one species, *P. veris*, with three varieties, var. *officinalis*, var. *elatior* and var. *acaulis* respectively. (This taxonomic concept persisted in British botany through all editions of Bentham's *Handbook of the British Flora*, to Rendle's 7th edition in 1924.) In 1762 William Hudson published his *Flora Anglica*, including the Cowslip and Oxslip in *P. veris* but raising the Primrose to specific rank with the new name *P. vulgaris*. In 1765 John Hill also gave the Primrose specific rank, but took up Linnaeus's varietal epithet *acaulis* as *P. acaulis*, a name which has occasionally been adopted since. However, at specific rank *P. vulgaris* Hudson has three years' priority over *P. acaulis* (L.) Hill and so has been widely adopted.

The current argument is over the rank given to the Primrose in Linnaeus's *Flora Anglica* (1754). Greuter (1989a) has concluded that here Linnaeus raised the Primrose to specific rank under the

Echium	vulgare	227 - 1.	Solanum	nigrum	265 - 4.
	Lycopſis	227-2.		Dulcamara	265-1-2.
Primula	veris officinal.	284 - 3.	Ramnus	catharticus	466-1.
	elatior	2.		Frangula	465 - 1.
	acaulis	1.	Evonymus	europæus	468 - 1.
	farinoſa	285-1.	Ribes	rubrum	456 - 1.
Menyanthes	trifoliata	285 - 1.		alpinum	456 - 2.
	Nymphoides	368-2.		nigrum	456 - 4.
Hottonia	paluſtris	285 - 1.	Hedera	helix	459 - 1.
Lysmachia	vulgaris	282 - 1.	Illecebrum	*verticillatum*	160 - 1.
	thyrſiflora	283 - 3.	Glaux	maritima	285 - 1.
	Nummularia	283 - 1.	Theſium	Linophyllum	202 - 1.
	nemorum	282 - 5.	Vinca	minor	168 - 1.
Anagallis	arvenſis	282 - 1.		*major*	168 - 2.
					DI-

FIGURE 1. Linnaeus's *Flora Anglica* (1754); lower part of p. 12, from Ray Society 1973 facsimile.

name *P. acaulis*, so that this name has priority over *P. vulgaris* Hudson (1762). Stearn (1973, p. 68), however, in collaboration with the late J. E. Dandy, had concluded that Linnaeus merely repeated his taxonomy of *Species Plantarum* in his *Flora Anglica*, and that apparent inconsistencies were due to obvious slips of the pen or typographical errors. Greuter reproduced in facsimile the relevant page of Linnaeus's *Flora Anglica* (see Fig. 1), and argued that names given there which are neither trinomial nor subordinated by indentation must be accepted as specific binomials. In the case of *Primula*, 'veris officinal[is]' appears on one line, with 'elatior', '*acaulis*' and 'farinosa' on successive lines indented only very slightly under 'veris'. The indentation, or lack of it, may here tend to suggest that all four taxa were given specific rank. As Greuter has noted, the italicisation of *acaulis* merely denotes that this taxon does not occur in Sweden.

However, when we looked again at the Kew copy of *Flora Anglica* (see Fig. 2) which we had consulted ten years ago, we found that the typesetting is different from that of the Ray Society's facsimile edition (1973), and that 'elatior' and '*acaulis*' are indeed indented under 'veris' almost to the position of the varietal epithet 'officinal[is]', while 'farinosa' is indented almost as far. There are similar inconsistencies between copies in indentation on the same page (see *Echium*, *Ribes*, *Hedera*, *R[h]amnus*, *Vinca*) and on other pages, and it is clear that there were at least two different printings of this dissertation and that the typesetting indentation was haphazard. We are grateful to Dr J. L. Reveal for informing us that the Natural History Museum, London possesses both printings. It appears that in the version represented at Kew the printer was instructed to remove excessive spaces between some generic names and the following epithets without moving succeeding epithets, so that indentations become quite different. Indentation thus appears meaningless as far as evidence of rank is concerned. It would be false to argue that in the Kew copy the position of the epithets *alpinum* and *nigrum* in relation to *rubrum* under *Ribes* (see Fig. 2) indicates that they represent infraspecific taxa. But certainly, if the Kew copy alone were considered, the weight of evidence from indentation alone would indicate that Linnaeus still regarded *elatior* and *acaulis* as varieties of *P. veris* and not as separate species, contrary to Greuter's conclusion.

But the clinching evidence of what Linnaeus did or did not do in *Flora Anglica* is provided by a point already stressed by Stearn (1973, p. 68). For the Cowslip, Linnaeus employed the trinomial *Primula veris officinal[is]*, indicating that he still recognised varieties in the species. If he had raised all three taxa to specific rank he would certainly have dropped the varietal epithet *officinalis*. To our knowledge, in all his botanical works he never employed a varietal epithet in species in which he did not recognise varieties. The aim of *Flora Anglica* was essentially to list the known flora of England according to the binomial system, and although he did introduce a few novelties (Stearn 1973, pp. 63–68), in the case of *Primula* it is clear that he merely retained his taxonomy from *Species*

Echium vulgare	127 - 1.	Solanum nigrum	265 - 4.
Lycopſis	127·2.	Dulcamara	265-1-2.
Primula veris officinal.	284 · 3.	Ramnus catharticus	466 - 1.
elatior	2.	Frangula	465 - 1.
acaulis	1.	Evonymus europæus	468 - 1.
farinoſa	285-1.	Ribes rubrum	456 - 1.
Menyanthes trifoliata	285 - 1.	alpinum	456-2.
Nymphoides	368-2.	nigrum	456-4.
Hottonia paluſtris	285 - 1.	Hedera helix	459 - 1.
Lysmachia vulgaris	282 - 1.	Illecebrum *verticillatum*	160 - 1.
thyrſiflora	283 - 3.	Glaux maritima.	285 - 1.
Nummularia	283 - 1.	Theſium Linophyllum	202 - 1.
nemorum	282 - 5.	Vinca minor	168 - 1.
Anagallis arvenſis	282 - 1.	*major*	168 - 2.

DI-

FIGURE 2. Linnaeus's *Flora Anglica* (1754); lower part of p. 12, from Kew copy.

Plantarum published the previous year. The erratic behaviour of a typesetter in 1754 does not alter the facts and cannot be used as a reason to upset established nomenclature of a well-known plant. Nor is the issue affected by the slightly more orderly, but still inconsistent, typesetting of the reprint of *Flora Anglica* in Linnaeus's *Amoenitates Academicae* (1759, vol. 4), where all four epithets *veris*, *elatior*, *acaulis* and *farinosa* were equally indented under *Primula* (p. 97). The inclusion of the varietal epithet *officinalis* still indicates that Linnaeus had not changed his taxonomy. Indeed, throughout all his works Linnaeus kept the Primrose and the Oxlip as varieties of *Primula veris*. The correct name (and relevant synonyms) at specific rank for the Primrose is therefore as follows:

P. vulgaris Hudson, *Fl. Angl.*, 70 (1762).
P. veris var. *acaulis* L., *Sp. Pl.* **1**: 143 (1753).
P. acaulis (L.) Hill, *Veg. Syst.* **8**: 25 (1765).

THE LATIN NAME OF THE OXLIP

Having concluded that Linnaeus raised the Primrose and Oxlip from varietal rank in *Species Plantarum* (1753) to specific rank in *Flora Anglica* (1754), Greuter (1989a) has cited the correct name for the Oxlip as *Primula elatior* (L.) L., *Fl. Angl.* 14 (1754) instead of the more usual *P. elatior* (L.) Hill (1765). He has warned that, if this is not accepted, the specific name for the Oxlip will have to change. The reason for this conclusion is that he considers that when Hill in 1765 published the name *Primula elatior* he did not make a new combination based on Linnaeus's *P. veris* var. *elatior* but described a new species, which, according to Schinz & Thellung (1907, p. 333), is not the Oxlip but the hybrid between the Cowslip and Primrose, the False Oxlip. This would then mean that the name *P.* × *elatior* Hill would have to be applied to the hybrid, that any later combination of Linnaeus's *elatior* at specific rank would be an illegitimate later homonym, and that a new name would have to be found for the Oxlip. Fortunately we cannot agree with this sequence of conclusions.

The fact that Hill may have described and illustrated the hybrid *P. veris* × *vulgaris* under the name *P. elatior* is irrelevant if the latter is a combination based on Linnaeus's var. *elatior* (*International code . . . Berlin 1987*, Art. 7.12). The question therefore is whether Hill made a new combination or described a new species. Throughout the 26 volumes of the quarto edition of *The Vegetable System* (1759–1775), in which the name appeared, Hill never cited any authors for the binomials he used, nor did he cite any basionyms. He was, however, clearly using the Linnaean system, to which he referred directly in his introduction (Hill 1759, vol. 1, p. 24) with a comment that "it will live . . . so long as there is science". It would be ludicrous to argue that the names he used were independent of those published previously by Linnaeus simply because he used no author citations. Such a conclusion would require that every name in all 26 volumes of the *Vegetable System* should be listed in *Index Kewensis* as new species attributed to Hill.

Article 33.2 of *International code . . . Berlin 1987* requires that a full and direct reference be given in valid publication of a new combination after 1 January 1953, surely with the implication that before 1953 such a reference is not necessary. All the circumstantial evidence, and in particular the coincidence of all the epithets *officinalis*, *acaulis*, *elatior* and *farinosa* under *Primula* in the relevant publications of both Linnaeus and Hill, points to the fact that Hill was merely taking up the earlier Linnaean epithets and was not describing new taxa. The coincidence of the epithets themselves refers us back to Linnaeus, which is confirmed (if it were necessary) by Hill's direct reference to Linnaeus in his introduction, as noted above. Publication of the combination by Hill, not Linnaeus, was accepted in the original volume of *Index Kewensis* (1895) and by generations of botanists since. It is comparable with the combination *Helianthemum nummularium* (L.) Miller, *Gard. Dict.* (ed. 8), [sub]. *Helianthemum* no. 12 (1768), also published with a passing reference to Linnaeus himself in the introduction to the book, and with a reference under the generic name, but without any reference to the basionym *Cistus nummularius* L., *Sp. Pl.* **1**: 527 (1753), and nonetheless universally accepted as a new combination at the present time. To maintain today, when the need for nomenclatural stability is being much discussed, that such names should be treated as newly described species, with consequent new typifications, rather than new combinations, would not only be highly undesirable, it would be contrary to the *International code*. We are happy to conclude that the correct name for the Oxlip should be maintained as follows:

P. elatior (L.) Hill, *Veg. Syst.* **8**: 25 (1765).
P. veris var. *elatior* L., *Sp. Pl.* **1**: 143 (1753).

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(*Accepted July 1992*)

Short Notes

DIANTHUS ARMERIA L. NEW TO IRELAND AND OTHER RARE PLANTS IN WEST CORK

This note presents a preliminary report of extensive floristic research on Sherkin Island and adjacent islands in Roaringwater Bay to the west of Baltimore, West Cork (vice-county H3). During field-work from March to September 1992, based at Sherkin Marine Station, K.C. (joined by J.R.A., 25 August–4 September) made so many significant records of rare native and ruderal species that it seemed pertinent to make the most interesting results available. All data have been lodged at Sherkin Marine Station. Some of our herbarium voucher specimens of the plants are fragmentary or even lacking, as many of the plants are extremely rare and protected by Irish law. Nomenclature follows Stace (1991).

Dianthus armeria L.
Horse Island, rocky pasture near the sea, 1 September 1992, *J. R. Akeroyd & K. Clarke*, **DBN**, **herb. Sherkin Marine Station.**

Six plants in all were found, severely grazed by sheep and goats. The plants had anomalous few-flowered inflorescences with secondary growth below, but could be distinguished by the annual/biennial habit and flowers c. 1 cm in diameter, bright reddish-pink and scentless. The leaves, bracts and stems were reddish.

Dianthus armeria, a plant of grasslands on sandy soils, has not previously been reported from Ireland. It occurs over much of southern and central Britain, but is now rare and decreasing (Perring & Walters 1976; Stace 1991). The Irish station is an area of some 12 × 3 m on a south-facing slope of submaritime grassland interspersed with a few outcrops of Old Red Sandstone. The species-rich sward, dominated by *Agrostis vinealis* Schreber, *Cynosurus cristatus* L. and *Koeleria macrantha* (Ledeb.) Schultes, is grazed to 5–8 cm, with grass-stems and chewed inflorescences of *D. armeria* up to 18 cm. Further down the slope the grassland is coarser and enriched, with patches of nettles and thistles. On adjacent rock outcrops a more heathy flora, dominated by *Ulex gallii* Planchon, includes a large, unrecorded population of *Ornithopus perpusillus* L., a rare but often overlooked plant in Ireland (fide J. R. Akeroyd & R. FitzGerald). No soil analyses have been carried out, but it may be significant that the site is adjacent to old copper workings.

D. armeria has a wide distribution in Europe, where it extends northwards to southern Norway and westwards to Galicia, Cornwall and mid-Wales (Jalas & Suominen 1986). Its occurrence in southern Ireland, although a welcome surprise, is perhaps therefore not too unexpected. It should certainly be sought elsewhere in W. Cork and on coasts from Co. Cork to Co. Dublin. It is the only member of the genus *Dianthus* that is apparently native to Ireland.

Allium ampeloprasum L. var. *babingtonii* (Borrer) Syme
Sherkin Island, road from church towards Sherkin Point, garden of deserted cottage, July 1992, obs. K. Clarke.

This distinctive leek has long been known from the Aran Islands and the coasts of Clare, W. Galway (Webb & Scannell 1983) and from Donegal, and is also widespread in Scilly and the coast of mainland Cornwall. It is considered to be a relic of ancient cultivation, probably introduced from the Mediterranean region where the species has its centre of distribution, but perhaps a native species (Webb & Scannell 1983). Var. *babingtonii*, endemic to western Ireland and south-western England, is frequently associated with human habitation and old ruins. The Sherkin plants might have been introduced, but they do provide a geographical link between the two main areas of distribution of this variant.

Asplenium obovatum Viv. subsp. *lanceolatum* (Fiori) P. Silva
Cape Clear Island, South Harbour, damp stonework, 3 September 1992, *obs. K. Clarke & J. R. Akeroyd.*

We observed a single plant of this rare fern at South Harbour, where it had last been recorded, as *A. lanceolatum* Huds., in 1896 (Colgan & Scully 1898). The warden of the Cape Clear Bird Observatory later kindly directed us to a second locality to the west of South Harbour where the plant had been rediscovered by another botanist on a damp stone wall just a few days previously, allowing us to confirm the identity of our own plant.

Centaurium pulchellum (Sw.) Druce
Horse Island, damp grassland above patch of scrub on east coast, 10 m, 19 June 1982, *L. C. Wright LW0045*, **herb. Sherkin Marine Station**.

We were unable to refind this species ourselves, but the herbarium material represents the only recent record from Co. Cork. It is apparently the first record of this species from Roaringwater Bay since 1818 when it was reported on Cape Clear Island (Colgan & Scully 1898). *C. pulchellum* has recently been rediscovered at several old stations in Co. Wexford (fide J. R. Akeroyd & R. FitzGerald), so may be overlooked.

Kickxia elatine (L.) Dumort.
Sherkin Island, Foardree, open peaty ground on south-facing slope above sea, *obs. J. R. Akeroyd & K. Clarke*, 29 August 1992.

A very rare, submaritime plant in Ireland, now restricted to Counties Cork and Wexford and usually found on cultivated land. It was found at Foardree whilst examining a population of *Lotus subbiflorus* Lag. discovered there earlier (fide K. Clarke). However, we failed to find *K. elatine*, described by Polunin (1949) as "frequent on cultivated ground", elsewhere on Sherkin or Cape Clear Islands, although fragments of a formerly rich weed flora (cf. Polunin 1949, 1950) have survived in the islands.

Rumex pulcher L.
Sherkin Island, above Horseshoe Bay, obs. 28 June 1990, 25 August 1992, J. R. Akeroyd.

Ten plants of this rare Irish dock were located in two small colonies at the eastern end of Sherkin Island. This confirms reports from the area by Polunin (1950) and earlier workers. As the species has persisted for nearly 100 years on Sherkin, has been repeatedly recorded in Co. Wexford and is a member of native plant communities (fide J. R. Akeroyd), it cannot be regarded as merely "casual" (Perring & Walters 1976) and is probably native in Ireland.

Tuberaria guttata (L.) Fourr.
E. Calf Island, rock outcrops in heathland, 20 May 1992, *K. Clarke C198*, **herb. Sherkin Marine Station**.

This confirms an old record of the species from E. Calf, where it was not refound by Polunin (1950). The other Irish stations are all on islands or peninsulas in the extreme west of the country: on the coasts of W. Mayo and W. Galway and on Sheep's Head and Three Castles Head, Co. Cork (recorded by J. R. Akeroyd & D. A. Webb in July 1987), respectively some 25 km to the north-west and west of E. Calf Island.

In addition to the above reports, we have made or confirmed records on Sherkin Island or adjacent islands of many rare or local Irish plants, including *Althaea officinalis* L., *Artemisia absinthium* L., *Lotus subbiflorus*, *Trifolium striatum* L. (cf. O'Mahony 1979), *T. micranthum* Viv., *T. arvense* L., *Torilis nodosa* (L.) Gaertner and *Viola lactea* Sm. The total number of flowering plants and ferns on the islands of Roaringwater Bay, including Cape Clear and Sherkin Islands, now stands at about 500, at least ten of them among the rarest of Irish plants – a flora of remarkable richness. A full Flora of the area is currently being prepared.

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We are grateful to Matt Murphy, Director of the Sherkin Island Marine Station, for providing accommodation and facilities for our research, and to Michael and Robbie Murphy for their skillful and cheerful ferrying of us around the waters of Roaringwater Bay. Our work in 1992 on Sherkin

Island would never have been possible without the solid groundwork provided by the studies of Lucy Wright (1981–2) and Jennifer Shockley (1990).

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PILOSELLA × *FLORIBUNDA* (WIMMER & GRAB.) ARVET-TOUVET (ASTERACEAE) IN THE BRITISH ISLES

Stewart (1903) recorded *Hieracium auricula* L. from an old limestone quarry at Cave Hill, Belfast, and remarked: "I have known this plant growing on the debris of the Whitewell limestone quarries, Cave Hill, for at least six years. During that time it has neither increased nor decreased. It partially occupies an area of about two square yards. The district around it is uncultivated, save for grass. There are few gardens in the vicinity – none close at hand. I consider it an alien, but how it has reached here is not easily understood". It was first recorded there in 1897 and last seen in 1910 (Wear 1923). Pugsley (1946, 1948) renamed it *H. helveolum* (Dahlst.) Pugsley. Sell and West (Sell 1967) made *H. helveolum* a subspecies of *Pilosella lactucella* (Wallr.) P. D. Sell & C. West. The same authors, when writing the account of *Hieracium* for *Flora Europaea* (Tutin *et al.* 1976), decided it was better put under *Hieracium* × *floribundum* Wimmer & Grab., i.e. *Pilosella floribunda* (Wimmer & Grab.) Arvet-Touvet which is where *H. helveolum* was originally placed by Dahlstedt as subsp. *helveolum*.

P. floribunda is almost certainly a hybrid between *P. lactucella* (Wallr.) P. D. Sell & C. West and *P. caespitosa* (Dumort.) P. D. Sell & C. West, which can spread vegetatively as well as by seed. It differs from *P. caespitosa* by its glaucous, less hairy leaves, and from *P. lactucella* by its much taller habit.

On 21 June 1991, R. P. Bowman discovered 45 or more plants occupying an area of about 4 × 2 m, in grass heath with *Calluna vulgaris – Erica tetralix* tussocks, on the wide verge of the B3056 between Stephill Bottom and Pig Bush in the New Forest, S. Hants. v.c. 11, GR SU/35.05, **herb. R.P.B.** It was the site of military emplacements during the 1939–1945 war, and *P.* × *floribunda* may have been introduced during that period.

It is a good match with the eight plants from the Belfast locality in **CGE**, and with continental material in that herbarium.

Pilosella × floribunda (Wimmer & Grab.) Arvet-Touvet in *Bull. Soc. Dauph.* 1880: 280 (1880).
Syn. *Hieracium floribundum* Wimmer & Grab., *Fl. Siles.* **2**(2): 204 (1829); *Hieracium floribundum* subsp. *helveolum* Dahlst., Hier. Exsicc. **4**: nos. 14 & 15 (1891); *Acta Horti Berg.* **2**(4): 13 (1894); *Hieracium helveolum* (Dahlst.) Pugsley in *J. Ecol.* **33**: 347 (1946); *Pilosella lactucella* subsp. *helveola* (Dahlst.) P. D. Sell & C. West in *Watsonia* **6**: 314 (1967).
Rootstock rather thick, sometimes producing leafy stolons. Stems 10–35(–45) cm, erect, rather slender, green below, darker above, with numerous long (to 7 mm), pale, dark-based simple eglandular hairs throughout and with numerous to dense, small stellate hairs and numerous, short, dark glandular hairs in the upper part. Leaves 50–180 × 6–20 mm, glaucous-green with a whitish

midrib; the basal numerous, in a rosette, narrowly elliptical or narrowly oblanceolate, the outermost rounded at apex, the inner obtuse or subacute and mucronulate, long attenuate at base to a broadly winged petiole, with few to numerous, long (to 4 mm), pale simple eglandular hairs on or near the margin, and similar ones with red bases along the midrib (sometimes the hairs are found on the surfaces and sometimes small stellate hairs are present on the lower surface); the cauline 0–3, similar to basal but smaller; when stolons are present they bear numerous leaves which are similar to basal but small. Inflorescence of 3–7 capitula, compact; peduncles 3–25 mm, with dense, white stellate hairs, numerous, short, dark glandular hairs, and few to numerous, long simple eglandular hairs. Capitula 15–20 mm in diameter. Involucral bracts 6–9 × 1·0–1·5 mm, dark green with whitish margins, linear-lanceolate, rounded-obtuse at apex, with numerous, very small stellate hairs particularly on the margins, numerous, short, dark glandular hairs down the centre, and few to numerous, long, whitish, dark-based simple eglandular hairs. Ligules bright yellow, paler beneath, glabrous. Styles yellow or slightly discoloured. Margins of receptacle pits shortly dentate. Achenes 2–3 mm, purplish-black.

In Stace (1991) it will key out to *P. caespitosa*, but differs from that species in its bluish-green rather than yellowish-green leaves which are not as hairy on the surface. In Europe it occurs in the north and centre southwards to north Switzerland and the east Carpathians. It is a triploid with 2n = 27. Little is known about its biology.

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REGENERATING BALSAM POPLAR (*POPULUS CANDICANS* AIT.) × BLACK POPLAR (*P. NIGRA* L.) (SALICACEAE) AT A SITE IN LEEDS

In 1983 poplar regeneration was observed on a patch of waste ground at a site in central Leeds, Yorkshire. Vegetation surveys carried out in other towns over the next eight years failed to reveal further examples and it gradually became clear that this was a most unusual occurrence. A literature search revealed only one other incidence in the UK; this involved different poplar taxa at a sewage works at Hackney, East London (Wurzell 1985). During 1991 the Leeds population, which is now very well established, was investigated in more detail.

The parents, which are growing on a traffic roundabout at the junction of Kirkgate and Crown Point Road, are 20 well grown specimens of the Balsam Poplar (*P. candicans* Ait., all female) and two similar sized Black Poplars (*P. nigra* L., both male). The origin of *P. candicans* is unknown; it may be a hybrid between *P. balsamifera* L. and *P. deltoides* Marshall and, if so, the regeneration could well be tri-clonal, a most unusual occurrence. The large quantities of seed which are shed in late June collect as piles of white 'fluff' wherever there is a little shelter. Following rain, they germinate within 24 hours to produce extensive, dense swards of seedlings with dark blue-green elliptic cotyledons. Most of these are subsequently killed by drought. In many years however a number survive, particularly where the substrate contains fine material. This has led locally to very dense stands of uneven aged young poplars up to several metres high; hundreds of individuals are involved.

The community they are invading is typical of dry, brick rubble demolition sites all over the country (Gilbert 1989). Leading herbaceous species are *Agrostis stolonifera* L., *Artemisia vulgaris* L., *Chamerion angustifolium* (L.) Holub, *Poa annua* L., *Senecio squalidus* L. and *Taraxacum officinale* Wigg. which provide an open vegetation into which woody plants such as *Buddleja davidii* Franchet, *Fraxinus excelsior* L., *Malus domestica* Borkh., *Salix caprea* L., *Sambucus nigra* L. and the poplars readily self-seed. The only remarkable feature of the vegetation is the presence of the poplars, now up to 3 m high and visually dominant. The climate of Leeds is not unusual in any way and open, competition-free conditions are a universal feature of urban areas so the reason behind this regeneration episode is enigmatic.

The hybrid plants are too young for features such as canopy shape, sucker development or trunk morphology to be assessed, and to date none has flowered so their sex is unknown. However it is already clear that they show a greater range of variability in leaf characters than either parent. A hundred leaves were collected from strong shoots of each parent population and compared with a similar number from the progeny (Table 1). The results suggest that by using combinations of leaf characters it should be possible to identify populations that have arisen as hybrids between the black and balsam poplar. The range of variation in leaf characters is wider than in either parent; the mean expression of this variation is intermediate between that shown by the parents and new characters are present such as the subpallid colour of the underside of the leaf (34%), rounded leaf base (20%) and subacute leaf tip (17%). The variability of the parents needs to be fully understood before such determinations are made (see Jobling 1990).

The opportunity was taken to investigate seed viability which is reported to drop to zero after only a few days (Brendell 1990). A large sample of seed, collected from bursting capsules on 29 June 1991, was stored in daylight at room temperature. Initially, then at seven day intervals, subsamples of c. 200 seeds were moistened and placed on damp filter paper in a petri dish. Germination occurred within 24 hours but the dishes were left for seven days before being scored. The results

TABLE 1. A COMPARISON OF THE CHARACTERS OF *POPULUS NIGRA*, *P. CANDICANS* AND THEIR HYBRIDS

Character	*P. nigra*	Hybrid	*P. candicans*
Leaf shape	Triangular 80% Diamond 20%	Triangular 28% Diamond 39% Ovate 26% Heart-shaped 3% Elliptic 4%	Heart-shaped 80% Ovate 20%
Leaf base	Cuneate	Cuneate 80% Rounded 20%	Cordate-subcordate
Leaf tip	Acute through acuminate to cuspidate	Acute through acuminate to cuspidate 83% Subacute 17%	Acute through acuminate to cuspidate
Colour of underside	Green	Green 31% Pallid 35% Subpallid 34%	Pallid (whitish)
Serration	Crenate	Crenate 52% Serrate 47% Entire 1%	Serrate
Gland(s) at top of petiole	Absent	Present 52% Absent 48%	Present 68% Absent 32%
Hairiness of petiole	Hairy 80% Subglabrous 20%	Hairy 49% Subglabrous 4% Glabrous 47%	Subglabrous 84% Glabrous 16%
Cross section of petiole*	Flattened	Flattened 25% Rounded 75%	Rounded
Scent of unfolding foliage	Unscented	Scented to some extent	Balsamic

* This character was difficult to assess.

showed that a germination rate of 80% is maintained for the first week, after a fortnight it had dropped to 25%, after three weeks to 1%, and after five weeks to zero. In this instance it would be correct to record that germination dropped to zero after a few weeks.

At the London site, where hundreds of selfsown poplars have established at two adjacent disused sewage works (the Middlesex and the Essex Filter Beds) ecological conditions are very different. Here the substrate is mud in the bottom of seasonally waterlogged lagoons. The parents involved are two varieties of black Italian Poplar which have crossed to produce abundant regeneration of the hybrid *P.* × *canadensis* Moench 'Serotina' (male) × 'Marilandica' (female); the former has also crossed with Balsam Poplar to produce the hybrid *P.* × *canadensis* 'Serotina' (male) × *P. candicans* Aiton (female).

These examples from Leeds and London are the only recorded instances of alien hybrid poplars, which are usually present as single sex clones, regenerating in Britain and are a further example of how new taxa, with their dispersal centre in urban areas, are being added to our flora. In the Ruhr district of Germany, I have observed that Black Poplars and Balsam Poplars hybridise freely, their progeny are a conspicuous feature of dry urban wasteland sites in industrial areas. It would appear that unlike Black Poplar regeneration, which is currently limited by a lack of suitably muddy germination sites (Milne-Redhead 1990), regeneration involving alien poplars may be controlled by the chance juxtaposition of compatible genotypes.

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SEXUAL DIMORPHISM IN *ERIOPHORUM VAGINATUM* L. (CYPERACEAE)

In Britain, *Eriophorum vaginatum* L. is one of the major dominants in ombrotrophic mire vegetation and comes into flower in early spring, before most other bog species. On 22 March 1991, we had an opportunity to observe its floral characters in a central part of Borth Bog (Cors Fochno) in Cardiganshire (v.c. 46), one of the largest intact raised mires in Britain. Tussocks of *E. vaginatum* are a prominent component of the vegetation at Borth Bog, so there was an abundance of material on which to make observations.

The florets of *E. vaginatum* are wind-pollinated and strongly protogynous. Following pollen liberation, anthers are shed leaving the more persistent filaments protruding from the glumes. Eventually, the filaments too are abscised, and the perianth bristles elongate rapidly and massively to form the familiar cotton-like heads which aid seed dispersal.

What seemed curious about the floral biology of *E. vaginatum* at Borth Bog was that no stamens were visible on the flowering spikes of some tussocks, even though they were at the appropriate ontogenetic stage, with withered stigmas on the one hand and no sign of remnant filaments or developing 'cotton' on the other. Suspicion that these plants were male-sterile was confirmed by closer inspection; three tiny vestigial stamens, or staminodes, were clustered around the base of the

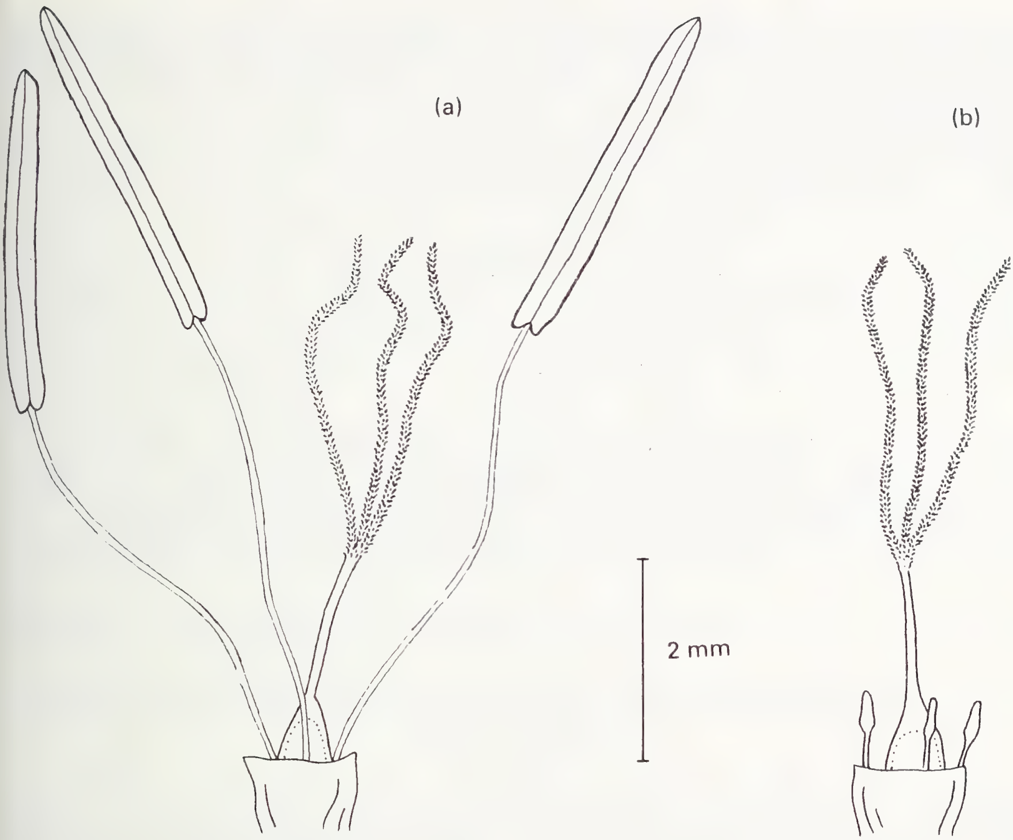

FIGURE 1. Flowers of *Eriophorum vaginatum* collected from Borth Bog in March 1991: (a) hermaphrodite; (b) male-sterile (glumes and bristles removed).

ovary in every floret. These staminodes were clearly non-functional, with minute, empty, non-dehiscent anthers, white or brown in colour, on filaments which had failed to elongate. The striking difference between these structures and those of male-fertile plants is illustrated in Fig. 1.

Several male-sterile and male-fertile tussocks were examined in the field, and no variation in stamen development was detected, either within or between inflorescences on the same tussock. However, no thorough search for plants of intermediate phenotype was carried out. Similarly, no attempt was made to assess the abundance of male-sterile tussocks on 22 March 1991, but they were obviously frequent in the study area. No marked ecological separation of the two sex phenotypes was apparent.

We re-visited the same section of Borth Bog on 21 June 1991 to see whether the two phenotypes were setting seed. It was past the optimum time to make such an assessment as fruiting spikes were disarticulating. Sexing had to be carried out with great care because staminodes were being shed from male-sterile florets, as were remnant filaments from male-fertile spikes. Many of the remaining intact fruiting heads of both phenotypes were barren. However, several florets in both male-sterile and male-fertile spikes were found to contain ripening nuts. It appears therefore that the Borth Bog population of *E. vaginatum* is gynodioecious (*sensu* Darwin 1877), with co-existing female and hermaphrodite tussocks.

The only previous record of sexual dimorphism in *E. vaginatum* of which we are aware was reported in a talk on pollination and seed dispersal in Danish Cyperaceae given by the eminent botanist C. Raunkiaer to the Botanical Society of Copenhagen at a meeting on 14 May 1892

(Anonymous 1893). Raunkiaer stated that he had found *E. vaginatum* to be completely gynodioecious on a small island in the Hvalsølille Sea; unfortunately, no further description of the sexual characteristics was transcribed. Male-sterility has been reported for other species of *Eriophorum* by several authors, including Dickie (1865) and Knuth (1906), but not for *E. vaginatum* by Wein (1973).

Further investigations into the distribution of gender in *E. vaginatum* and other British cottongrasses are in progress.

ACKNOWLEDGMENT

We thank Anna Williams for translating the account of Raunkiaer's talk.

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CORYNEPHORUS CANESCENS (L.) BEAUV. (POACEAE) ON THE WEST COAST OF SCOTLAND

There are three records between 1895 and 1961 of *Corynephorus canescens* (L.) Beauv. on the Morar coast. In 1948 R. C. L. Burges collected "on sands one and a half miles south of Morar", Westerness v.c. 97 in **E**. If this distance is stretched a little, is there similarity between this record and that of S. J. P. Waters, 1961, "sand dunes by Camusdarach" which is slightly more than 3 km by road from Morar? Or is it more likely that the Burges record refers to the earliest known site at Toigal which by road is 2·5 km south of Morar? This site of *C. canescens* was found by F. Townsend, as *Weingaertneria canescens* Bernh., on "Sand Dunes by the sea between Morar river and Arisaig, Scotland, July 1895", in herb. Druce, **OXF** with duplicates in **CGE**, **E**, **K** and **LIV**. There has been no further report of this site, except the reference to Burges above, until 24 July 1991 when Alfred Slack, Elizabeth Norman and John Trist found the remains of the colony.

Beeby (1897) reported that one Eneas R. Macdonnel of Morar introduced *C. canescens* to this site; but this 'introduction' is Beeby's interpretation of Macdonnel who *in litt.*, 1896 to Townsend wrote "it is not indigenous but was introduced direct here and not by accidental admixture". This does not imply that Macdonnel introduced either seed or plant.

In 1991, after a thorough search of the dunes, we found a single plant of *C. canescens* within the area described by Townsend. He reported to Beeby (1897) that "the grass occurs in plenty on the sand-hills". At Morar the dunes are highly mobile and bare of vegetation except for *Ammophila arenaria* (L.) Link, which is largely confined to the crests, and a little *Carex arenaria* L. At the site of the single *C. canescens* there was one plant each of *Aira praecox* L., *Rumex acetosella* L. and *Carex arenaria* which were within 10 m of a small dune crested with *Calluna vulgaris* (L.) Hull.

Marshall (1967) reports that *Corynephorus canescens* is a plant of substrates which are extremely low in mineral nutrients, and this is true of this site at Toigal, which showed available phosphorus 4 mg/l^{-1}, potassium 9 mg/l^{-1} and magnesium 7 mg/l^{-1}. These values are very low and would offer minimal plant nutrition.

The pH of the Toigal sand is high at 8·3. It was treated with dilute hydrochloric acid and shown to have no calcium carbonate present, indicating that there must be another source of calcium. This was confirmed by the detection of ammonium acetate extractable calcium in moderate quantity.

This sand consists of multi-faced subangular particles of quartz, some of which are transparent, opaque and ferrugineous; minute black particles of a mineral are also present and may represent 1–2% of ferro-magnesian minerals.

The instability of these dunes has probably been a major influence in the past history of this *Corynephorus* colony. Consideration may also be given to Marshall (1967) who has shown that this taxon can thrive in a wide range of pH (3·7–8·5). Perhaps in this case we should only regard the high pH value as one of several factors which have influenced the gradual decline of this grass colony.

C. canescens has a shallow rooting system of 7·5–10 cm in depth (Marshall 1967). In this site on the coast it is subject to high winds which puts further stress on the sand to retain moisture. However this area has an annual rainfall of c. 1500 mm (Met. Office 1991) which to some extent will offset the disadvantages of a medium which lacks moisture storage. *C. canescens* grows best where up to 10 cm of sand accretion per year takes place though Marshall points out that where this exceeds 2 cm at germination too much sand may be trapped and seedlings are smothered. Even in this event some young plants may survive which have not germinated from seed and which owe their existence to vegetative internodal growth.

Rabbits may have contributed to the decline. The single plant of *C. canescens* of 1991 had twelve culms of which only three panicles survived the rabbits. Reference has been made to the sparse vegetation of the dunes which would not attract rabbits. There are no rabbit-grazed swards about the dunes but they are found around the settlement. As rabbits have probably been present here for a long time, it would be difficult to assess their part in the decline of the *C. canescens* colony which has survived for 97 years and now appears to be reduced to a single plant.

ACKNOWLEDGMENT

I thank Dr Bryan Davies for soil analysis and guidance in unfolding the calcium source.

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Book Reviews

The correspondence of Charles Darwin. Vol. 7: *1858–1859*. Edited by F. Burkhardt & S. Smith. Pp. xxxv + 671. Cambridge University Press, Cambridge. 1991. Price £35 (ISBN 0–521–38564–4).

463 pages of this volume are taken up with the correspondence during the dates given; a further 34 pages record letters located or re-dated since the publication of *Correspondence* vols 1–6 (covering the years 1821–1857). The eight appendices include a chronology, an abstract of Darwin's theory of natural selection and a copy of Wallace's 'On the Tendency of Varieties to depart indefinitely from the Original Type', which forced Darwin's hand into publishing the *Origin*. Of the other appendices, one concerns a memorandum to H. M. Government about the status of the nation's premier natural history collections vis-à-vis the British Museum – plus ça change . . . In addition, there are comments on the manuscript, a bibliography, a biographical register and an index.

Of course, the nub of this volume is Darwin's preoccupation with his book *On the Origin of Species by means of Natural Selection*, the publication of which (1859) had to be brought forward as a result of Wallace's letter from the island of Gilolo in the Moluccas. As ever, there is much correspondence with his friend Joseph Hooker and his mentor, Charles Lyell, which reveals Darwin's doubts about rushing into print over his theory – would that some modern workers might so reveal their innermost feelings about their pet ideas. Nor does Darwin seek succour solely from his great contemporaries; many of his letters seek information on points of detail from a host of less noteworthy correspondents.

Apart from the scientific 'dynamite' enshrined in this correspondence, however, the reader continues to be given access to a view of a stratum of Victorian life scarcely touched upon by Dickens, for example. Nevertheless, the death, from scarlet fever, of his youngest child, Charles Waring, at the age of two years is a reminder of the universal perils of the age. The agony of this event, revealed in a letter to Hooker, is counterpointed by a letter to Darwin's eldest child, William, about a younger (George) son's prowess at billiards.

With its revelations of the ways in which a great scientist arrived at one of the seminal biological theories of this or any other age, together with a view of the society within which such ideas developed, this volume is of widespread interest and value. It continues the feast of high scholarship which is epitomised by this distinguished editorial and publishing treatment of Darwin's *Correspondence*.

D. M. Moore

Genetics and conservation of rare plants. Edited by D. A. Falk & K. E. Holsinger. Pp. xviii + 283. Oxford University Press, Oxford. 1992. Price £35 (ISBN 0–19–506429–1).

Rare species are on the increase; the public expects botanists, who have highlighted the problem for so long, to develop workable schemes that prevent the extinction of endangered species. This book, resulting from a 1989 conference convened by the Centre for Plant Conservation in St Louis, helps to ensure that such schemes have a strong scientific basis. The complementary approaches of 'off-site' and 'on-site' conservation are examined. Limited space is given however to the complexities of re-introduction.

Building on what is known of rare plant population biology, the book then considers methods for sampling, assessing and conserving their genetic variation. Finally the conclusions are drawn together into a set of practical guidelines for conservation programmes. One of the strengths of the book is that it calls on expertise in the fields of zoology, forestry and crop genetic resources. Here the authors have successfully focussed their expertise on the specific problems faced in conserving rare plants. It is a pity, however, that the chapter on germplasm management failed to emphasise such practical problems as 'empty' seeds in seedlots of wild species.

There are some very valuable contributions from leaders in the field of plant population genetics. Hamrick *et al*. point out the relative benefits of using morphology, isozymes and DNA studies in assessing genetic diversity. In these 'high tech' days, it is comforting to know that measurements on 'real' plants still have a valuable part to play in such assessment.

Not surprisingly, the book draws mainly on examples from the Developed World. In the Developing World, the ratio of botanists to species means that the biology and even rarity of a species is often not known. This makes development of conservation programmes difficult. Broad generalities help. Biodiversity within wet tropical forests will be best conserved 'on-site' (see contribution from Bawa & Ashton). In the dry tropics, however, where desertification threatens, long-term conservation may often only be achieved through 'off-site' activities. The broad statement on page 114 that tropical species' seed cannot withstand drying and cold storage is erroneous; many dry tropical species are quite amenable to seed storage. With the clock ticking, there will be little time left for detailed studies in many cases to determine the best conservation strategy. Indeed, many of these studies will only be possible once material has been taken into safe keeping in seed banks and botanic gardens; so by using the sampling guidelines given in this book we should conserve something now and worry about the precision of the approach later on.

In summary, this volume has been well edited, has a wealth of information bringing together some 850 references and has been produced to a high standard. A proportion of the book is accessible to the general reader; the more genetical elements might have been more so had a glossary been included. The book is an important step towards practical action. Botanists and conservationists will find it a useful addition to the literature.

S. H. Linington

The Hamlyn photographic guide to the wild flowers of Britain and Northern Europe. R. Gibbons & P. Brough. Pp. 336, including 163 pp. of colour plates. Hamlyn Octopus, London. 1992. Price £20 (ISBN 0–600–57452–0).

Here is yet another illustrated Wild Flower book, but this time it is hardly a field guide. Its size, 22 × 29 cm, is too large for most pockets, and its weight, 1·63 kg, is too heavy for most rucksacks after packing waterproofs, food, camera, etc. It must therefore be considered as an indoor reference book, as even a quick glance showed it to be more useful than the proverbial coffee table book.

After the general acknowledgments and bibliography are two pages of introduction and explanations on using the book, and two pages of glossary terms with diagrams. Then follow 320 pages with descriptions of over 1,900 species and 1,500 colour photographs, 1,000 distribution maps and more than 400 line drawings of important identification characters.

The text and illustrations are arranged according to the systematic order used in *Flora Europaea*, and with a few minor exceptions the nomenclature also follows *Flora Europaea*. Grasses, sedges and rushes are not included.

The distribution maps, text, line drawings and photo index on the left-hand page and 8–12 relevant photographs on the right-hand page do make reference easy. The photographs are lettered in a diagram of the plate layout, and the letter identifies the map, text and index of photographs. Where possible the English name is used in the marginal photographic index. Both the scientific and English names are given in the text.

On the whole the photographs are good. Some appear to have been selected to show important characters separating 'look-alikes' such as *Potentilla sterilis* and *P. micrantha*. It is a pity that a few photographs are enlarged more than other members of the same genus on the same plate. This could be confusing to a beginner, even though size may be given in the text. Two examples are the smaller species of *Cerastium*, and *Sedum villosum* is so much smaller than *S. telephium*.

The distribution maps, though of necessity tiny, are an added interest and the colour codes give an idea of the status of the species where it does occur. The area covered is about the same as in previous Floras of Britain and Northern Europe.

The line drawings are necessary for some species as even good photographs cannot show smaller critical features, but there is space in the margins for a few more. A beginner with an unknown flower and no knowledge of plant families will be faced with the daunting task of turning page after page in search of a photographic match. There is no key, but descriptions of families appear in systematic order in the text and species in the larger genera are grouped under headings of similar characters. The last six pages contain a combined index of English and scientific names, which makes for easy reference.

A few errors are inevitable in such a work, but the index has over 20 omissions.

While I find the book too large and heavy for use in the field, I certainly enjoy the photography and find the distribution maps interesting, though a few do not agree with the distributions given in the text.

V. Gordon

Bob Press's field guide to the trees of Britain and Europe. J. R. Press; photographic consultants E. & D. Hosking, artwork by M. Tebbs. Pp. 247, with numerous colour plates and black and white illustrations. New Holland, London. 1992. Price £17.95 hardback (ISBN 1–85368–103–2); £9.99 paperback (ISBN 1–85368–104–0).

Field guides are a popular theme for publishers, and this is a fine example of the category. Richly illustrated with colour photographs and line drawings, in a format which allows the inexpensive production of versions in other languages, and with enough information to allow a reasonable chance of successful tree identification, this book is likely to prove very popular. The simplicity of style is similar to that of Oleg Polunin's, but Bob Press has been able to use the pick of the photographic agencies rather than relying mainly on the work of one person.

The coverage of tree species is wide, with over 450 species treated; native and naturalised species are given equal emphasis, with all the main species illustrated by at least one colour photograph. Line drawings in the left hand margin emphasise smaller features helpful for identification, and there is a short glossary of terms. Keys are in two forms: a numbered dichotomous key relying on both foliar and floral characters, and a synoptic key based entirely on leaf characters. The 52 families are described briefly in the introductory pages, facilitating comparisons and avoiding interruptions to the text. Text descriptions include a rather generalised indication of the distribution of the tree in Europe, followed (for naturalised species) by an indication of their country of origin. There is an appendix with information on arboreta, and a short bibliography. Separate indexes to common names and scientific names are provided.

The high quality of reproduction of colour photographs now achievable by modern publishers is well displayed in this inexpensive book, which was printed in Singapore. Taxonomically up-to-date, and concisely written, the book is unfortunate only in its title. Why, in 1992, does a publisher choose to refer to "Britain *and* Europe"?

J. R. Edmondson

Biology of plants. 5th edition. P. H. Raven, R. F. Evert & S. E. Eichhorn. Pp xvii + 791; lavishly illustrated. Worth Publishers, New York. 1992. Price $59.95 (ISBN 0–87901–52–2).

This substantial book is the latest in a long tradition of all-embracing introductory Botany textbooks. It is a marvellous introduction to botanical science, with a well organised and very readable text supported by excellent diagrams and photographs, almost all in colour, on nearly every page.

Biology of plants has 31 chapters divided into six sections covering cell biology, genetics, diversity, anatomy, physiology and ecology. Scattered throughout the book there are also essays, separated from the main text, discussing topical themes such as 'The Great Yellowstone fire' or 'Jobs versus owls'. The level of treatment is generally aimed at the first year university student, and is designed primarily for its North American home market. This is only really noticeable in the chapter covering vegetation types, which perhaps leans too heavily on North American case histories to the exclusion of more representative examples elsewhere in the world.

As would be expected, recent advances in plant physiology and molecular biology are well covered, but there are also some interesting reinterpretations of long-known phenomena; for example, the 'infection' of grasses by ergot is now seen as a partnership in which the grass receives protection from herbivores by the toxic fungus.

My main criticism of the book concerns the authors' definition of what is a plant. They exclude algae from their Kingdom Plantae, leaving only the bryophytes and vascular plants. The green algae are thus separated from their descendants, and giant kelps are left as odd bedfellows to the unicellular Protista. Despite this divorce, the actual coverage of the algae, as well as the more traditional 'non plants' – viruses, bacteria and fungi – is one of the most comprehensive of any introductory textbook I have seen.

At around £40 for 800 pages *Biology of plants* is an excellent value textbook from A-level onwards, but it would be a shame if its only audience were students. It is an excellent introduction to the world of plants for anyone, and with superb plant paintings by Rhonda Nass and a beautiful cover, courtesy of Van Gogh, it might even find its way on to one or two coffee tables.

A. S. GUNN

British plant communities. Vol. 2: *Mires and heaths*. Edited by J. S. Rodwell. Pp. x + 628. Cambridge University Press, Cambridge. 1991. Price £95 (ISBN 0–521–39165–2).

In 1989, I was, for all too brief a period, the last appointed Chief Scientist of the Nature Conservancy Council (R.I.P.). While in the post, however, my most pleasant task was to bring the National Vegetation Classification to its triumphal climax as a manuscript to be transmitted to the publishers, Cambridge University Press. Last year I saw with pleasure the first volume (reviewed in *Watsonia* **19**: 49, 1992). Unlike volume 1, which dealt with woodlands and scrub, this second volume is a truly 'British' volume, in that it deals with vegetation that is centred on Britain, and which makes Britain special. Here is a tremendous compendium of information on mires and heaths – long needed, but it will also be long used.

The format seems well suited to the task. The community descriptions do not lend themselves readily to review, except for the passing comment that they are very thorough. The separate introductions to mires and heaths are well crafted, and excellent synopses, although there are some dense passages. For example, "The perspective looking towards the Continent from our own generally oceanic standpoint is rather different from that hitherto proclaimed as normative from the opposite direction" (p. 350).

At 38 plant communities, one might query if the mire classification were not too fragmented. The difficulty of identifying homogeneity in mire vegetation, as well as the variation in substrate and climate across Britain, all contribute to mires being such rich systems, and explain why so many units are described, I found the 'block' diagrams gave an instant clarity of view for ecological position. The discussion of the changing community context of *Schoenus nigricans* is also of interest to illustrate that communities are but spatial and temporal kaleidoscopes of species. But here is also a weak spot – for it would be marvellous to see that discussion set in a broader context of Ireland and the western fringe of Europe north and south. Given the 20 year support from the (J.)N.C.C., and the fact that they have an international branch, it would be good if future volumes could take a wider view. Even if that is not possible, I hope someone will eventually fund and produce a synthesis of British plant communities in their European context.

With regard to heaths, the point is well made that without appropriate management heaths become very hard to distinguish, and tend to a uniform Callunetum; which has clear conservation implications. It also underlines the very dynamic nature of these communities. Again, the introductory description is sound, and the block/circle diagrams are helpful to explain lines of variation. However, I believe it is simplistic to suggest that lowland dry heaths are a linked circle; for my money there are two clear groups corresponding to the Ulicetalia minoris and Vaccinio-Genistetalia, as discussed by Bridgewater (1980) in *Phytocoenologia* **8**: 191–235. The Ulicetalia minoris is a southern and western order and the Vaccinio-Genistetalia an eastern and northern order, with some overlap between.

Boundaries between wet and dry heaths probably deserve more discussion throughout the volume. So too does the position of *Erica ciliaris* heaths, which are given rather short shrift in this current treatment. The associations Ulici gallii – Ericetum ciliaris and Ulici minoris – Ericetum ciliaris described by Bridgewater in 1980 I still regard as valid, but vegetation represented by these associations is not even accorded variant status in this current work. Others will be able to test these different views – provided it is done in a fully European context. As the author says (p. 13) "For the classification is meant to be not a static edifice, but a working tool for the description, assessment and study of vegetation". Indeed, I sincerely hope that one by-product of the series will be an increase in phytosociological papers in the British journals, as well as the expansion of British papers in the continental ones.

Keys are provided for both mires and heaths. Do they work, and are they worth the effort? I used them with sample data collected during the last three years. The results? Success every time, despite some rather obscure wording of the couplets.

This is a book any botanist interested in phytogeography and vegetation will want to buy. And so here is my biggest gripe, aimed not at the superb work done by the contributors, but at Cambridge University Press. Having hired excellent and far-sighted editorial staff to secure works like this for their list, why then price them out of most libraries' reach, let alone interested botanists? If I want to buy the book here in Australia, the price is $325!

But enough of gripes – this work is elegant testimony to those who developed the concept, and participated through the years, but especially to John Rodwell who has the fortitude to have ridden out the all-too-many rough patches, when it seemed the end would never come. And from my personal knowledge, Lynne Farrell, once of the N.C.C. and now English Nature, did an excellent back-room job, steering it through the shoals of Government bureaucracy. We should all look forward to the third volume.

P. B. Bridgewater

FLORA: The Computerised key to 786 species of British wild plants, version 1.10. Poly Enterprises Plymouth Ltd, Seale Hayne Faculty, Polytechnic South West. Newton Abbot. 1992. Price £99.88, with discount for multiple copies.

Recent years have seen a great increase in general use of computers and botanists have been quick to explore the possibilities to which computer technology can be put to aid their studies. Several programs have been developed with the naturalist in mind, building databases for use in plant recording, mapping, etc., and some have delved into the realms of plant identification. Computer aided keys have appeared for specialist groups (e.g. sedges and orchids), but *FLORA* is the first published attempt at a general usage computerised key to British flowering plants.

The *FLORA* package contains a disk (with the databases and program), a User Instruction Manual and a botanical reference manual. Once loaded on to the hard disk of your machine (taking up a tiny 260K) the menu-driven program enables plants to be identified using a multi-access approach, with a total of 48 possible characters to choose from. Characters are grouped into categories, according to the approach of the user. Three general categories (primary, secondary and tertiary) hold groups of characters in descending order of their usefulness in identification. The characters are also grouped into categories relating to the flower, leaf, stem or environment. In general, identification begins in the primary category, and character states are entered against those characters evident from the specimen. For novices to the program there is a 'beginners tour' leading you through all the characters in the primary category showing all their possible states. When a few characters are entered the database can then be usefully searched for matches. The program sorts through the database and the species are listed in descending order of likelihood. If need be you can return to the category summary tables and enter more character states until the search gives a fewer number of possibilities. At this stage you are advised in the instructions to turn to other botanical reference books for descriptions and pictures.

Having used the program myself, and enlisted the help of others less experienced in plant identification, I have found that the program is relatively easy to use, and generally successful. The authors claim that as few as six characters need to be entered to effect an identification. My experience is that unless you know which characters will narrow down the field quickly you will probably have to key in considerably more. This leads me into my first criticism of the program, the lack of on-line help facilities. It would be very useful to be able to list the characters that will differentiate effectively between your shortlist of species, and thereafter concentrate your efforts.

With the great diversity in plant form across the families it is very difficult to produce a general list of characters and their states that will deal with all species in a satisfactory manner. The writers of *FLORA* have had to simplify this variation, and on the whole they have produced a workable system, and have tried to avoid using technical terminology. There are some rather odd character states; for example *Rumex* flowers are described as 'grass-like', and the character 'leaf venation' not only caters for parallel, pinnate and palmate venation but also for succulence and compound leaves. In order to save storage space and to increase compatibility with non-graphics supporting computers, the writers have decided not to include illustrated help screens, but rather to rely on the botanical reference manual. Even allowing for the promised reprint (initial problems with printing have left many of the drawings faint and some unusable) the booklet does not to my mind clearly define the characters and this has led to mis-scoring of characters when testing the program (in the botanical reference manual the same leaf shape, obovate, is included in both 'paddle' and 'oval' character states).

As with many partial Floras this program falls down in its depth of coverage. Grasses, sedges, rushes and gymnosperms are excluded, and critical groups (e.g. *Euphrasia* and *Salix*) are treated as aggregates. Looking at some of the datasets used there are an alarming number of missing data for the species included. This leads to problems when separating some of the species. Although much of the terminology is non-technical, a certain degree of botanical knowledge is required to operate the program and sort out errors of scoring that frequently arise. I can see the potential for this program in schools and field centres (particularly with the educational discount price) where it could be used to encourage children to look at and identify plants. If *FLORA* was considerably cheaper then I could see more botanists buying a copy, but at the quoted price most field botanists would be better advised to invest in one (or two!) of the full Floras of the British Isles.

M. F. Watson

Obituary

JOCELYN MARY LEWIS RUSSELL
(1905–1992)

Jocelyn Russell, the able, lively and lovable personality, died on 14 May 1992, aged 86. She was born at Ockham, Surrey, on 28 December 1905, the only child of Walter Lewis Castelden and Charlotte Mary Katherine, née Thring, who died very shortly after. So, Jocelyn was brought up until she was four by a sister of her father – who came from Canterbury and managed Henderson's Transvaal Estates. By his second marriage he had four children, to the youngest of whom, Mrs Joanna Huntingford, I am greatly indebted for many details. He died in 1953.

From 1921 to 1923 Jocelyn was sent to the Godolphin School at Salisbury, where her contemporary was another enthusiastic botanist, the late Mrs Barbara Garratt. This was followed by an art school and work in her father's office. On 1 January 1935, she married Basil Henry Sackville Russell and they lived in Manchester, Portugal (1937) and the Belgian Congo (where he was employed by Vacuum Oil), before returning to England at the outbreak of World War II. Basil, later a Squadron-Leader, joined the R.A.F.V.R. and Jocelyn the Mechanised Transport Corps.

After the collapse of France, her unit was drafted to the Middle East, joining in January 1941, at Cairo, the Free French Forces with the British 8th Army. As those will know who saw the television programme on 29 March 1989 (filmed 18 months before) "Tin Hats and Silk Stockings", she also painted wild flowers when she was out there. Some 40 of these, dating from 1941 to 1944, with names and localities, were on show at the Centenary Exhibition at Kew in 1953, who said they made a very fine display and asked if they could eventually be returned there. Many were made at Bir Hukayyim, where the battle raged for a fortnight in 1942. She made a notebook (which was shown on the TV programme) grouped by families, of 115 of the plants she saw during the time before she got to Tunis. For each she wrote out a full and detailed account with a clear, characteristic coloured drawing. This material has also gone to the Royal Botanic Gardens, Kew.

Her arduous tour lasted four years and three months, from Syria to Tunis, then into Italy and southern France; and her stalwart service was rewarded on 19 July 1944, with the French Colonial Medal with clasp 'Libye' and on 20 June 1945 with the clasp 'Tunisie', and on 16 April 1947 with the Croix de Guerre avec étoile en bronze. The citation included "A participé à toutes les campagnes, faisant des liaisons aux postes avancés. A notamment assuré dans les combats de Tobrouck, le ravitaillement en eau de la formation, malgré les mitraillages et les bombardments de l'aviation ennemie, a continué ces missions de liaison avec la même succès et la même intrépidité"; and on 27 July 1947 the Commemorative Medal of the Free French Forces.

While she was in Tobruk, she learnt that her husband, dropped by parachute from a flying boat in Sumatra in 1942, shortly after meeting her in Cairo, was missing, presumed killed. Meanwhile, she had met Constance Spry, the flower arranger, who appeared one day in her tent in Africa and offered her a job after the war. This developed into a close friendship, Jocelyn travelling widely in her Rednose cars, demonstrating the art. She even did Prince Philip's private bouquet for Princess Elizabeth on their wedding day, which she delivered personally in her Morris 8 to Buckingham Palace.

Although she had been keen on flowers ever since she was a child, she learnt of the Wild Flower Society only by chance when she was 43. She joined the B.S.B.I. the following year, 1950, and the London Natural History Society in 1951. Thereafter these led her dominant interest in wild flowers, she contributing every bit as much as she learnt, sending records to various Floras and the like. Not surprisingly she rapidly took a leading part. For our Society she gave long service to the Meetings Committee (1953–70), the Conservation Committee (1964–78) and the Council. She was a Vice-President from 1976 to 1980. For the Wild Flower Society she held various posts, not the least being her founding, in 1957 of the Branch 'Parnassus', the highest refuge for top members, running it until 1986.

Two of her discoveries were *Dichondra micrantha* in 1955, naturalised near Hayle in Cornwall

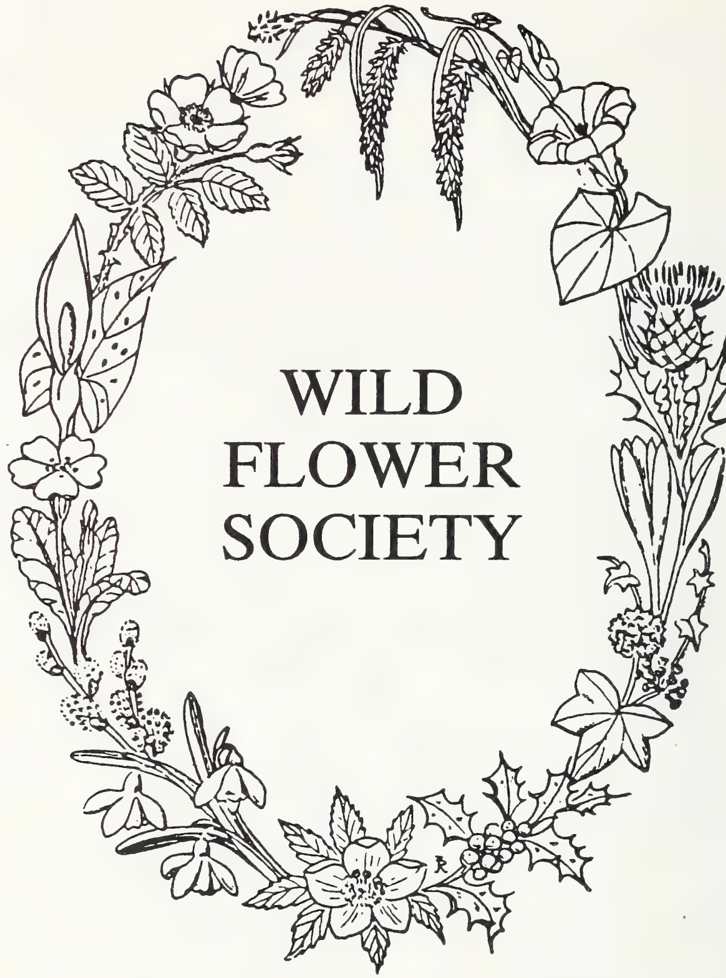


FIGURE 1. The design for the front cover of the *Wild Flower Magazine* drawn by Jocelyn Russell in 1959.

and new to the British Isles; and while in Jersey she realised what none of us had, why *Ranunculus paludosus* was so called, when it was always seen in flower in dry places. She showed that its habitat had to be wet in winter.

In 1959 there was a competition for a design for the front cover of the Wild Flower Magazine, and her garland with a flower for each month was the outstanding entry (Fig. 1). Since then it has also been used on the front cover of the Wild Flower Diaries, the Compliments Slips, and even the Car Sticker. In 1961 appeared R. W. Butcher's *New Illustrated British Flora*, for which Jocelyn did many of the plates, Dr Butcher describing them to her as "beautiful", and to me as "very good". She left numerous delicate and delightful coloured drawings of flowers (garden ones too) from the countries she visited. Those with European flowers have been gifted to the Natural History Museum; those from North and South Africa to Kew. She had coloured in exquisitely, and with date and place, every possible species in the *Illustrations* to Bentham & Hooker's *Flora* and most of those in Dr R. W. Butcher and F. Strudwick's *Further Illustrations of British Plants*. These are kept, as the treasures they are, by her family. They were kindly lent in November 1992, along with a sample of her drawings, and shown at the A.G.M. and Tea Party of the Wild Flower Society; and also a fortnight later at our own Exhibition meeting.

Among the papers of this eager searcher are her notebooks from 1951 to 1968, detailing where to find all manner of scarce, rare and very rare plants (and she had seen the rarest of plants, including *Epipogium aphyllum* quite soon after it was rediscovered). There are others with copious notes on what she found on her trips, often with itineraries which are now in the Natural History Museum. These drawings and photographs show that she botanised at least in Scotland (1950–55, 1958, 1968, 1974–5); Wales (1952, 1954, 1956–7, 1968); Ireland (1952, 1954, 1958, 1967); Jersey (1954, 1956–7); Guernsey (1956–7); Alderney (1956); Herm (1958); France (1946, 1950, 1958, 1963–5); Andorra and Pyrenees (1963); Portugal (1968); Italy (1944–5, 1963–66, 1972); Austria (1964); Switzerland (1964–8); Norway (1963); Greece; Turkey (1976); and South Africa (1969). She was in touch with, and often close friends of, many of the leading botanists' professional and amateur.

She was a skilful photographer, the evidence being in box after box, at least ten of them filled with 2 × 2 slides, these going similarly to the Natural History Museum and Royal Botanic Gardens, Kew.

Bald facts such as all these give no impression of the warm, exuberant, cheerful companion she was, with infectious enthusiasm. What a lot of good she did to, and for, many of us. There are accounts of her in the *Wild Flower Magazine* Nos. 341, for September 1954, 407 for Autumn 1986 and 425 for Autumn 1992.

D. McClintock

Report

ANNUAL GENERAL MEETING, 9 MAY 1992

The Annual General Meeting of the Society was held in the Jodrell Laboratory Lecture Theatre, Royal Botanic Gardens, Kew, at 10.45 a.m. 74 members were present. Dr P. Macpherson, President, taking the chair, welcomed members, particularly any who had joined in 1991 or who were attending their first A.G.M.

Apologies for absence were read and Minutes of the 1991 Annual General Meeting, published in *Watsonia* **19**: 67–71 (1992), were approved and signed by the Chairman.

REPORT OF COUNCIL

The adoption of this report, which had been circulated to members, was proposed from the Chair. Mr R. G. Ellis noted that the speciality of the late member Mr M. C. Clark was mycology, and with this amendment the Report was accepted unanimously.

HON TREASURER'S REPORT AND ACCOUNTS

The Hon. Treasurer, proposing the adoption of his Report and Accounts, which had been circulated to members, highlighted the B.S.B.I. Database (Leicester), for which the hardware, at an expenditure of £6,000, was now in place. Mr Walpole acknowledged with thanks the hard work of our members and staff at the University of Leicester, whose enthusiasm had ensured the successful input of the initial project, the *List of vascular plants of the British Isles* by D. H. Kent which was now ready for publication. The Treasurer also commented on the small number of resignations in spite of a rise in the subscription rates this year, and he invited queries on the accounts. There being none, the Report and Accounts were accepted unanimously.

RE-ELECTION OF HON. GENERAL SECRETARY AND HON. TREASURER

Proposing the re-election of these Officers the President stated that the Society was fortunate to have two such hard-working Officers, thanking Mrs Briggs for tackling with good humour the continual flow of mail, the administration, and the dispersal of information including regular notes in *B.S.B.I. News* which informed members of the Society's activities and projects. He also thanked Mr Walpole for his hard work on the finances, including the V.A.T. and the Accounts, and for his wise counsel on Committees and Council. Both were then re-elected with acclaim and applause.

ELECTION OF COUNCIL MEMBERS

In accordance with Rule 10, nominations had been received for Mr F. Horsman, Mrs A. Lee and Mr P. Thomson. Profiles had been published with the Annual Report and these members were elected unanimously by the meeting.

ELECTION OF HONORARY MEMBERS

Council had nominated two members: proposing Mr J. F. M. Cannon, Dr N. K. B. Robson outlined Mr Cannon's long years of service to the Society as a past-President, as a member of three of the

Permanent Working Committees, and also as a general Umbelliferae referee. On the staff of the Natural History Museum, Dept. of Botany, and later as Keeper of Botany there, Mr Cannon was closely connected with B.S.B.I. activities centred at the Museum (the official address of the Society). Proposing Mr E. S. Edees, Mr A. Newton had sent a note which was read to the meeting reminding us that Mr Edees had been a member of the B.S.B.I. for 60 years, and v.c. Recorder for Staffs. for 35 years. Author of *Flora of Staffordshire*, the first county Flora to be based on tetrad mapping, and joint author with A. Newton of *Brambles of the British Isles*, Mr Edees had also been a *Rubus* referee for more than 30 years, and his nomination was strongly supported by the local botanists in Staffordshire. Their election as Honorary Members was unanimous and greeted with applause.

RE-ELECTION OF HONORARY AUDITORS

The Hon. Treasurer, in proposing the re-election of Grant Thornton, West Walk, Leicester, referred again to the honour for the Society to present their Accounts over the name of these distinguished Auditors, and the re-election was passed unanimously with appreciation.

ANY OTHER BUSINESS

The Hon. Treasurer added thanks to the Secretaries and Chairmen of Committees, and all who had assisted with the running of the Society's affairs; and as Chairman of the Publications Committee he warmly thanked the Editors of the Society's Journals and publications, whose considerable work was very much appreciated by the Society.

The President announced that Council had nominated Dr F. H. Perring as President-elect 1993–5 for election at the Annual General Meeting, 1993. Dr Perring replied that he was deeply honoured and that he would take up this office with serious commitment.

On behalf of the Society the President recorded congratulations to Professor C. A. Stace on the publication of his *New Flora of the British Isles*, an achievement in which we could share in that the author's published thanks listed many B.S.B.I. members, and he had also acknowledged the Society as "a great source of inspiration to him". General appreciation was confirmed by the applause of the meeting.

The Hon. General Secretary was seeking help with the heavy burden of the administration and correspondence and those present were requested to let her know of any volunteers.

There was no other business and the meeting closed at 11.15 a.m.

MARY BRIGGS

PAPERS READ AT THE ANNUAL GENERAL MEETING

Two papers were presented at the A.G.M. Dr P. Macpherson gave the Presidential Address on *Colonisation of the Glasgow Garden Festival site three years on: implications for recording* (see *Watsonia* **19**: 169–179) and Professor G. Ll. Lucas spoke on *Plant management for conservation purposes*.

Thanks were recorded by J. Ounsted and P. S. Green, Vice-Presidents, to Professor G. T. Prance, Director, Royal Botanic Gardens, Kew for permission to use the Jodrell Laboratory, and to the President and to Professor G. Ll. Lucas for their Address and Paper.

The President then thanked all those involved in the arrangements for this successful meeting, especially Dr D. A. Simpson, who with Mrs R. Simpson had organised the bookings and refreshments, and who with Mr P. C. Boyce had guided members on tours round the Gardens in the afternoon.

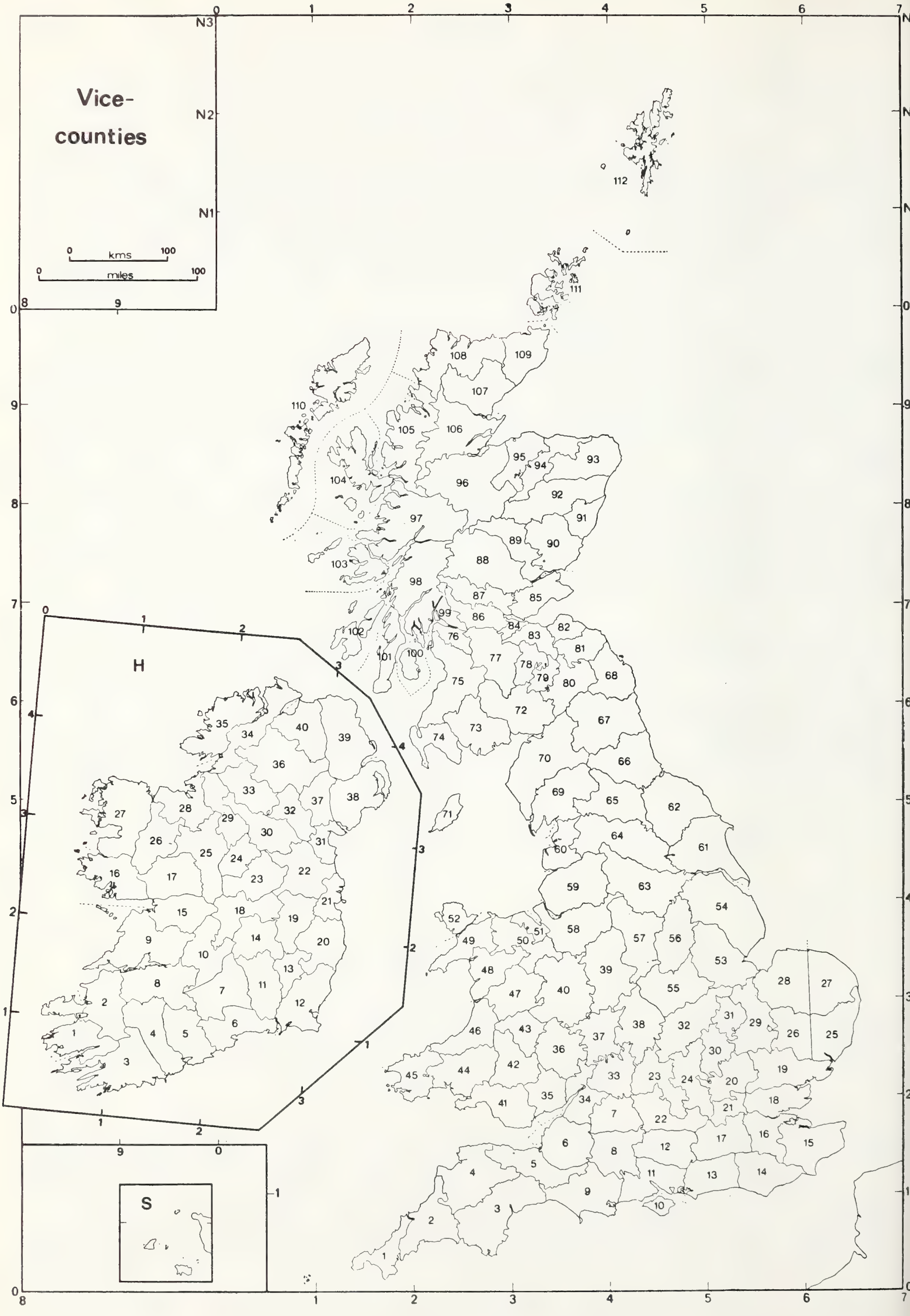
M.B.

FIELD EXCURSION HELD IN CONJUNCTION WITH THE A.G.M.

KEW GREEN AND RIVERSIDE, SURREY (V.C. 17). 10 MAY 1992

In all, 45 people attended this meeting associated with the A.G.M. at the Jodrell Laboratory, Royal Botanic Gardens, Kew. The first part of the day was spent crawling around on Kew Green (some 40 botanists' bottoms were seen) searching for the small plant species that grow on this sandy grassland. It was too early for some of the more notable clovers but we did find *Trifolium subterraneum* L., *Ornithopus perpusillus* L., *Montia fontana* L., *Rumex acetosella* L., *Stellaria pallida* (Dumort.) Piré and *Aphanes inexpectata* Lippert. On our way to St Anne's Churchyard we saw *Rumex pulcher* L. The churchyard has long been known for interesting naturalized species and we saw *Phytolacca acinosa* Roxb., *Sisymbrium strictissimum* L. and *Sisyrinchium striatum* Smith in bud, young plants of *Galactites tomentosa* Moench becoming established and lots of *Soleirolia soleirolii* (Req.) Dandy and *Atropa belladonna* L. in flower with both *Allium paradoxum* (M. Bieb.) Don and *Ranunculus ficaria* L. subsp. *bulbifer* Lambinon demonstrating bulbils. During lunch several people saw *Saxifraga granulata* L. also with bulbils, behind the cricket pavilion; it was 45 cm tall. After lunch the march along the river bank was rather poorer in interest but still managed *Angelica archangelica* L., *Oenanthe crocata* L., *Ceratochloa carinata* (Hook. & Arn.) Tutin, *Tragopogon pratensis* L. subsp. *pratensis*, *Diplotaxis muralis* (L.) DC. and *Bolboschoenus maritimus* (L.) Palla in its highest site on the tidal River Thames but we failed in our attempt to see *Barbarea stricta* Andrz. After our long walk, some went on to Richmond Park and others returned to Richmond or Kew having had a good day; on the way back I saw more than 15 herons fishing in the river.

J. M. Mullin



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INSTRUCTIONS TO CONTRIBUTORS

Scope. Authors are invited to submit Papers and Short Notes concerning the taxonomy, biosystematics and distribution of British and Irish vascular plants, as well as topics of a more general or historical nature.

Manuscripts must be submitted *in duplicate*, typewritten on one side of the paper, with wide margins and double-spaced throughout.

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 separate sheets and attached at the end of the manuscript.

Figures should be drawn in black ink and identified in pencil on the back with their number and the author's name. They should be drawn no more than three times final size, bearing in mind they will normally be reduced to occupy the full width of a page. Scale-bars are essential on plant illustrations and maps. Lettering should be done with transfers or high-quality stencilling, although graph axes and other more extensive labelling are best done in pencil and left to the printer. Photographs can be accepted if they assist in the understanding of the article.

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 of Papers, Short Notes, Book Reviews or Obituaries.

Submission of manuscripts

Papers and Short Notes: Dr B. S. Rushton, Department of Biological and Biomedical Sciences, University of Ulster, Coleraine, Co. Londonderry, N. Ireland, BT52 1SA.

Books for Review: Dr J. R. Edmondson, Botany Department., Liverpool Museum, William Brown St, Liverpool, L3 8EN.

Plant Records: the appropriate vice-county recorder, who should then send them to C. D. Preston, Biological Records Centre, Monks Wood Experimental Station, Abbots Ripton, Huntingdon, PE17 2LS.

Back issues of Watsonia are handled by Dawson UK Limited, Cannon House, Folkestone, Kent, CT19 5EE to whom orders for all issues prior to Volume 18 part 1 should be sent.

Recent issues (Vol. 18 part 1 onwards) are available from the Hon. Treasurer of the B.S.B.I., 68 Outwoods Road, Loughborough, Leicestershire, LE11 3LY.

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R. R. Mill, E. C. Nelson, C. D. Preston,
B. S. Rushton

ISSN: 0043-1532

Botanical Society of the British Isles

Patron: Her Majesty Queen Elizabeth the Queen Mother

Applications for membership should be addressed to the Hon. General Secretary, c/o Department of Botany, The Natural History Museum, Cromwell Road, London, SW7 5BD, from whom copies of the Society's Prospectus may be obtained.

Officers for 1993-94

Elected at the Annual General Meeting, 15th May 1993

President, Dr F. H. Perring

Vice-Presidents, Mr A. O. Chater, Mr P. S. Green, Dr G. Halliday, Mr A. C. Jermy

Honorary General Secretary, Mrs M. Briggs

Honorary Treasurer, Mr M. Walpole

Editors of *Watsonia*

Papers and Short Notes, J. R. Edmondson, R. R. Mill, E. C. Nelson, B. S. Rushton*

Plant Records, C. D. Preston

Book Reviews, J. R. Edmondson

Obituaries, J. R. Akeroyd

*Receiving editor, to whom all MSS should be sent (see inside back cover).

Watsonia, **19**, 209–229 (1993)

The distribution of the Wild Service Tree, *Sorbus torminalis* (L.) Crantz, in the British Isles

P. ROPER

South View, Sedlescombe, Battle, East Sussex, TN33 0PE

ABSTRACT

The results of a survey of the Wild Service tree, *Sorbus torminalis* (L.) Crantz (Rosaceae), in the British Isles initiated by the Botanical Society of the British Isles and the Biological Records Centre in 1974 are summarised and analysed. It is confirmed that the tree is a useful indicator of ancient woodland and hedgerows and that it shows a marked preference for two kinds of soil: those derived from clays and those derived from harder limestones. The reasons for this are discussed as well as the occurrence of the species on other soils. It is suggested that the very low rate of reproduction from seed is mainly the result of seed predation and that the northerly limits of its range are influenced by the lower rate of seed production in places with cooler, less sunnier summers.

The pattern of modern records in England and Wales reflects to some extent the part the tree has played in the life of the countryside over many centuries. It has been conserved and planted in some areas for its fruit, its wood and for ornament, but in other areas it is scarcely known by local people and held in little regard. Today it is usually much commoner in the first of these areas.

Areas where the Wild Service tree grows have been divided into three types: those where it is relatively abundant, those where it is scattered but widespread and those where it is rare. These often, but not always, show a correlation with the solid or drift geology. Mapping in this way also shows that there are large areas of England and Wales where conditions appear suitable but from which the tree has not been recorded.

INTRODUCTION

In 1974 the B.S.B.I. and the Biological Records Centre, Monks Wood (B.R.C.), organised a national survey of the Wild Service tree, *Sorbus torminalis* (L.) Crantz (Rosaceae) and in the same year I became coordinator of the survey.

The purpose of the survey was given by the Biological Records Centre as follows:–

> "Wild Service is typical of ancient and undisturbed lowland primary woodland. Whilst the *Atlas of the British flora* gives a good idea of its general distribution it may have been overlooked in some areas. It will be of great use in recognising primary woodland for conservation to associate its occurrence with individual woods, not just grid squares, and to trace its distribution in hedgerows."

The initial phase of the survey was conducted by the distribution of standard record cards (see Fig. 1) from the B.R.C. to B.S.B.I. members, foresters, reserve wardens and others likely to have an interest. On return to the B.R.C. these were forwarded to me. Appeals were also made on radio, television and in the press to members of the general public which resulted in much further information not only on the distribution of the tree, but on its economic and folkloric roles. Many of these latter records came from people who were uncertain of the tree's identity, but leaves or fruit were sent for confirmation. Over 1000 records, both on cards and from other sources, were received, many from areas where the tree had not hitherto been reported and even after an interval of nearly 20 years records still occasionally arrive.

A comprehensive search of appropriate literature was also undertaken and this indicated areas where the tree had once occurred, and might still exist, but the data have not found their way into county Floras or other published material. In Pembrokeshire, for example, the tree was clearly well known to local people long before any formal record appeared in the botanical literature.

B.S.B.I. Wild Service-tree Survey

Sorbus torminalis (L.) Crantz

NEED FOR SURVEY

Wild Service is typical of ancient and undisturbed lowland primary woodland. Whilst the *Atlas of the British Flora* gives a good idea of its general distribution it may have been over-looked in some areas. It will be of great use in recognising remaining primary woodland for conservation to associate its occurrence with individual woods, not just grid squares, and to trace its distribution in hedgerows.

Apart from its distribution generally and in individual wood-lands, notes on the size of the trees and on the presence of seedlings and suckers will be useful, but this information is not essential. Please send details of location of populations even if the additional sections are incomplete.

Return completed cards to:
B.R.C.,
Monks Wood,
Huntingdon
From where further cards may be obtained.

Grid Reference Vice-County

Locality (name): .... Date ....

Habitat (ring): Woodland Hedgerow Park Tree

Woodland/Park name: .... Area ....Acres

Soil (ring): Clay Loam Sand Wet Dry

Distribution (ring): Scattered Local Boundary

Sketch of occurrence — show distribution (indicate North and Scale)

Number and size of trees* —

Measure at 5ft. from ground and put the number of trees in each size class in the appropriate column.

Less than 3" diam.	3-6" diam.	6-12" diam.	More than 12" diam.

Reproduction (ring): Flowers Fruit Seedlings Suckers

Notes —

Recorder: **Address:**

* Do not include suckers unless established as separate trees.

FIGURE 1. The standard record card used in the survey of the Wild Service tree.

GEOGRAPHICAL DISTRIBUTION

The Wild Service almost certainly entered Britain from the Continent after the last Ice Age, although it was probably one of the later arrivals, and spread north and west along river valleys (avoiding wetlands), or through the forests with which much of the country was covered. Its current altitudinal limit in Britain is around 300 m and it has forked east and west at the southern end of the Pennines and skirted the higher hills of the West Country and Wales. The northern advance, so far as modern records show, continued to the southern Lake District in the west and, following the Magnesian Limestone, to North Yorkshire in the east.

Deciding how best to present the geographical distribution of the Wild Service has not been easy. Many prefer a national or Watsonian vice-county dot map method, but this is only useful for giving a broad indication of the distribution across the country or in a vice-county. It also gives a potentially misleading picture of a species that is occasionally found at quite high densities, but also occurs as isolated plants in widely scattered locations. At first glance the species seems to be associated with certain geological areas, but closer inspection reveals that this presents only a partial picture with some baffling anomalies. The best explanation of its distribution in the wild is derived from an analysis of its occurrence in relation to both solid and drift geology coupled with as much data as one can obtain about socio-historical factors. The tree is widespread on the Weald Clay of Kent, Sussex and Surrey for example, but almost absent from an area east of Tonbridge where the Weald Clay is overlain by sand and gravel. Further east still it reaches one of its highest densities in an area where its fruit were once in much demand as food (Hanbury 1770; Maynard 1925; Pratt 1854–57; Roper 1975) and where it is still widely known by a dialect name (Chequer Tree) and cultivated to a greater extent than elsewhere. Its economic history, which has a considerable bearing on its present distribution, is reflected in its vernacular name 'Wild Service'. (Originally the species was known simply as the Service – in many alternative spellings – and Wild Services were simply those growing wild rather than in gardens or orchards. The usage is the same as in terms like 'wild blackberries' or 'wild boar'. When *Sorbus domestica* L. was introduced in the 17th century it was called '*sorbus legitima*' and this was translated as 'true service' to indicate that it was the *Sorbus* to which classical authors referred.)

I have based my observations largely on the ten mile (1:625000) solid and drift geology maps published by the British Geological Survey. The maps give a broad indication of the type of substrate and in some instances provide a very useful picture. However, drawing too many inferences from cartography at this scale is unwise and as accurate a picture as possible of local conditions should be obtained before reaching any firm conclusions on a particular site. The Wild Service, although favouring particular habitats and areas, will survive almost anywhere in lowland Britain, but this is quite a different matter from its being able to establish itself without any help from man and to reproduce successfully.

Bearing all these provisos in mind I have illustrated the present distribution by considering the more or less discrete areas in the British Isles where the species has been recently recorded (Figs 2 and 3) and its relative abundance within these areas. This distribution may reflect recording activity to some extent, but generally there seem to be other reasonably satisfactory explanations for the presence of the species and its density in a particular area. Equally interesting is its absence from large areas that appear suitable and often lie adjacent to places where it is relatively abundant.

1. WEST CORNWALL

There are a few scattered records from the area west of Bodmin. All are confined to the Lower Devonian and are often associated with the lower reaches of river valleys. Britain's most westerly record is from the Loe Pool south of Helston, although there is a planted tree at Castallack in Penwith.

2. CAMEL VALLEY, CORNWALL

The area surrounding the Camel estuary and the Camel river and its tributaries in central northern Cornwall had, in the recent past, a concentration of Wild Service trees of which a few remain (Hamilton Davey 1909; Thurston & Vigurs 1922). The area is rather complex geologically, but most locations are on the Upper and Middle Devonian formations.

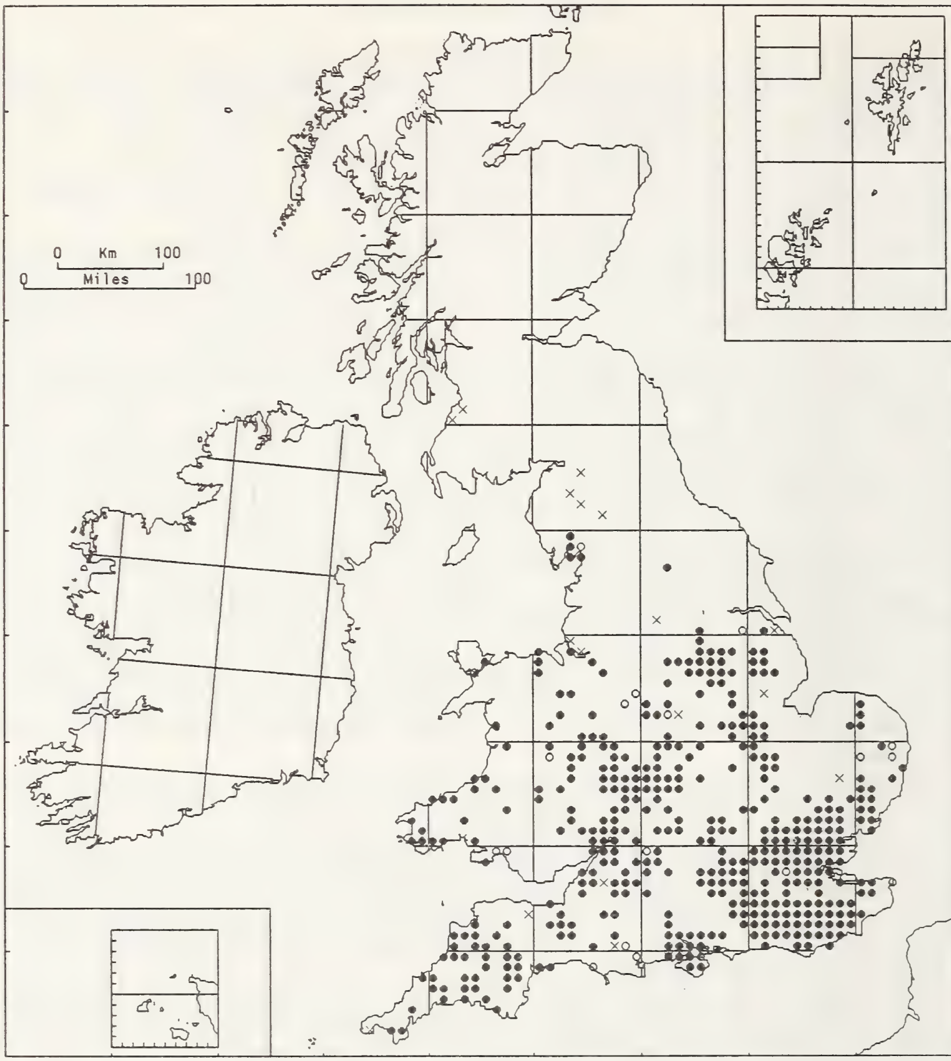

FIGURE 2. Distribution by 10-km squares of the Wild Service tree in England and Wales. This map, though useful, presents a potentially misleading picture due to the fact that some 10-km squares may contain only a single tree whilst others may have hundreds often growing together in suitable areas (cf. Fig. 3). ● 1950 onwards, ○ before 1950, × introductions. Planted trees in Irish gardens have not been included as there are few precise locations.

3. LOWER TAMAR VALLEY

The tree is widespread along the river Tamar that divides Devon from Cornwall in the south. In some places it has spread away from the river, in particular on to the soils derived from the Culm Measures of the Upper Carboniferous in south east Cornwall. Old records from the south east of Plymouth can be considered part of this grouping.

4. CENTRAL & NORTH DEVON AND NORTH EAST CORNWALL

The Culm soils that stretch right across this area have a thin scatter of Wild Services, often in hedges or on roadsides, although they are absent from a large tract of country west of Tiverton.

The association with the Culm Measures is marked and there are very few records from the

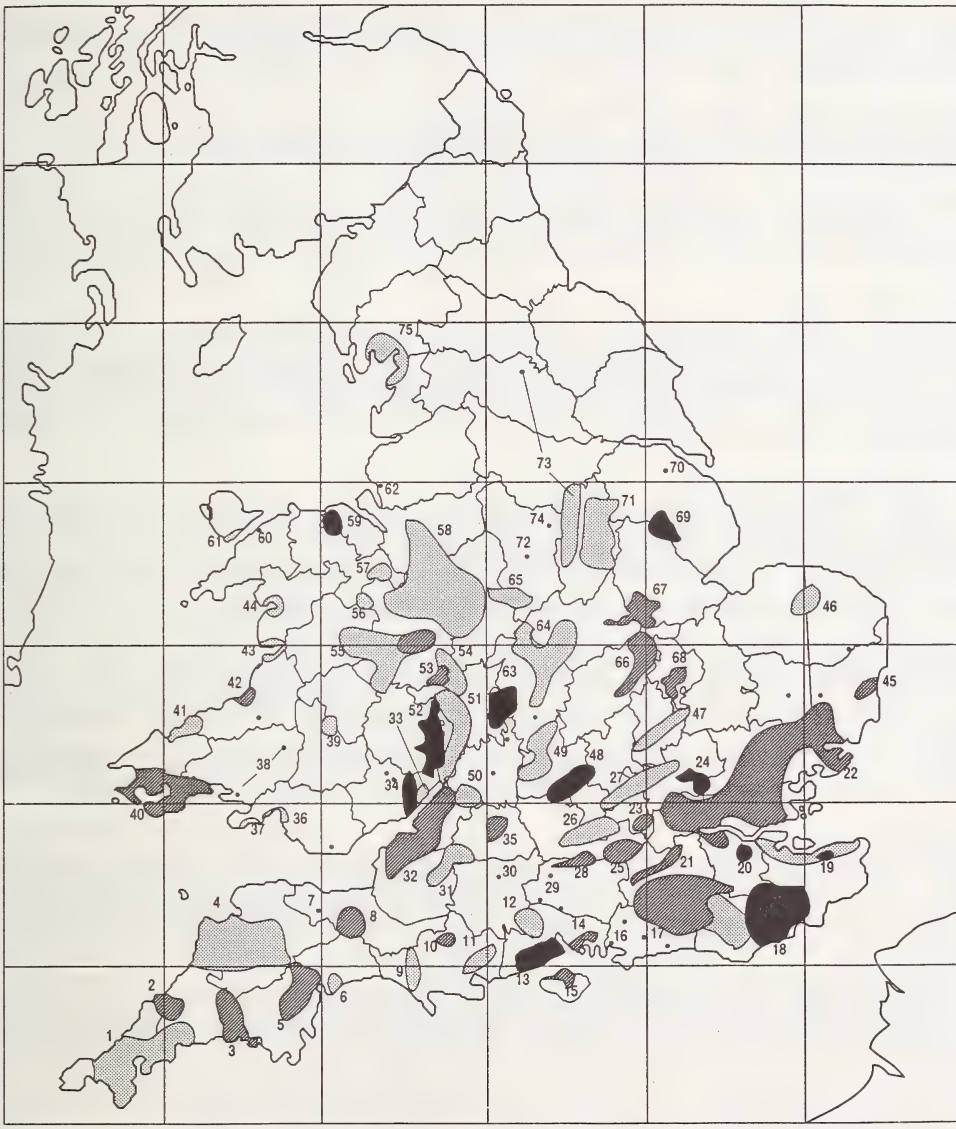

FIGURE 3. Relative density of distribution of the Wild Service tree. The map shows each of the areas covered in the text with isolated records as single dots. As well as these areas it is important to note that there are many apparently suitable places where the Wild Service has not been recorded. Boundaries are those of Watsonian vice-counties. The numbers refer to the sections in the text. ■ Areas were the species is generally not infrequent and, in places, reaches its highest concentrations. ▨ Well-established but at lower concentrations. ▒ Vulnerable or, in a few cases, apparently recently extinct (widely scattered, mainly as isolated trees with data often based on a high proportion of old records).

extensive formations of granite, Middle Devonian or New Red Sandstone that lie adjacent. The explanation is probably that the soils of the Culm are mainly clayey and water retentive, whereas the others drain more freely.

5. SOUTH EAST DARTMOOR

This is perhaps an extension of 4 above. There is a concentration of locations to the east and south of Dartmoor on Culm Measures and other Carboniferous formations in this still well-wooded area. There is also an old record from Chagford, the only one in Britain from granite, and a population on Devonian limestone near Newton Abbot.

6. SOUTH EAST DEVON

I have only two old records from this area at Budleigh Salterton and Aylesbeare.

7. BRENDON HILLS

There is only one record from the southern section of the Upper Devonian formation that runs from the Quantocks across Exmoor to Ilfracombe.

8. VALE OF TAUNTON

The species is scattered throughout the Vale and parts of the Quantocks on the Lower Lias, the Devonian and the Keuper Marl, the latter a formation it favours, northwards through the Bristol area, across Worcestershire and Warwickshire to the north Midlands as far as Nottinghamshire.

In Somerset there are some areas to the south and east that would appear suitable for the species, but from which there are no records.

9. SOMERSET/DORSET JURASSIC

There are a few trees in woods on the Oolite east of Crewkerne. An old record from Puncknowle near the coast to the south is from a geologically similar area.

On the whole, *S. torminalis* seems to avoid the Jurassic Cotswold limestone (Oolite), but it does occur in small areas on this formation from Dorset to south Lincolnshire.

10. NORTH DORSET CLAYS

The tree occurs very sparingly in woods on the Oxford and Kimmeridge Clays in this part of the county which is similar geologically to the Braydon Forest area west of Swindon in Wiltshire (see 35 below).

There is an old record (1799) from Broadley Wood west of Blandford Forum (Mansell-Pleydell 1895). This could either have been on chalk or, perhaps more probably, clay with flints.

11. LONDON CLAY IN DORSET

The Wild Service has a clear association with the London Clay almost everywhere this formation occurs and Dorset is no exception. There is substantial documentary evidence indicating that *S. torminalis* was widespread in the Lytchett Matravers/Wimbourne Minister area well into this century (Mansell-Pleydell 1895; Marchant 1937). I have had no recent records, but a careful search might well reveal that the tree still persists in this area.

Archaeologists have identified Wild Service charcoal from Maiden Castle, the Iron Age hill fort on the chalk south west of Dorchester (Salisbury & Jane 1940), but this might not have been of local provenance.

12. TEST VALLEY, HAMPSHIRE

There are scattered records from the valleys running from Redlynch and Alderbury south east of Salisbury eastwards to the River Test and in the Test Valley itself south of Romsey. These are largely associated with the London Clay and earlier Tertiary formations, although one site is on chalk south west of Broughton and in the area south of Romsey the London Clay is much overlain with alluvium, gravel and river terrace deposits.

13. NEW FOREST

The distribution of the Wild Service in the New Forest is one of the most difficult to interpret and it perhaps reflects the way in which the forest has been managed as well as other factors. The trees are concentrated in three areas:–

a. The south east of the Forest between the Beaulieu River and Lymington. This is partly on the Tertiary period Hampstead Beds and Bembridge Marls and partly on the overlying glacial gravels and sands from the more recent Quaternary period.

b. An area between Totton and Beaulieu Heath on the eastern fringes of the Forest. This is largely on the complex series of Tertiary gravels and clays comprising the Barton, Bracklesham and Bagshot Beds that overlies the London Clay.

c. The area around Cadnam, again on the eastern outskirts of the Forest. Geologically this is similar to b above.

The tree occurs on the clay soils over the Hampstead Beds and Bembridge Marls in the northern part of the Isle of Wight and here it clearly flourishes on this type of terrain. The Barton, Bracklesham and Bagshot Beds, however, cover not only large areas of the New Forest, but extend westwards nearly to Dorchester and over many square kilometres where Surrey, Hampshire and Berkshire meet. The Wild Service is absent, or very rare, in all these places although there are several records from the formation to the east of Southampton Water and in the Pamber Forest area around Silchester on the Hants./Berks. border.

14. SOUTH EAST HAMPSHIRE

There is a well-defined grouping of Wild Service in south east Hampshire almost entirely on soils associated with the London Clay, the Barton, Bracklesham and Bagshot Beds and overlying glacial gravels. Some of these trees are probably relicts from the Forest of Bere.

15. ISLE OF WIGHT

The tree has been recorded, at one time or another, from many woods in the northern part of the Isle of Wight and it still grows there, particularly beside estuaries and where there are low cliffs with landslips. All these locations are on the clay soils derived from the Tertiary Oligocene as in the south eastern New Forest.

There is one record from the Lower Greensand north west of Sandown in an area of complex post-glacial geology. It was quite close to here at Nunwell that Sir John Oglander, in the early 17th century, "planted above a hundred young elms and ashes, some chestnuts and service berries in the grove of my house" (Bamford 1936).

The fruit also used to be sold, mainly to children in Ryde (Bromfield 1856), and it would therefore seem that the distribution has been modified by human activity on the island, although it is undoubtedly a native plant.

16. WEST ITCHENOR, WEST SUSSEX

The tree has long been known from a location by Chichester Harbour where glacial gravels overlie London Clay. This is some 16 km from the nearest locations in Hampshire and 32 km from the substantial populations in the Weald.

17. WESTERN WEALD

The Wild Service has one of its strongholds in the Weald of Kent, Sussex and Surrey and there are concentrations on both the eastern and the western sides. In the west it is largely confined to the Weald Clay but spills over on to the Hastings Beds between Haywards Heath and Horsham and here and there on to the Greensand. There are two records from the chalk at Findon and near Amberley, but the status of these needs further investigation.

In the west, records stop abruptly at Petworth, although the Weald Clay continues for some 24 km along the Rother Valley.

The tree is also relatively scarce on the Weald Clay between Pevensey and Chailey in Sussex and between Yalding and Hildenborough in Kent. In the latter instance it is missing from the extensive river terrace gravels associated with the Medway that overlie the Weald Clay.

18. EASTERN WEALD

There is a strong concentration of Wild Services in the area north west of the Romney Marsh between Ashford in Kent and Robertsbridge in East Sussex. They grow on Weald Clay and the Wadhurst and Guestling Clays of the Hastings Beds, but are almost entirely absent from the sandstones and other light soils. I have searched many suitable looking woods on Gault Clay and on the clayey soils overlying the Purbeck Beds in areas close to strong Wild Service populations without locating a single tree, although the Midland Hawthorn, *Crataegus laevigata* (Poiret) DC., another indicator of ancient woodland that often grows alongside Wild Service, is abundant in these places.

This Wealden group of records spreads, at a thinner density, southwards and westwards almost to the coast at Hastings and Fairlight and to the Ashdown Forest area.

It is in this part of the Weald that the species is still widely known as the Chequer Tree, as it is in some other parts of south east England, and it has entered into the life of the rural community to a greater extent than anywhere else in Britain. There are several farms, houses and one wood named after the species and there is a clear association with the many Chequers Inns in the area (Maynard 1925; Roper 1975). The fruit, known as Chequers, were widely eaten within living memory (Pratt 1854–57 and D. Baird *et al.*, pers. comm., 1975) and were probably used to make a cider-like drink, hence their association with public houses. Because of this the tree is frequently planted in the area and has clearly been given preferential treatment that it has seldom received elsewhere in woods, hedges and on roadsides. The social history of the tree here and elsewhere in Britain and Europe has been covered by Roper (1975, 1987).

19. BLEAN, KENT

The species is plentiful in woods on the London Clay in the Blean area of north Kent. There are also a few records from the Sittingbourne and Rochester area of the London Clay and its underlying Tertiary beds further to the west, and older references (Hanbury & Marshall 1899) indicate that the trees were probably more widespread in the north Kentish clays.

20. SOUTHFLEET, NORTH WEST KENT

An area where the species occurs covering several square kilometres has been on record since the 16th century – "in Kent it groweth in great aboundance, especially about Southfleet and Gravesend" (Gerarde 1597) – and it is still flourishing. Some trees grow on London Clay or associated Tertiary gravels, but others appear to be on clay with flints or chalk. Careful investigation of individual sites and the history of land management would be needed to establish why the trees are found here but are absent from similar places nearby.

21. SURREY COMMONS

There are scattered records from the London Clay commons of central and west Surrey from Wimbledon to just north of the Hog's Back. The species closely follows the narrow belt of clay between the sands and gravels to the west and north and the chalk to the south.

22. LONDON AND ESSEX

This is a larger geographical area than many considered here, but records spread in a continuum, with some local concentrations, from the Essex coast to the borders of Buckinghamshire and Berkshire in the west and Kent and Surrey in the south. Virtually all are associated with London or Boulder Clays and the gravelly soils that overlie them. Many represent survivors, or descendants, of trees from the large forests of Essex and Middlesex which encompassed the smaller forests of Epping, Hatfield and others.

The earliest record I have from anywhere in Britain (other than the report of Iron Age Wild Service charcoal from Maiden Castle, Dorset) is from Havering Park, Essex (enclosed as a royal park in the Middle Ages). In 1260 two Wild Service trees (described in the text as "alyeras") were brought from the park to the Tower of London for the manufacture and repair of crossbows, a purpose for which the wood was renowned. Owing to a mistranslation of the Latin text these trees have been considered by some authors to be hawthorns, but this is incorrect.

Today there are concentrations of records from the Basildon area and to the south east of Chelmsford and these are associated with the Tertiary and Quaternary gravels overlying the London Clay. It has also been noted that trees here tend to be associated with places where the water supply is increased by the effect of differential percolation through the bedded strata.

In Epping Forest the trees grow mainly on London Clay, but north eastwards from Chipping Ongar to the Ipswich area records are scattered across the Boulder Clay, or its associated gravels. It is curious that, although the Boulder Clay sheet continues much further to the north, Wild Service records become very scattered indeed beyond the Suffolk/Essex border. I am inclined to think this is due to land and forest management over the last several thousand years rather than natural factors and in earlier times the Wild Service could have been much more widespread in East Anglia.

To the west the tree is still remarkably well-distributed within the London Clay triangle of north west London, often in urban situations such as on Hampstead Heath and in Ken Wood (Gilmour 1972). There are also scattered records from south east London and an old record from Wimbledon Common, again on London Clay.

If these London and Essex records are plotted on a Quaternary geology map, their absence from hundreds of square kilometres of glacial river terrace deposits along the valleys of the Thames, the Lea and the Wey is very marked. It is remarkable that there are sufficient trees left to give such a clear indication of the ecology of the primaeval wildwood that once covered what is now one of the world's largest cities. It also highlights the Wild Service's ability to survive in unfavourable circumstances for long periods.

23. SOUTH EAST BUCKINGHAMSHIRE

In the well-wooded area around Burnham Beeches that lies in the rectangle between the M40 and the M4, and the A412 and the Thames at Cookham, there are a number of records from the river terrace deposits that the species seems to avoid elsewhere. Careful investigation of individual sites might provide the reason as might the history of woodland management in the area.

24. SOUTH EAST HERTFORDSHIRE

To the south west of Hoddesdon and the east of Welwyn, with an outlier west of Hatfield, there is a concentration of records in a county where the species is otherwise rare. Most are on Boulder Clay or associated gravels, with a few on London Clay.

In the 18th century the Wild Service tree was well-known in Hertfordshire: Miller (1768) said "in many parts of Hertfordshire there are large trees now growing". He may have been referring to the area north of Barnet where the tree still occurs in some quantity or to south east Herts. (Harper 1981). 92 years earlier M. Cook was planting them for the Earl of Essex on his estates at Hadham and Cassiobury. Apparently they fruited well on the Boulder Clay at Hadham, but at Cassiobury (Cook 1676) "we have them on a sharp gravel, the Fruit naught, and the trees bear very badly".

25. WINDSOR FOREST, BERKSHIRE

There is a strong concentration of the trees in the London Clay area of Windsor Forest, Berkshire. The trees are closely associated with the clay, avoiding the river terrace deposits to the north and the gravelly or sandy Tertiary beds to the south.

26. SOUTHERN CHILTERNS

From the Reading area north across the Chilterns there are scattered records of the species over a 12 × 18 km. well-wooded, geologically complex area typified by clay with flints, river terrace deposits and other gravels cut by rivers down to the underlying chalk or, on the southern fringe, the London Clay. As with the trees in south east Buckinghamshire (see 23 above), a study of individual sites is needed to determine the conditions that favour the species in this area.

27. CENTRAL AND NORTHERN CHILTERNS

There are very few records from the more elevated parts of the Chiltern range in Hertfordshire, Buckinghamshire, Oxfordshire and Berkshire. As far as I can determine the trees are confined to the clay with flints cappings on the hills.

28. PAMBER FOREST, HAMPSHIRE/BERKSHIRE BORDER

There is a group of records from the wooded area, formerly Pamber Forest, around Silchester on the Hants./Berks. border. They are mainly on Quaternary sands and gravels that overlie the London Clay.

The Tertiary formations running from the Kent, Essex and Suffolk coasts and with which the Wild Service is so closely associated reach their westerly limit immediately beyond Newbury before reappearing to the south of the chalk. There is one record from the area west of Newbury, then a long gap before the species is found again in any quantity in the Cotswolds near Bradford-on-Avon.

29. HAMPSHIRE CHALK

The Wild Service is recorded from three places on the Hampshire chalk, one of which, near Hurstbourne Tarrant, possibly refers to a clay with flints site. The locations are widely separated and untypical and, in my view, do not constitute adequate evidence that the species once grew more widely on chalk soils under British conditions.

30. SOUTH WILTSHIRE

The only modern record I know of from v.c. 8 is of a Wild Service in a hedge between Wilsford and Beechingstoke. This is on the Gault Clay in the Avon Valley south east of Devizes. If the tree is growing on Gault, it is the only current record of which I am aware from a formation which, in many respects, seems well-suited to its requirements.

Aubrey (1685) said that "cervise-trees" grew at the foot of Heddington Hill and at Whitesheet (I presume the one at Mere) and the trees here may have grown either on Gault Clay or on chalk.

31. WILTS./AVON BORDER

There is a concentration of records, mainly from the Greater Oolite and Cornbrash, but spilling over on to the Oxford Clay along the Cotswold line from Castle Combe to Frome and roughly associated with the old forest of Selwood. Most of the records are from the lower lying parts of the River Avon catchment, but otherwise seem to have little in common. They lie in the counties of Wiltshire, Avon and Somerset although they only extend over an area of some 32 × 12 km.

There are outliers to the east on an area of Kimmeridge Clay and the Lower Greensand near Calne, and to the south on the Upper Lias near Evercreech.

32. WESTERN AVON

The Wild Service is widespread and sometimes fairly abundant from the Mendip Hills, through the Bristol area and northwards along the Vale of Berkeley. It occurs on the Keuper Marl, the Upper and Lower Lias and the Upper and Lower Carboniferous formations, in the latter instance sometimes on the limestones that make up much of the Mendip Hills and the Avon Gorge. In this it displays its two main habitat preferences: for open and often steep rocky areas and for nutrient rich, heavy clays.

Towards the north of the Vale of Berkeley the concentration of records increases in an area of complex Silurian and Cambrian geology. Similar areas occur across the River Severn to the north and these are more fully considered in 52 below.

33. FOREST OF DEAN

As Rackham (1986) has pointed out, the Forest of Dean was subjected to management regimes, largely in the 19th century, that have altered the existing tree composition almost beyond recognition. This is reflected in the virtual absence (very unusually for our ancient lowland forests) of the Wild Service. There are only a few near Brean and more on the outskirts of the forest in the Cinderford area. These belong, however, to the group of records running northwards away from the forest on the Silurian formations of the Malvern Fault.

Wild Services grow on the cliffs bordering the Severn Estuary at Chepstow and Lydney and in the Lower Wye Valley, but these again are not strictly part of the Forest of Dean.

36. LOWER WYE VALLEY

The Carboniferous Limestone of the Lower Wye Valley is renowned for botanical diversity and boasts a large number of *Sorbus* species. Wild Services are found in the open rocky woods and on cliffs from the Goodrich area to Chepstow, though not on the stretch where the river flows through Devonian strata. This and Weston Big Wood near Weston-super-Mare are the only areas in Britain from which the hybrid (*S.* × *vagensis* Wilmott) between the Wild Service and the Whitebeam, *Sorbus aria* (L.) Crantz, has been recorded.

There are two Wild Service records close together from Llanfihangel Ystum Llywern in the valley of the River Trothy in Gwent. This site is only 10–12 km from the River Wye, but the tree is found almost nowhere else in the very extensive Lower Devonian countryside through which much of the upper River Wye and its tributaries run, although it has its densest populations in some of the woods immediately adjacent to the eastern boundary of this area and reappears beside the Wye on the Wenlock Series in Radnorshire (Powys) (Anon. 1976).

35. FOREST OF BRAYDON, WILTSHIRE

Between Swindon and Malmesbury in north western Wiltshire there is a concentration of records from the woodland remnants of the Forest of Braydon, which lie mainly on the Kimmeridge Clays of the Upper Jurassic.

In general the species seems to be commoner on Oxford Clay and it is of note that the 50 km gap in records between Braydon and Wychwood on the Oxon/Bucks. border is largely across an area of the Thames Valley where the clay is overlain by river terrace deposits similar to those from which the tree is absent in south west London and the Medway Valley, Kent.

36. SOUTH WALES

There are very few current records for South Wales and if the species has ever been commoner there it could well have been largely restricted to the coast between Cardiff and the Gower and the immediate hinterland.

Many *Sorbus* species grow on cliffs close to the sea and their fruits fall on to the beach or into the water, sometimes in considerable quantities. They can also be washed down rivers into estuaries and must be able to travel for some distance by this means. From the beach to the cliffs is only a short distance for a bird or fructivorous mammal and some coastal colonies may have originated through seed being spread in this way rather than by overland routes.

Outside the Gower there are a few old records of probably planted trees in the Swansea area and another at Wenvoe south west of Cardiff. If they were indeed planted they could, as in some other places, have originated from wild trees in the area.

37. GOWER PENINSULA

There are several trees in the woods along the limestone cliffs on the southern side of the Gower Peninsula growing in similar circumstances to those in the Wye Valley, the Avon Gorge and the Arnside area of Westmorland.

Inland the Gower is almost covered in a sheet of Boulder Clay and there are no *S. torminalis* records.

38. CARMARTHENSHIRE

V.c. 44, now part of Dyfed, has records from three scattered locations that imply that the tree was once more widespread in lowland Wales. It is found at two sites in the heavily wooded Cwm Mawr valley on cliffs of Pennant Sandstone capped by Boulder Clay into which suckers are spreading. Further west there are five trees on a wooded estuarine Red Sandstone cliff of the Lower Devonian (also capped with Boulder Clay) north of Laugharne.

Well inland at Poor Man's Wood, near Llandovery, there are three trees in an oakwood that now belongs to the Dyfed Wildlife Trust on clay derived from rocks of the Upper Ordovician.

39. RADNORSHIRE AND BRECKNOCKSHIRE, POWYS

The Wild Service grows on cliffs of the Wenlock Series of the Silurian bordering the Wye to the south of Builth Wells and further upstream on similar cliffs by the River Ithon in v.c. 43, Rads. (now part of Powys). It is also found on this formation in Brecs. (v.c. 42) and further to the north. Further search will almost certainly reveal more locations in suitable lower lying parts of Wales, both inland and on the coast. In many cases plants have been kept small due to grazing by sheep, but several of these sites have now been fenced and the trees should now be able to grow to their full size.

40. SOUTH PEMBROKESHIRE

The Wild Service was first recorded formally from Pembs. (v.c. 45) only in 1971. Since then it has proved to be fairly widespread and even boasts a unique local name – maple cherry.

The majority of trees grow in oakwoods on the low cliffs or banks bordering the extensive estuarine system that runs out to sea at Milford Haven. The rock here is mostly Old Red Sandstone of the Lower Devonian and these groups of trees are analogous to those associated with some of the south Cornish estuary systems.

Further coastal records occur on the Coal Measure sandstones on the western side of Carmarthen

Bay and there are a few inland records from this geologically very varied peninsula north to the Newgale area (Anon. 1976).

Davis (1976) has observed that in this area the trees only fruit well after warm summers, confirming that it is a thermophilous species at the limit of its range in Britain. The same has been observed elsewhere in the west and the north in this country and elsewhere in Europe (Büsgen 1929; Conwentz 1895; Termena 1972). In the south of England the tree usually fruits well, but will frequently miss one, and sometimes more seasons, another phenomenon well-known in trees that prefer a warmer and sunnier climate than our own.

41. TEIFI AND NEVERN, DYFED

There are small Wild Service areas in woods adjacent to the lower reaches of the rivers Teifi and Nevern north of the Mynydd Preseli in northern Pembs. (v.c. 45) and southern Cards. (v.c. 46), now both in Dyfed.

The soils here are derived from Upper Ordovician rocks of the same type as those at Poor Man's Wood, Llandovery (see 38 above).

42. ABERAERON, DYFED

There is a scatter of records from the low-lying area inland from the coast at Aberaeron in Cards. (v.c. 46), mostly on steep, wooded river banks.

The soils here are derived from the Llandovery Series of the Silurian and cover much of western central Wales which is mainly free of boulder Clay and other drift. One record is from a hedge at Llangybi over 15 km from the coast and in a tributary valley of the River Teifi. The location is, however, still on the Silurian and falls within the grouping.

43. DOVEY VALLEY (CWM DYFI)

There is one record of a plant at the top of a steep, rocky, wooded slope in a valley off the main Dovey Valley between Machynlleth and the estuary. The whole of this area, as with 41 above, is on the Llandovery Series of the Silurian. The site is just in v.c. 47, Monts. (now part of Powys), and quite different from those in the east of the vice-county (see 56 below)

44. BARMOUTH

The most northerly of the west central Wales populations are the few trees that grow in steep, rocky woods on Cambrian formations close to the Mawddach estuary.

45. NORTH EAST SUFFOLK/SOUTH NORFOLK

There are a few records from the area to the south west of Southwold of trees growing on soils derived from the underlying Boulder Clay. One correspondent sent me leaves from the Southwold area and said he knew at least five sites for the species in the neighbourhood.

R. Mabey (pers. comm., 1976), has noted that members of the Yoxford Women's Institute knew that the tree grew wild in their district. This indicates that there may be more sites for botanists to discover in the area.

There is one outlier of this group of records well inland near Mendlesham, another near Hempnall south of Norwich (Withering (1818) said the trees grew at Bath Hills near Bungay not far from here) and a garden relict north east of Bury St Edmunds. The Wild Service has been quite widely planted in the past for ornamental and utilitarian purposes. The source of such plants is often local and older garden trees may indicate a wild population nearby.

Most of the woodland cover in East Anglia was removed long ago but a map in Rackham (1986) shows that this north east Suffolk/south Norfolk Wild Service area is broadly congruent with an area where villages still had their own woods at the time of the Domesday Survey in the 11th century. This area stretched north to the Foxley district in Norfolk (see 46 below).

46. CENTRAL NORTH NORFOLK

There are several Wild Services in Foxley Wood on the Boulder Clay sheet near Themelthorpe (E. Norfolk, v.c. 27) and a recent record from a wood at Mileham (W. Norfolk, v.c. 28), both to the north east of Dereham. Older records from the neighbourhood indicate that these are survivors from an earlier, more widespread woodland population.

47. SOUTH MIDLAND LOWER GREENSAND

There are five Wild Service locations along the Lower Greensand ridge that runs from south western Cambridgeshire to Leighton Buzzard in Bedfordshire. Although the correlation with the solid geology seems too close to be accidental, most trees are in fact on Boulder Clay and elsewhere the tree does not occur on soils derived from the Lower Greensand. Examination of the 1:50000 Ordnance Survey map shows that this ridge is more heavily wooded than the surrounding plain, perhaps because the countryside was less easily cultivated due to its hilliness. The survival of the Wild Service is almost certainly due to this rather than to the underlying solid geology.

48. BERNWOOD (BUCKINGHAM/OXFORDSHIRE BORDER)

There is a concentration of records of trees over the narrow, 16 km stretch of countryside from the Quainton, Bucks. area to just south of Oxford and associated with the ancient Forest of Bernwood.

None of this area is covered in glacial drift and most of the sites are in woods on Oxford Clay, with a few associated with the Greensand/Portland Beds complexes of the Kimmeridge Clay.

49. WYCHWOOD, OXFORDSHIRE

Before deafforestation, which followed enclosure in 1857, Wild Service berries from the Forest of Wychwood used to be sold in Burford market and probably elsewhere locally.

The tree continues to be found at low concentrations in some of the few remaining woodlands, nearly all of which are on soils deriving from the rather complex Oolite and Upper and Middle Lias, that typify the Cotswold belt. The tree seems not to be found on the adjacent Lower Lias and is scarce on this formation everywhere in the south and west and virtually absent from it in the north and east. On a site near Kineton in Warwickshire on the Lower Lias some 32 km north of Wychwood, the tree appears to be on the overlying Boulder Clay.

Scattered records occur westwards towards Cheltenham and the Vale of Evesham and there were once, no doubt, trees in the woodlands throughout the whole of this area.

50. CIRENCESTER/STROUD

There is a somewhat isolated group of records of trees in Cirencester Park some of which are planted, and records from the Tetbury and Painswick areas in the Cotswolds. These locations are not dissimilar to those cited in area 48 above and again one can surmise that the tree was once more widespread locally. The fact that there is a unique Cotswold name for the species – 'lizzory' or 'lezzory', clearly derived from 'alizier', one of the Old French words for the species (Boulger 1908) – lends support to this hypothesis.

51. VALE OF SEVERN

There are records of the tree, mainly from the Keuper Marl but also on the Lower Lias near Pershore, from Gloucester to Stourport. Sometimes the tree grows on cliffs by the river, but more often in woods and sometimes hedgerows nearby.

52. MALVERN

The Malvern and Suckley Hills and their southward extension to the outskirts of the Forest of Dean are one of the strongholds of the Wild Service in Britain and are clearly associated with the complex Silurian strata of the Ludlow, Wenlock and Llandovery Series that go to make up these hills. On the spur of this formation that runs north west towards Hereford the Wild Service reaches one of its highest densities in Britain with up to 125 trees per hectare in Haugh Wood near Mordiford. Stoke Edith Wood, also in this area, is the type location and the source of the only British records of the *British Red Data Book* moth, *Stigmella torminalis* (Wood), whose larvae, like those of several other moths, mine the leaves of the tree (Emmet 1976; Shirt 1987).

53. WYRE FOREST

The Wild Service is not uncommon in the Wyre Forest and neighbouring parts of Worcestershire, Shropshire and Staffordshire growing mainly on soils derived from the Westphalian Series of the Upper Carboniferous. In the forest itself it is widespread, but occurs particularly along the central Dowles Brook. While there are probably more soil nutrients here, it is possible that the tree was encouraged by the millers who had premises along the Dowles since its wood was among the best for making cogs for mill machinery (Du Breuil 1854; Hanbury 1770; Hickin 1971).

54. UPPER SEVERN VALLEY

The tree is found north of the Wyre Forest along the Severn Valley showing a marked preference for the Westphalian Series and largely avoiding the Lower Old Red Sandstone to the west as it does everywhere in western central England and eastern Wales. It is not found on the river terrace deposits, a distinctive feature of its distribution everywhere. Records become far scarcer north of the limit of glaciation, though there are a few from Boulder Clay-free areas east and north of Bridgnorth.

55. WENLOCK EDGE AND THE WELSH MARCHES

As with the Malverns (52 above), the Wild Service has been recorded from much of the Wenlock Edge and associated Silurian areas, with a concentration to the north around Ironbridge. There are scattered records to the south west as far as the northern tip of Herefordshire and the Welsh border at Knighton. There is one site near Pontesbury to the south west of Shrewsbury and two in the Welsh hinterland, one on the Severn at Abermule and the other on the Afon Banwy (a tertiary tributary of the Severn) south of Meifod. Both these are in Monts. (v.c. 47).

Unlike the more southerly areas of this type, the rocks of the Wenlock and other series of the Silurian are overlain by Boulder Clay and glacial sand and gravel and all the *S. torminalis* records from this area are on, or very close to, drift deposits. Sinker *et al.* (1985) say that in the Shropshire region the tree is "a characteristic member of the ancient broad-leaved woodland community together with holly, yew and small-leaved lime on sandstones and other freely drained acid rocks as well as on limestone".

56. WEST SHROPSHIRE LIMESTONE

There is one old and one more recent record from the Carboniferous Limestone west of Oswestry. This area is well known for its apomictic *Sorbus* species that are so often confined to open limestone areas and in this case the Wild Service is responding in the same way. The nature of the terrain reduces competition for light from more vigorous tree species and allows the *Sorbus* spp. to reach maturity whereas on richer soils in the same neighbourhood they would be shaded out.

57. UPPER DEE VALLEY

There is a small group of records from the Upper Dee Valley on the Shropshire/Clwyd border between the point where the river debouches from the Vale of Llangollen downstream to Bangor-is-y-Coed.

Unlike the lower part of the valley, this area is still heavily wooded. The geology is varied with much overlying clay and gravel drift.

58. NORTH WEST MIDLAND PLAIN

There is a very thin scatter of records, many of them old, across the low-lying agricultural plain of north-east Shropshire, west Staffordshire and Cheshire. Much of the soil is heavy and derived from the thick sheet of Boulder Clay left by the last glaciation, while elsewhere there are glacial sands and gravels. The underlying Permian and Keuper Marl appear here and there.

There seem to have been concentrations of the tree to the north and west of Shrewsbury, to the south of the Potteries and in the Delamere Forest area, although these are based on very few old records. Elsewhere there are, or were, isolated trees.

It is possible that the species was once widespread in this area, although perhaps always rare. If one looks, for example, at the records from the sticky soils of the Culm Measures in central and north Devon, one sees a similar, though slightly denser, pattern of scattered records.

59. VALE OF CLWYD

There is a surprising concentration of records in the Vale of Clwyd, mainly in the area around Denbigh some way inland, but with an outlying station south of Prestatyn. Some of these records are associated with Carboniferous Limestone, but the area is extensively covered with Boulder Clay and the trees are growing in woods and hedges rather than on cliffs.

60. GWYNEDD COAST

One tree has long been known from the Craig y Gigfran on Garth Point, an area of Cambrian and Ordovician rock on the coast of the Menai Strait in Bangor.

I also have an unconfirmed record of a tree alongside the Conwy Estuary on the Benarth Estate to the south east of Conwy itself. My informant thought it might have been planted, but the geology and the general situation are of the type favoured by the species and the area warrants further investigation.

61. ANGLESEY

There is a long history of the species (possibly planted) at Trefarthen, near Brynsiencyn close to the Menai Strait in the south-west of the island (Davies 1813) although it has not been seen recently as far as I know. Non-native trees, including *Sorbus* spp., have been extensively planted in some parts of Anglesey (Sell 1989), but there is no overriding reason why the Wild Service should not be native here.

The underlying rocks in this part of Anglesey are metamorphic Horneblende Schists, but almost the whole island is overlain by a mantle of Boulder Clay.

62. LIVERPOOL

There is a record of a Wild Service on the rocks at Knot's Hole, Liverpool "in a situation quite exposed to the salt water, and where it must occasionally be washed by the spray of the sea" (Withering 1818). There have been no recent reports. In many ways this location is analogous to those were the species grows on various parts of the coast of Wales, or further north around Morecambe Bay. The rocks at Knot's Hole are New Red Sandstone.

63. FOREST OF ARDEN

There is a strong concentration of records in the area south of Birmingham that is roughly congruent with the ancient Forest of Arden. The trees are found in woods and hedges, almost entirely on Keuper Marl.

64. NORTH EAST MIDLAND PLAIN AND FOREST OF CHARNWOOD

North of the Arden area the tree becomes very much scarcer. Its chances of survival have been reduced by urban development and agriculture and, as is the case in other areas, it does not grow as successfully on the extensive Boulder Clay and drift as on other soils. As in the south Midlands and places further north, it is absent from the very extensive Lower Lias.

There is a small concentration of trees on the Westphalian Series of the Carboniferous east of Sutton Coldfield and another in the northern part of Charnwood Forest. Elsewhere the records, mainly from Keuper Marl, are very thinly scattered and mostly date back some considerable time.

65. STAFFORDSHIRE AND SOUTH DERBYSHIRE

There are scattered records from the Needwood Forest and Bagot's Park area of Staffordshire with an isolated hedgerow tree from a neighbouring part of Derbyshire. Most are on Boulder Clay, although the underlying stratum is Keuper Marl throughout.

66. NORTHAMPTONSHIRE AND ROCKINGHAM FOREST

The tree has long been known in northern Northamptonshire and north western Cambridgeshire in the old Rockingham Forest area. The early 19th century poet John Clare, who came from this neighbourhood, was familiar with the tree and called it by its local name of Surrey as well as Service Tree in his writing (Clare 1832). J. R. Gilson (pers. comm., 1977) has reported that parish bounds in the Rockingham Forest area used to be beaten with branches of the tree, and the branches also used to be carried at the head of village processions (Grindon 1883). All this indicates that the tree has long been familiar in the countryside here.

It now grows almost exclusively in woods, and occasionally hedges, on soils derived from the Oolitic limestone formations that are so characteristic of this area and generally avoids places where there is a Boulder Clay covering. This is in contrast to the examples immediately to the north where the reverse is true and Boulder Clay seems to be preferred.

67. RUTLAND AND KESTEVEN

There are still widespread records from this once heavily wooded area, although many trees were destroyed during the replacement of deciduous woods by conifer plantations after the Second World War.

The tree is particularly concentrated on the Boulder Clay spur followed by the Great North Road from a few km north of Stamford to Grantham and records extend westwards on a similar substrate to Dunsby in Lincolnshire. To the south east there are scattered records across the Vale of Catmose area and from beyond Oakham.

Both in Rockingham Forest and this area, pheasant shooting has been popular, particularly on the large estates, since the last century. Many Wild Service trees grow in the coverts where the birds are raised or roost and the birds are known to be very fond of its fruit (Conwentz 1895). This may, to some extent, have helped the tree survive as gamekeepers undoubtedly know what their birds like. In some cases the species could have been deliberately introduced, particularly into the smaller woods that are wholly artificial and that were established with game and foxes in mind.

68. HUNTINGDONSHIRE

There is a group of records from central Huntingdonshire and one to the south near St Neots. These are on Boulder Clay and the underlying Oxford Clay. In the case of the latter, it is remarkable how the cluster of records to the south-east of Sawtry (which includes Monks Wood) almost exactly matches a small area where the Oxford Clay is not covered by glacial drift.

69. BARDNEY FOREST, LINCOLNSHIRE

Although much of the countryside to the east of Lincoln is now conifer plantation, there are still some remnants of the ancient wildwood that persisted here until the middle of the 19th century and the area is noted for its rich wildlife.

Records of the Wild Service are numerous and are concentrated in an area only some 14 × 20 km in size. They grow almost entirely on the Boulder Clay, although a few records seem to be from the alluvial soils in the Witham Valley.

The topography and geology of much of central England is not dissimilar to that in this area and this strong population of the Wild Service may give some indication of the density it once reached in many other places.

70. NORTH LINCOLNSHIRE

There is one record of a tree in a hedge on the chalk in north Lincolnshire far from any other Wild Service trees. It is almost certainly introduced.

71. EAST NOTTINGHAMSHIRE

The Wild Service is well-distributed, mainly in woods, throughout the Keuper Marl of eastern Nottinghamshire with a couple of records, clearly belonging to this group, on the other side of the River Trent at Gainsborough. This preference for the Keuper Marl in an area largely free of drift is striking and, apart from one record on the New Red Sandstone near Thoresby, the species remains on its preferred soil throughout the Sherwood Forest area.

The Keuper Marl continues north through Yorkshire to Teesmouth and the sudden cessation of *S. torminalis* records is clearly related to the fact that from north Nottinghamshire the formation vanishes under a great sheet of drift.

72. PEAK DISTRICT

There is one record from Wild Cat Tor on the Carboniferous Limestone at Matlock (Willmot 1975). Other *Sorbus* spp. grow well on the limestone eyebrows and other habitats created by the geology of this area and in this instance the Wild Service is responding to the environment like some of the related *Sorbus* spp., especially the apomicts.

73. MAGNESIAN LIMESTONE

The Wild Service appears in woods on Magnesian Limestone from its southern extremity and follows it up the Nottinghamshire/Derbyshire border northwards to the Chadwick-le-Street area in South Yorkshire. There are now some 20 known locations along this limestone belt and its associated mudstones despite the fact that the formation is never more than about 9 km wide (Willmot 1975). It is also largely free of drift and the species is clearly responding, as many other plants do on this formation, to the soil conditions deriving from the solid geology.

Beyond Chadwick-le-Street it reappears, after a gap of over 60 km, on a Magnesian Limestone cliff near Fountains Abbey in Mid-W Yorks. (v.c. 64). It seems perfectly natural on this site, which is the most northerly so far discovered on this side of the country, but one should always be wary of the status of plants with some economic value growing near ancient monasteries.

74. DERBYSHIRE COAL MEASURES

In 1974 four bushes of Wild Service were found in a hedge bordering a green lane at Staveley, Derbyshire on Coal Measure shales only 8 or 9 km from plants on the Magnesian Limestone (Willmot 1975). The species occurs on this formation in one place in Pembrokeshire, but otherwise nowhere else, although it is very widespread.

75. MORECAMBE BAY AND THE SOUTHERN LAKES

The Wild Service occurs on Carboniferous Limestone rocks and in lowland woods with glacial drift derived soils in a number of places around Morecambe Bay (Piggott 1973/74). In the Arnside area many of these woods are known to be ancient and were part of the Chase of Harneshed and the deer park created there in the 16th century. The wildlife and social history of the other localities where the Wild Service is found also indicate that their vegetation is of natural origin.

Often in these steep rocky areas the Wild Service responds like other members of its genus, particularly the apomictic species (on Jack Scout it grows with *Sorbus aucuparia* L., *S. rupicola* (Syme) Hedlund and *S. lancastriensis* E. F. Warb.) but, in Grubbins Wood and elsewhere, it grows in similar situations to those in the more heavily wooded areas of the south.

There are good reasons to believe that old records from Plumpton near Ulverston, Brigsteer and Levens Park are authentic and new sites in this area may remain to be found. As recently as 1987 a long-established Wild Service was found on a low cliff on the shore of Lake Windermere, a place one would have thought had been quite well-worked botanically. This is the most northerly site in Britain where the species can be accepted as native. There are a few old records from further north on the Cumbrian limestones, but these trees are almost certainly planted.

From time to time one hears of ‘service trees’ in north-east England and southern Scotland. Sometimes these are simply misidentifications, but the Swedish Whitebeam, *Sorbus intermedia* (Ehrh.) Pers., is very widely known as the Service Tree in this part of the country and this is often the species meant. The Wild Service has been planted at several places in Ireland (Forrest 1985).

CONCLUSION

The Wild Service tree is, as other authors have established (Peterken 1974), a useful species for indicating primary woodland and ancient hedgerows, as well as some other types of relatively undisturbed habitat, and it is more likely to be found in an area that is still, or was once, part of an ancient forest, but its presence on any particular site does require interpretation. Apart from biological and ecological factors and the history of land and forest management in the British Isles, the tree has economic, aesthetic and other qualities that have favoured its survival in some districts to a greater extent than would be the case with many other species.

While the present survey has been as comprehensive as possible, it is clear that the Wild Service remains under-recorded. Although it grows to a large size – I know one tree over 18 m tall and with a spread of 21 m, while trees of between 22 and 24 m have been reported from several parts of Britain and of 25 m from the Crimea and the Caucasus (Elwes & Henry 1906; Howard 1947; Conwentz 1895) – it is easily overlooked, and there are many areas that have not been thoroughly searched. Despite this, the limits of its range in the British Isles are now reasonably well defined: it is essentially a lowland tree of England and Wales and has not been reported in the wild from Scotland, Ireland, the Isle of Man or the Channel Islands.

Its range is unlikely ever to have extended to Scotland. In the Atlas Mountains, where the Wild Service and the Whitebeam, *Sorbus aria* (L.) Crantz, grow (Jahandiez & Maire 1931–34; Quezel & Santa 1962), the Whitebeam extends to higher altitudes and this is an analogue of the situation in Britain where the Whitebeam is found further north in a cooler climate than the Wild Service. The

Whitebeam and *Sorbus devoniensis* E. Warb. are both found in Ireland (Clapham *et al.* 1962) and the latter species has recently been reported from the Isle of Man (Proctor *et al.* 1989; Sell 1989). If both these species could cross the Irish Sea, there would seem no reason why other *Sorbus* spp. could not do the same, so it is worth continuing to look out for the Wild Service in these places.

HABITAT PREFERENCES

The Wild Service in Britain and elsewhere grows in several distinct and apparently dissimilar habitats, although an understanding of the requirements of the species goes some way to providing an explanation of its distribution. These habitats can be divided into four broad categories:–

1. Nutrient-rich soils, clays in particular (Brown 1894). The species is more abundant and grows better on some clays than others. It does well on Weald and Wadhurst Clay in the south-east, and on London Clay and Oxford Clay (in the latter instance especially where there are, or were, ancient forests). It is widespread on the Culm Measures in the West Country and the Keuper Marl from Somerset to Nottinghamshire. It is less common on Boulder Clay, but grows well where it occurs, and is virtually absent from Gault. One possible explanation is that it grows better on clays with a lower calcareous mineral content, although woodland management over the centuries is a more likely factor.

Woodland soils overlying clays often do not share the characteristics of the underlying stratum: they are usually lighter and more acid and may be modified by downwash or other local conditions. While the Wild Service can send its roots below the surface soil layer, the natural distribution (as is the case with any forest tree) is governed by the conditions in which it has to develop as a young plant and the superficial soil qualities are therefore an important factor.

2. Areas of hilly or undulating gravel terrace and similar formations deposited in the glaciations of the Tertiary or Quaternary periods. There is some evidence that its presence on these formations is associated with bands where the water content is higher due to the slope and the layering of the material (Kozlowski 1962). Such gravels are often accompanied by seams of clay which may improve the nutrient content locally.

Those who cultivated the tree in the past noticed that they did not fruit as well on freely-draining gravelly soils as on clay (Cook 1676).

3. Coastal and inland cliffs, rocky hillsides, landslips and similar open or disturbed habitats.

4. Large river valleys, especially those containing cliffs and rocky slopes.

The Wild Service is capable of becoming a large forest tree reaching the canopy layer, and its absence from lighter lowland soils may be due to the fact that it competes poorly with oak and other trees (Longman & Coutts 1974). If it is overshaded by trees that grow more rapidly, the Wild Service can survive, but will not flower and fruit. Away from nutrient-rich soils it depends on open habitats where there is less competition and where it can flower and fruit more successfully. In these places chances of seed survival are also higher due to their becoming lodged in crevices and similar positions where predators cannot easily reach them. The young plants are also less likely to be damaged by browsing or grazing due to their inaccessibility.

The present pattern of distribution indicates that the Wild Service was probably widespread, if seldom abundant, on the stiffer soils in the forests that covered much of the lowlands of England and Wales in the past. In many places it has been severely reduced, or eliminated, by human activity and this has been compounded by its low rate of reproduction from seed compared with many other native trees. There are two main reasons for the latter: climatic and ecological. Gabrielian (1961) contends that the species evolved in dry, open woodlands and there is ample evidence to show that climatic conditions affect the tree's ability to flower and produce viable fruit. Warm summers promote fruit formation (Davies 1976; Büsgen 1929) and increase the number of seeds per fruit. In the warmer, drier parts of Britain many trees often fruit only every other year and in marginal habitats, particularly towards the edge of the range, even less frequently. Termena (1972) has shown that both temperature and humidity affect pollen viability and fruit production of the species in the Bukovina area on the borders of the Ukraine and Romania. In northern Poland good crops of fruit were only produced every 25 years (Conwentz 1895).

Although the fruit is avidly devoured by birds, Wild Service seems only rarely to be bird-sown (the seed, with its thin testa, is probably digested in the bird's gut) (Prime 1960). In large, lowland forests wild boar and other animals, including domestic pigs and cattle, may well have been important agents for the dispersal and burial of Wild Service seed: wild boar are known to like the fruit and the effects of their trampling on woodland ecology have been well-documented (Conwentz 1895; Darling & Morton Boyd 1969; Goodwin 1975; Tansley 1968). Elsewhere seed was, and still is, extensively predated by birds, small animals and invertebrates so that almost none remains (Corbet 1974; Janzen 1970; Tansley 1968; Termena 1972).

The wild boar as well as burying much seed by rooting and trampling, destroyed many small rodents (Tansley 1968) as did the much higher numbers of predatory animals and birds that were formerly widespread. Populations of voles and mice have increased substantially as predators have declined and animals like rabbits, grey squirrels and pheasants (all of which eat seeds or seedlings of Wild Service) have been introduced and have spread.

Like many trees and shrubs within the family Rosaceae, Wild Service seeds need a period of some three months of near freezing temperatures before germination will take place (Gordon 1982). In places where winters are longer and colder than in much of Britain, germination will normally take place in the first spring following seed formation whereas in Britain two or more years are often needed and the seed is at risk for far longer. This is true of many tree seeds, but the first spring germination that would have taken place more regularly during periods when the climate was colder could have helped the Wild Service to reproduce from seed in slightly larger numbers in those days.

While a cooler, less continental, climate and increased seed and seedling predation coupled with other factors may have reduced populations of the Wild Service and prevented recolonisation, its survival in ancient hedges and woodlands has been helped by its ability to reproduce from suckers. Wild Services live a long time: Mitchell (pers. comm., 1975) has estimated the age of large old trees to be around 200 years and many of these may themselves have arisen from suckers produced from an earlier generation of trees. Some mature populations – that in Epping Forest, for example – have been shown to originate largely from suckers (Lloyd 1977) and O. Buckle (pers. comm., 1975) was of the view that virtually all the Wild Services that he knew of in West Sussex (for which he was B.S.B.I. vice-county recorder) had originated from suckers. No one knows how far back these sequences may have extended since the original seeds germinated, but it is clear that the species can survive for long periods before conditions recur in which seeds germinate freely. Suckers are often mistaken for seedlings and care must be taken in reaching a judgement on the origin of a given tree (the root from which a sucker arose can often be discovered just beneath the soil surface).

As a result of the survey the Wild Service has, in the last 19 years, been shown to be more abundant than was thought and it is clear that it had been overlooked in many places. Its range is known to extend slightly further north than Morecambe Bay and further into Yorkshire than was realised. It is also widespread, though rare, in the lower lying parts of Wales. There are, however, many areas in the British Isles where it might be expected to occur from which it has not been reported.

More evidence has come to light to show that the tree was formerly more abundant than today, though probably never common in most areas. There is no doubt that the species is found almost exclusively in ancient woodlands and hedges or on rocky outcrops, unless planted, and its value as an indicator of primary woodland is confirmed.

The survey has also revealed that the tree has had a considerable social and economic role much of which has not hitherto been recorded or gathered together and which has undoubtedly affected the current pattern of distribution since the tree has been conserved and planted in some areas and neglected or destroyed in others. This is the subject of a separate paper (Roper 1987).

Although the formal survey of the Wild Service is now complete, I am always interested to have any new records or information about the natural or social history of the tree. There is much work still to be done on its associations with insects, fungi, bryophytes and lichens and the uses to which the fruit and the wood were put.

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Cardamine bulbifera (L.) Crantz (Cruciferae) in the British Isles

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ABSTRACT

The taxonomy, reproduction, dispersal, habitats and distribution of *Cardamine bulbifera* (L.) Crantz (Cruciferae) in the British Isles are described, and all localities traced are listed. It is currently known from about 155 native and 27 introduced sites. It is a scarce plant in Britain; the main threats to its survival are woodland replanting and clearance.

INTRODUCTION

Coralroot (*Cardamine bulbifera* (L.) Crantz)* was first recorded in Britain by J. Goodyer, "at Mayfield in Sussex in a wood called Highreede", in 1634 (Wolley-Dod 1937), and it is now known to be a very local, native plant of ancient woodlands in South East and Central England. It is widely introduced elsewhere in England, Scotland and Ireland. On continental Europe, the plant is also local, occurring widely from central France eastwards (though rare near the Mediterranean coast) to the Black Sea, the Caucasus and northern Iran, and northwards to 64° in southern Scandinavia.

At least 13 species of *Cardamine* have been recorded in the British Isles. In addition to *C. bulbifera*, there are five other native species: *C. amara* L., *C. flexuosa* With., *C. hirsuta* L., *C. impatiens* L. and *C. pratensis* L. (Rich 1991). *Cardamine chelidonia* Lam., non L., *C. glanduligera* O. Schwarz, *C. heptaphylla* (Villars) O. E. Schulz, *C. kitaibelii* Becherer, *C. pentaphyllos* (L.) Crantz, *C. raphanifolia* Pourret and *C. trifolia* L. have been reported as introduced and are variously naturalized. *C. bulbifera* is easily distinguished by the large pinkish-purple flowers, scaly rhizomes and axillary bulbils. Some authors (e.g. Rose 1981) transfer *C. bulbifera* to the genus *Dentaria* L.

Cardamine bulbifera is considered to be a scarce plant in Britain (Stewart & Pearman 1991). The purpose of this paper is to document its ecology, occurrence and current status.

TAXONOMY AND VARIATION

Cardamine bulbifera shows little morphological variation. Schulz (1903) and Hegi (1958) noted a number of varieties and forms, of which only two have been noted in Britain, in addition to the typical *C. bulbifera* forma *bulbifera*. Forma *ptarmicifolia* (DC.) O. E. Schulz is distinguished by the broadly serrate teeth on the leaves; the leaflets also tend to be ovate and more asymmetrical (Fig. 1), and the plant is generally bigger and with browner bulbils. It is probably native in scattered localities through Europe to the Caucasus but appears commonest in the Alps, and has been introduced to

*Nomenclature follows Stace (1991), and Jones (1964) for *Cardamine*.

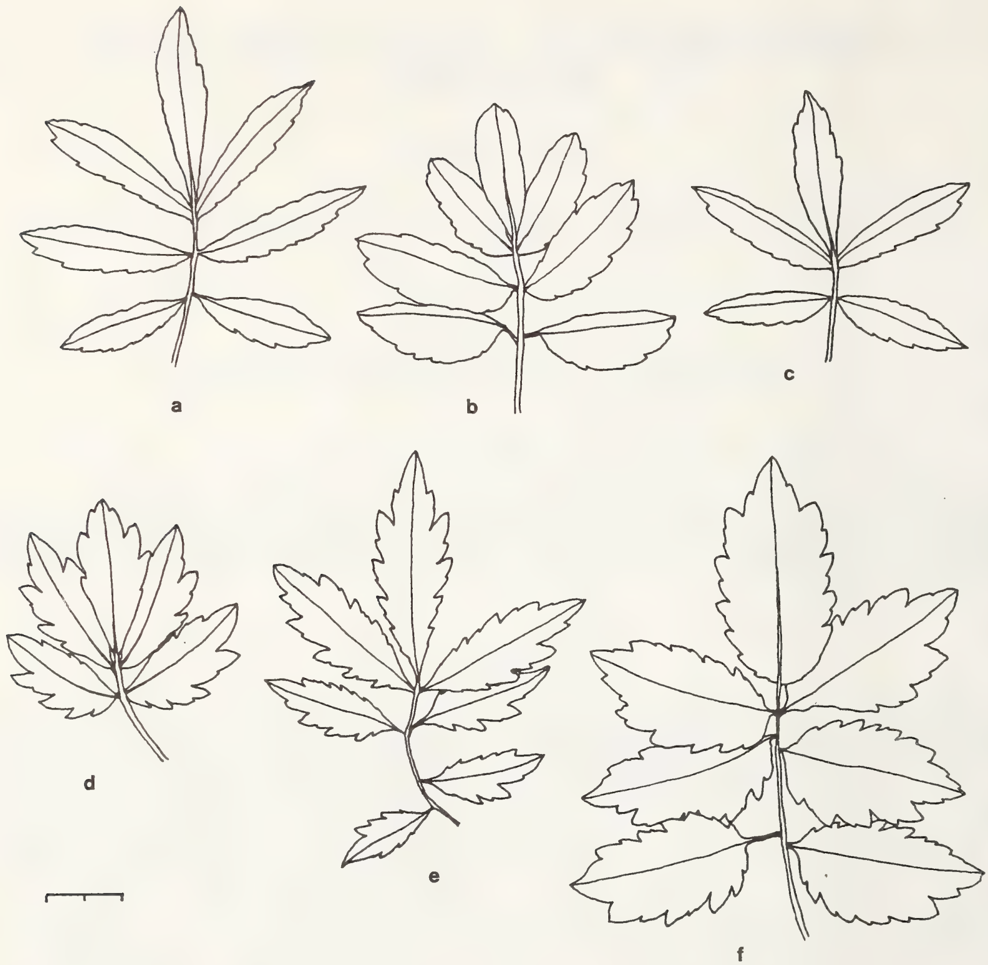

FIGURE 1. Basal leaf shapes of *Cardamine bulbifera*. a–c, forma *bulbifera* (native). a. Fennels Wood; b. Booker Common; c. Hawkhurst. d–f, forma *ptarmicifolia* (introduced). d. Silverdale; e. Trudoxhill; f. Warley Place. The scale bar is marked in cm intervals.

and naturalized in a number of localities in Britain. Forma *lactea* (Wirtgen) O. E. Schulz has white petals, and has only been cultivated in flower beds at Saville Gardens, Windsor Great Park (v.c. 17). Rich (1991) provides a description of native British material.

Examination of herbarium material of typical *C. bulbifera* show clinal variations in leaf shape across its natural distribution. The variation is most marked in basal leaves, but as these are rarely collected the variation is illustrated from middle stem leaves which are generally present on herbarium specimens (Fig. 2). Material similar in leaf shape to those of native British plants occurs in most of western Europe, specimens from Belgium being identical. Plants with broad leaves tend to occur mainly in the Alps. In Scandinavia, the leaflets tend to be longer and less toothed, and eastwards towards the Commonwealth of Independent States, the leaf shape is often narrower. In Bulgaria, Greece and Turkey, at the S.E. end of the range, the leaf margins often have pronounced teeth (but not as pronounced as in forma *ptarmicifolia*).

FIGURE 2. Clinal variation in representative middle stem leaf shapes of *Cardamine bulbifera* (distribution map redrawn from Hegi 1958). Outlying localities are shown as dots (●). The leaves are not drawn to exact scale.

REPRODUCTION AND DISPERSAL

Amongst the British flora, *C. bulbifera* is unusual in that it mainly propagates vegetatively by the axillary bulbils. The bulbils are probably reduced shoots with fleshy scale leaves (Hegi 1958), and are typically about 1 cm long, and black to dark purple. They are readily dislodged from the plant from June onwards. They fall to the ground and, after about four weeks, adventitious roots appear from the axils of the scale leaves, and then a few first leaves. In the second year, the plant produces the typical scaly rhizome with basal leaves, and in the third or fourth year, aerial shoots. Plants grown from bulbils have flowered in their third years in Britain (Ferroussat 1982). Occasionally, bulbils may start developing whilst on the plant; a plant brought to Maidstone Museum in late 1986 had some bulbils 10 cm long (E. G. Philp, pers. comm., 1989).

Many authors note that although flowering is common, *C. bulbifera* seldom produces ripe fruit or viable seed. Schulz (1903) had only seen fruiting specimens five times, and noted that they were all from near the coast, and that where it did fruit, bulbils were less numerous or not formed at all. This latter observation does not appear to apply to British material, fruiting plants regularly having bulbils. Hegi (1958) noted that fruit is only set under special conditions, usually in areas with high humidity and fresh limestone soils. These observations appear to be based on only a limited selection of material; examination of specimens at **K** and **BM** suggests that fruit set becomes more frequent at the south east end of the range, and in Turkey, some populations reproduce solely from fruit, lacking bulbils altogether. Reproduction by bulbils, does, however, seem to be the norm in Western Europe, and there may be a trade-off between fruit set and bulbil production – if the latter are stripped off the plant, fruit set is apparently more likely (Hegi 1958).

In the field in Britain, at least, it is generally not difficult to find a few fruits. Fruits are always borne on the larger plants (typically 22–25 cm tall, compared to the normal average of 19–21 cm), whose stems and foliage remain green and fresh until the seeds are shed. Thus if a patch of flowering plants is revisited in June, there may be one or two fruits maturing on a small proportion of the plants, whereas on the remainder, the small green ovaries which showed some initial development will have dropped off and the plants will have started to die back. In July, when the fruits are ripe (though green) the seeds may be scattered a considerable distance when the siliquae dehisce explosively (as in some other species of *Cardamine*) (Showler 1988). These seeds can be germinated successfully, and plants grown from seed may flower in their third year (Ferroussat 1982). Fruit set appears to have been unaffected by the opening up of the tree canopy by the great storms of 1987 in Britain (C. I. Pogson, pers. comm., 1988).

None-the-less, the sexual reproductive performance of the plant is well below its potential. The plants flower for only a very short period of time in late spring, and Clapham (Clapham *et al.* 1987) reports that they are rarely visited by insects. B. (1866) notes that the flowers have a faint, sweet scent. Ferroussat (1982) noted that plants at Old Park Wood were pollinated by Orange-tip (*Anthocharis cardamines* L.) and Green-veined White (*Pieris napi* L.) butterflies, together with the Raspberry Beetle (*Byturus tomentosus* Degeer (*B. urbanus* Lindemann)) and flies. Occasional visits of beetles and flies have been seen during the current survey, though it is not known if these were pollinators. Often only a small proportion of the plants flower, many reproducing solely by bulbils. The flowers may require cross-pollination (many crucifers have well-developed self-incompatibility systems) to produce seed. Some stamens and ovaries may have retarded development (Hegi 1958), pollen grains may degenerate, and some ovules do not develop at all. There is no support for the observation of Deakin (1871) that the flowers "are often imperfect". The species is a high polyploid with 2n=96 (duodecaploid) (Clapham *et al.* 1987), and the reduced fertility may also involve abnormal chromosome behaviour. Hegi (1958) points out that such reductions in fertility are often associated with taxa of hybrid origin, but there is no evidence to suggest this in *C. bulbifera*.

Cardamine bulbifera spreads vegetatively by creeping rhizomes and often forms patches.

Bulbils (and seed) may be dispersed naturally in a number of ways. Hegi (1958) reports that bulbils are often carried by ants in continental Europe, but this has not been observed in Britain. Many localities in Kent and Sussex are on, or close to, river banks and ditches, suggesting that dispersal by water may occur; Rose (1966) suggested that this may govern its micro-distribution in the Weald. Bulbils may also be transported by wheels, hooves or muddy boots; the majority of localities in the Chilterns and close by (v.cc. 20, 21 and 24) are alongside footpaths, though this could also reflect other ecological factors. It is also possible that small mammals play some part in distribution, but this has not yet been noted.

Whatever the mechanism, dispersal is obviously a limiting factor of distribution. Plants are often locally abundant but absent from apparently suitable sites nearby. On a wider scale, the distribution is often irregular and disjunct, and there are many gaps between populations (e.g. Hegi 1958). The plant does not appear currently to be limited climatically in Britain; it survives well in many introduced localities outside its native range, often persisting for long periods of time and spreading, as at Glenbervie (v.c. 91), where, since 1934 or before, it has colonised many parts of the extensive grounds and now forms a very large population.

HABITATS

In South East England, *C. bulbifera* is associated with two distinct types of woodland; first, the wet, generally acidic woodlands of the High Weald in Kent and Sussex, and second, the Chiltern Beech woods which are drier with basic soils. These two types are referred to subsequently as the High Weald and Chiltern.

The High Weald woodlands occur on both sides of the Kent-East Sussex border. They are for the most part ancient woodlands, often now broken into quite small areas, called 'shaws' or 'rews' – thin strips of woodland left between fields (Whitebread *et al.* 1989a, b). They have survived clearance primarily due to the presence of the many small, steep-sided streams or gills, which make the land unsuitable for agriculture. The soil is generally acidic to neutral (the soil pH ranged from 5 to 7) and clayey, and the tree canopy is predominantly *Quercus robur* L., *Fraxinus excelsior* L. and *Carpinus* *betulus* L. (Table 1). In the shrub layer, *Corylus avellana* L. is common, often with much *Crataegus laevigata* (Poiret) DC. The herb layer is usually very dense with many spring flowers such as *Hyacinthoides non-scripta* (L.) Chouard ex Rothm., *Mercurialis perennis* L., *Ranunculus ficaria* L., *Lamiastrum galeobdolon* (L.) Ehrend. & Polatschek and *Allium ursinum* L. *Carex pendula* Hudson is common in the damper places, and it is here especially that *C. bulbifera* is to be found, most frequently on the lower levels of the gills. It is often easiest to find the plant by walking up the stream beds, but even then the plants may not be easy to spot as in dappled sunlight small patches can be easily overlooked amongst *H. non-scripta* and other species of a similar height, and they are often very localised. For instance, by the Kent Ditch (a small stream marking the Kent-Sussex border for much of its length), *C. bulbifera* can occur on one bank but not the other 50 cm away. Many populations only have 15–20 flowering plants, usually, though not always, with juveniles, all occurring within a radius of 2–3 m. Plants are not always restricted to stream banks, and may be found nearby in damp, shaded areas of woodland. At a number of stations colonies are found on damp, sloping road verges, though these are often associated with ditches or water seepage.

Almost all the Kent and East Sussex sites are on Weald Clay or Wadhurst Clay and are of the High Weald habitat, as are the native sites in Surrey (two now destroyed) and those in the eastern part of West Sussex. However, at Harting (v.c. 13) (where the plants are probably introduced), High Rocks (v.c. 16) and Hawkenbury (v.c. 16), the plants are found on sandy soils. The single plant found near Brown's Wood (v.c. 14) is from a sandy road verge.

In contrast to the High Weald habitat, the Chiltern woodlands where *C. bulbifera* is also found are typically with a canopy of *Fagus sylvatica* L., often with some *Prunus avium* (L.) L. and *Fraxinus excelsior*, an understorey of *Corylus avellana* and *Ilex aquifolium* L., and a sparse herb layer (Table 1). The woodlands are relatively dry and on slopes, though aspect appears unimportant. The soil is generally a very thin layer of clay with flints over chalk; the pH of the soil around the roots of the plant ranges from about pH 6·0 to 7·5, and often there is a considerable amount of leaf litter. Hughes (1988) and Robinson (1988) acknowledge that *C. bulbifera* is a plant of ancient woodland and almost without exception, these woodlands are classified as such (Table 2). The herb layer confirms this, typically consisting of sparse *Mercurialis perennis*, *Rubus* spp., *Hedera helix* L., *Galium odoratum* (L.) Scop., *Arum maculatum* L. and *Lamiastrum galeobdolon*. *Hyacinthoides non-scripta* is often absent reflecting its preference for the more acidic soils, and *Carex pendula*, a common associate in the High Weald, is totally absent.

Cardamine bulbifera can be found in such Chiltern woodlands in Buckinghamshire, Hertfordshire and Middlesex, generally in small patches or strips along the edges of footpaths or close to them. The sparse ground layer and gently sloping terrain makes the plants more conspicuous than in the High Weald woodlands. Again there are frequently only 20–30 flowering plants (though 100–150 is not uncommon), but the number of juveniles ranges from very few to several thousand. The plants will grow through a thin covering of *Mercurialis perennis*, *Rubus* spp., or *Hedera helix*, and sometimes *C. bulbifera* grows in open areas where leaf litter has blown clear, usually as a tight patch. There are only two Chiltern sites on road verges, but this may be because wooded verges are much less common in the Chilterns than the Weald. There is no association with water, and only two Chiltern sites are anywhere near water courses and one of these is man-made.

The plants in Staffordshire in the ancient Needwood Forest are found in a habitat which approximates to the Chiltern type, but are on flat land and on Keuper marl, not chalk.

Plants can often be found in replanted ancient woodland, provided that there has not been too much disturbance to the soil and ground layer. They are able to survive in deciduous woodlands, but are lost under dense conifer shade. Trimen (1862) noted that in Sussex "it appears to like copses recently cleared of underwood".

Elsewhere in Europe, *C. bulbifera* also occurs in a similar range of acidic and basic woodlands (e.g. Keller 1988), though most authors only note that it is characteristic of base-rich Beech woods. Hartmann (cited in Hegi 1958) suggests that in the more continental areas it prefers damper soils, and at lower altitudes, base-rich soils. In Southern Europe, it only occurs in the mountains, and often on north-facing slopes.

Table 2 classifies the known stations by woodland type as identified in the N.C.C. Inventories of Ancient Woodland (Hughes 1988; Robinson 1988; Whitebread *et al.* 1989a, b; Hutton 1990) for each vice-county. It should be borne in mind that areas of less than two hectares are excluded from these inventories so that some small sites are not classified.

TABLE 1. VASCULAR PLANT SPECIES RECORDED WITHIN 2 M OF *CARDAMINE BULBIFERA* IN THE HIGH WEALD AND CHILTERN HABITATS
Only species occurring in 15% or more of either site are included; a further 56 species were also noted at lower frequencies.

	Recorded in % of sites	
Species	HIGH WEALD* (n = 27)	CHILTERNS (n = 57)
Acer pseudoplatanus	15	12
Alnus glutinosa	19	0
Carpinus betulus	52	16
Corylus avellana	48	25
Crataegus laevigata	22	0
Fagus sylvatica	11	74
Fraxinus excelsior	26	33
Ilex aquifolium	7	21
Prunus avium	0	16
Quercus spp.	26	9
Allium ursinum	19	2
Arum maculatum	4	30
Carex pendula	30	0
Circaea lutetiana	15	5
Galium aparine	41	19
Galium odoratum	7	33
Geranium robertianum	15	7
Hedera helix	70	37
Heracleum sphondylium	15	2
Hyacinthoides non-scripta	30	30
Lamiastrum galeobdolon	26	21
Melica uniflora	7	24
Mercurialis perennis	45	58
Ranunculus ficaria	19	11
Rubus spp.	74	69
Urtica dioica	19	16

* excluding High Rocks.

DISTRIBUTION

In Britain, *Cardamine bulbifera* is currently known as a native species in Sussex (v.cc. 13 and 14), Kent (v.cc. 15 and 16), Surrey (v.c. 17), Hertfordshire (v.c. 20), Middlesex (v.c. 21), Buckinghamshire (v.c. 24) and probably Staffordshire (v.c. 39) (Fig. 3). It has not been recorded in its sole Berkshire (v.c. 22) locality since 1944.

In view of their isolation from the other sites in South East England, and the regularity with which the plant is introduced, the Staffordshire sites must be viewed with caution. The first record from Pendeford (Pitt 1796) was unusual in that it occurred in "hedge sides on this farm"; however, Pitt's list also included other species of old hedgerows (e.g. *Rhamnus cathartica* L., *Frangula alnus* Miller) and is packed with detailed, careful botanical observations and there is no obvious reason to reject the record. There are at least three localities around Needwood Forest, which have sometimes been suggested to be introduced (Edees 1972), and there is an undoubted introduction at Trentham. Edees (1972), whilst quoting it as "rare and of doubtful status" accepts Pendeford and Blithfield as native localities. D. P. Earl (pers. comm, 1987) notes that colonies he has seen recently "look native on the Keuper Marl" but also points out that none of these are far from houses and two are close to a road or track, suggesting that they may have originally been planted. The evidence from Chiltern populations, also associated with tracks, suggests that this need not necessarily be so, but 'looking native' is not always a good guide to status either (Webb 1985). As the early dates of recording lend

TABLE 2. ASSOCIATION OF NATIVE POPULATIONS OF *CARDAMINE BULBIFERA* WITH ANCIENT WOODLANDS AS CLASSIFIED IN THE N.C.C. INVENTORIES OF ANCIENT WOODLAND

Vice-county	No. sites	Ancient woodland		Other habitats*
		Semi-natural	Replanted	
13. W. Sussex	8	4	1	3
14. E. Sussex	33	19	4	10
15. E. Kent	3	3	–	–
16. W. Kent	19	12	6	1
17. Surrey	1	–	1	–
20. Herts.	12	7	–	5
21. Middx.	2	2	–	–
24. Bucks.	56	38	13	5
39. Staffs.	2	–	2	–
Total	136	85 (62%)	27 (20%)	24 (18%)

* includes sites too small (less than 2 ha) to classify.

support to its native status, and as the plant also occurs in disjunct localities elsewhere in Europe, we currently accept the Needwood Forest plants as native.

Elsewhere in the British Isles, the plant has been introduced. It is often grown in gardens, perhaps as an unusual plant – it is certainly a pretty, early-flowering plant which can tolerate dense shade, though there are many other species with these attributes which flower for longer periods of time. Clear evidence is hard to come by, but *C. bulbifera* appears to have been cultivated in large gardens for many years (e.g. B. 1866). Once established, it can often increase rapidly and become almost a weed, as at Uffculme (v.c. 3), and at Knightshayes Court (v.c. 4) and Cliveden (v.c. 24) where it appears sporadically in flower beds. Escapes to adjacent verges or woodland, as at Bath (v.c. 6), Wellingore Hall Park (v.c. 53) and Silverdale (v.c. 60), are not uncommon, and it may persist for long periods of time. There are also many scattered records for introduced plants from the 1920s and 1930s, where it can no longer be found. Bulbils are easily collected, and the flourishing colony at Trentham (v.c. 39) may well have originated from the plants at Yoxall, and the casuals in v.c. 95 could have come from Glenbervie, not many kilometres away. Interestingly, the majority of West Country introductions are of forma *ptarmicifolia* suggesting a common origin. It would certainly be instructive to learn more of the history of the known introductions.

The plant has also been recorded as introduced to some localities in Germany (Hegi 1958).

RECORDS

Records have been collated from national and county Floras, journals, correspondence with the B.S.B.I. vice-county Recorders and numerous other botanists, and from the following herbaria: **BEL**, **BM**, **DBN**, **K**, **OXF**, **LANC**, **RNG**, **TCD** and **YRK**. Full details, including population forms, are lodged at the Biological Records Centre, Monks Wood.

In the following list of localities, vice-counties or sites where the plant is introduced are marked with an asterisk (*). The records are given in order of vice-county, 10-km square, and tetrad (tetrad nomenclature follows Ellis 1986). Exact grid references are given where known for extinct or unvisited sites. The names for modern sites are largely those on the First or Second Series 1:25,000 or 1:50,000 Ordnance Survey maps. An estimate of the total number of plants is given for most sites (sometimes only as the number of flowering plants counted). All undated sites have been visited recently between 1987 and 1992 by A.J.S., often with help from co-workers, unless otherwise stated. Sites where we have seen material of forma *ptarmicifolia* are noted.

**V.c. 3, S. Devon*: Bere Ferrers (SX/4.6L), 1916, C. W. Bracken (Martin & Fraser 1939), presumed

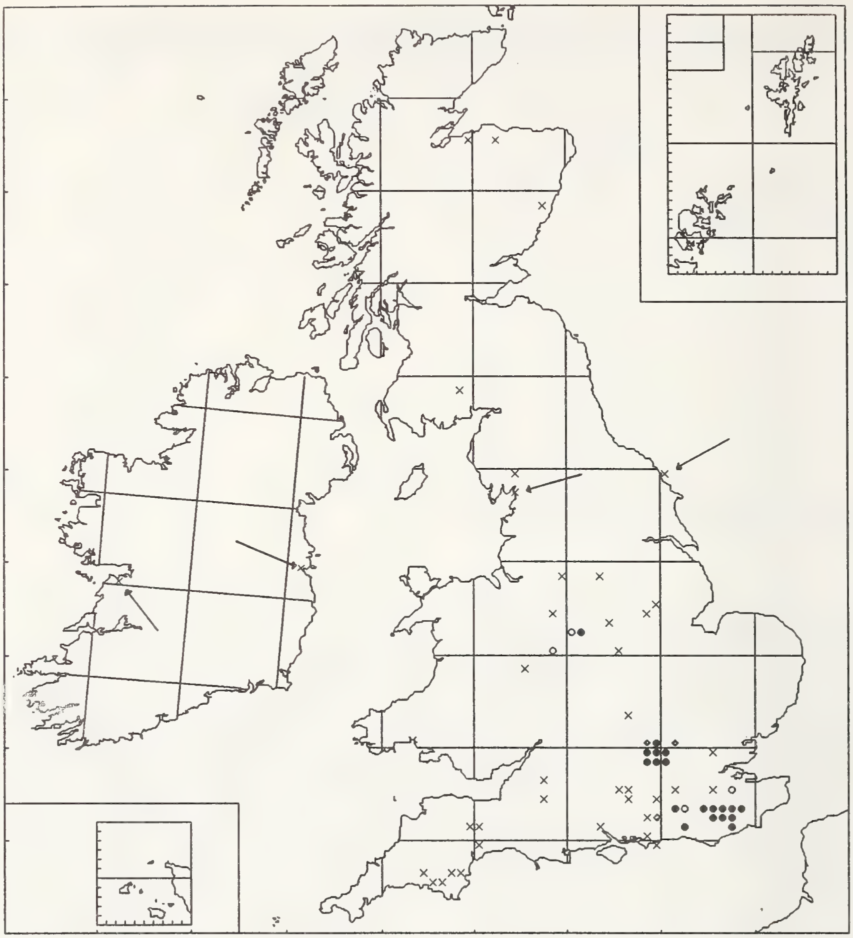

FIGURE 3. Current 10-km square distribution of *Cardamine bulbifera* in Britain and Ireland. ● native 1987 onwards, ○ native pre-1987, × introduction (all dates), ◇ record of uncertain status.

extinct. Plymstock (SX/5.5B), Plympton (SX/5.5N) and Harford (SX/6.5J), 1913, H. W. Smith (Martin & Fraser 1939), presumed extinct. Dartington Hall (SX/7.6W), woodland area of garden, C. Smith. Torbryan Plantation (SX/8.6I), "introduced by Mr Ogilvie and now spreading" (Martin & Fraser 1939), presumed extinct. Venn Ottery (SY/0.9R), over 800 plants, shaded lane verge, escaped from adjoining garden, W. Tucker (forma *ptarmicifolia*). Uffculme (ST/0.1R), garden of Yondercott House, thousands of plants over 0·25 hectare, in thin, damp woodland, Miss R. G. Laidlaw.

**V.c. 4, N. Devon*: Sherwill (SX/7.6), 1884, Wainwright (Martin & Fraser 1939). Knightshayes Court, National Trust (SS/9.1S), gardens by house, Miss R. G. Laidlaw (forma *ptarmicifolia*).

**V.c. 6, N. Somerset*: Millards Hill, Trudoxhill (ST/7.4L), in shrubbery and roadsides, escaped from Millards Hill House, P. Green & R. G. B. Roe (forma *ptarmicifolia*). Smallcombe Wood, Bath (ST/7.6S), scattered throughout but more frequent near ruins of adjacent garden, R. Randall & R. G. B. Roe (forma *ptarmicifolia*). Prior Park, Bath (ST/7.6), at one time abundant, destroyed by building work (Murray 1896). Batheaston (ST/7.6Z), about 500 plants, shaded track behind houses, probably dumped from garden, D. E. Green & R. G. B. Roe (forma *ptarmicifolia*).

**V.c. 11, S. Hants.*: Millbrook (SU/3.1W), J. F. Rayner (1915); presumed extinct.

**V.c. 12, N. Hants.*: Long since disappeared from East Ockley House (SU/5.5Q), D. H. Scott. Small copse near Preston Candover (SU/6.4), 1879, H. R. P. Fitzgerald, and Basingstoke (SU/6.5), 1916, G. W. Willis (Townsend 1904; Rayner 1929).

V.c. 13, W. Sussex: *Hotham Park, Bognor (SZ/9.9J), garden of former Bognor Museum, now demolished (H. W. Matcham teste M. Briggs). *Hunstan Copse (SU/8.0, R/Q), H. L. F. Guermonprez, ancient wood; searched for recently without success by N. J. H. Sturt, and probably last seen in the 1940s by F. Rose (pers. comm. to Mrs M. Briggs, 1987). *Harting Combe (SU/8.2C), one large clump, road side in Beech wood. A record for SU/8.2D (Hall 1980) is probably an error for this site. Half-way between Midhurst and Petworth (SU/9.2); this record, cited in Arnold (1907) and Wolley-Dod (1937), is based on a specimen said to be in **herb. Borrer**, which cannot be traced at **K**. Although the area is suitable, there are no other records and this site must be treated with caution. Warnham (TQ/1.3), "small copses in the parish", 25 April 1862, H. Trimen (Trimen 1862); exact site not traced, and presumed extinct. Langhurst Copse (TQ/1.3S), wooded verge south of, 2000+ plants. Tickfold Gill (TQ/1.3T), by stream in wood, 29 plants ("hundreds" were reported for this site in 1987, F. Rose *et al.* (pers. comm. to M. Briggs, 1987) so possibly overlooked). Nuns Wood (TQ/1.3, X and Y), a few plants in the woodland at the southern end, Mrs M. Briggs, 1961, and very sparse in western stream gulley in 1988. Great Benhams (TQ/1.3Y), north of, about 200 plants, shaded bank of Boldings Brook by bridge; this site is declining due to invasion by *Heracleum mantegazzianum* (A. Knapp, pers. comm., 1992). Horsegills Wood, Rusper (TQ/1.3Y), wet woodland, 600+ plants, Mrs M. Briggs, 10 May 1991. Terry's Cross (TQ/2.1H), 500 plants in hedge. (The record for TQ/2.2M (Briggs 1990) is an error.) Faygate (TQ/2.3), near, C. E. Salmon (Wolley-Dod 1937), probably extinct. There is a 40-column record card held at B.R.C. with details "Rusper, 11 June 1957, Collyers School Herbarium" which has the grid reference "TQ/20–.32–". As this grid reference refers to Roffey, Horsham, about 5 km south of Rusper, and *C. bulbifera* is known near Rusper in TQ/1.3, this record is dubious. Unfortunately, the Collyers School Herbarium cannot now be traced (Kent & Allen 1984) and it is impossible to check if the grid reference was correctly transcribed, or was added later to the B.R.C. card.

V.c. 14, E. Sussex: Withyham (TQ/4.3X), 140 plants in wood by Hewkins Bridge and also in churchyard, Miss E. J. Rich, 1992. Mayfield, Lawyers Wood (TQ/5.2T), Miss E. J. Rich, 6 July 1987; fruiting plants seen in 1992. Highreede Wood, Mayfield (TQ/5.2), J. Goodyer 1634; exact site not traced (Wolley-Dod 1937). Old Place Farm (TQ/5.2Y), one plant, E. side of road, Mrs P. Donovan, 1992, and roadside copse, Miss E. J. Rich, fruiting in 1992. Coggins Mill, by bridge (TQ/5.2Y), Miss E. J. Rich, 1992. Heronry Wood (TQ/5.2Z), 15 plants, wet muddy area close to entrance of wood near stream. P. C. Hall noted it as abundant in this wood when he was recording for the *Sussex plant atlas* (pers. comm., 1991) so possibly some colonies were overlooked. Furnace Wood (TQ/5.2Z), 6 m long patch on east verge of lane, Mrs P. Donovan, 1992. Banky Wood (TQ/5.2Z), four scattered groups in wet woodland, some on stream bank. TQ/5.3N, Hall (1980), further details not traced. Houndsell Place (TQ/5.3V), in 'wild garden' (wood), P. C. Hall, 26 April 1970. Mark Cross (TQ/5.3), in a hedge by the road side about a mile (1.5 km) from (Deakin 1871); presumed extinct. Great Wood (TQ/5.3X), P. C. Hall, 31 May 1969. Coggins Mill, (TQ/6.2D) stream bank 200 m east of, Miss E. J. Rich, 1992. Tidebrook (TQ/6.2E), large numbers of plants along 50–100 m length of road verge in woodland, and 20 flowering plants in damp, shady woodland to north. Mousehall (TQ/6.2E), 110 plants in lane east of Mill, and two in garden of Mousehall Cottage on old dam embankment, Mrs E. Gibb, 1992. Sharnden (TQ/6.2E), about 40 plants, wet woodland. Hawksden Park Wood, west of Hare Holt (TQ/6.2I), about 15 plants in hedgebank and ditch. Foxholes Wood (TQ/6.2G), J. Goodyer, 1634; not seen subsequently (Wolley-Dod 1937). TQ/6.2K, Hall (1980), exact site not recalled, possibly Cox's Mill (pers. comm., P. C. Hall, 1991). Burwash Weald (TQ/6.2L), three sites: steep bank near Mousehole Farm, 325 plants; Willingford bridge, 25 flowering plants on steep woodland stream bank and then clumps along the north bank of the R. Dudwell for about 1·5 km S.W. of bridge (F. R. Philps, pers. comm., 1987); Blackbrooks, about 100 scattered, flowering plants in wood. Coalpit Wood and Wet Wood (TQ/6.2M), about 500 plants in damp woodland. Wood N.W. of Stonegate Station (TQ/6.2, N & T), about 100 plants in damp Hornbeam wood. Rye Green Farm (TQ/6.2R), two sites: woodland west of farm with about 100 scattered, flowering plants; Bog Wood, 100 flowering plants on south bank, 60 on north bank. Bateman's (TQ/6.2R), 140 plants flowering along 25 m of dense hedge, and 500 plants in copse to north. Fonthill Farm (TQ/6.2W), farm track, 60 plants. Copse between Boarders Farm and Dudwell House (TQ/6.2X), P. C. & J. F. Hall, 31 March 1968; site now destroyed. Shoyswell Wood (TQ/6.2, ?Y/Z), Mrs M. Warren, 1972 (there is some doubt about the exact location of this site as the original grid reference was given as TQ/688.261). Burgham (TQ/699.284Z), un-named wood N.W. of, Mrs M. Warren, 1972. Wardsbrook Farm (TQ/6.2Z), about 500 plants in wood by stream. Singehurst Farm (TQ/6.2Z), neglected, small, swampy wood S.E. of, probably only a few plants, Mrs L. B. Burt, 1984; not seen in 1989 but probably overlooked. Rivenhall (TQ/6.3B), large patch (5 m long) on road verge with a few plants in ditch behind, Mrs M. Vincent-Smith, 1992. Brown's Wood, road verge opposite Coker's Down (TQ/6.3D), one flowering plant. (The record for TQ/6.3E in Briggs (1990) refers to High Wood, v.c. 16.) Brown's Wood, near Sunninglye Farm (TQ/6.3J), with 180 plants on verge in hedge, 30 flowering plants on verge in edge of wood, and 215 plants in wood. Sluice Wood (TQ/6.3M), thinly scattered on stream bank in dense woodland, mostly on north side of stream, one large patch on south side of stream. Win Bridge (TQ/6.3M), 30+ flowering plants in small copse by administrative county (but not v.c.) boundary (presumably same site as Bayham Abbey (Arnold 1907, etc.)). Floshet Wood (TQ/6.3N), nine plants in wood by stream; this site is in the administrative county of Kent. Park Wood, near Sidley Green (TQ/7.1, F/K), H. J. Sargent (Wolley-Dod 1937); not seen recently. Goldspur Wood (TQ/7.1J), one very large clump. Hollington Wood (TQ/7.1V), *A. H. Simpson*, 1918 (**K**); now apparently built on, though recorded for this tetrad in Hall (1980). Beauport Park (TQ/7.1, ?W/X) (Wolley-Dod 1937); this site is now a caravan park and the plant is presumed extinct. Bluemans (TQ/7.1X), wet, shady woodland, with 50 flowering plants (many fruiting). Brookside Farm, wood (TQ/7.2C), 10+ plants on edge of recent woodland/verge. Fleet Wood (TQ/7.2D), about 40 flowering plants on edges of muddy bridleway in damp, shady conditions. Little Boarzell, Swiftsden House (TQ/7.2, E & J), about 120 flowering plants (and more vegetative) mainly in the wild garden but also on verge. Wood between Mountfield and Robertsbridge (TQ/7.2, F/G), 1944, Miss Hanson (Peatfield 1944). Etchingham, Gigmore Wood (TQ/7.2H), 20 plants in ancient woodland. Peagle Wood (TQ/7.2J), 85 plants in wood on Sussex side of Kent Ditch, and damp woodland close to road in adjacent tetrad (TQ/7.2P), about 3000 plants, many flowering. Copse in fork of A265 and minor road to Merriments Shaw (TQ/753.284J), P. C. Hall, 8 May 1970; wood cleared and plant extinct by 1988. TQ/7.2M, Hall (1980), further details not traced. Merriments Shaw (TQ/7.2P), several patches with over 400 flowering and many vegetative plants in ancient woodland on Sussex side of Kent Ditch. Crossroads Farm (TQ/7.2P), about 200 plants in wood by A229 on Sussex side of Kent Ditch, and about 75 plants in wood 300 m south west of cross-roads. Terrace Wood (TQ/7.2, S/T), about 200 plants on both sides of A229, plus one by stream. Bodiam Wood (TQ/7.2T), one large patch near wet hollow. Records from "about Hastings" presumably refer to sites at Hollington, Beauport Park and Bluemans (Peatfield 1943), and there are no localised sites in TQ/8.1.

V.c. 15, E. Kent: Holman's Wood (TQ/777.287U), woodland with wet gills, F. Rose; not seen 1991, but probably still present. Kitchenham Farm (TQ/7.2Y), wood by Kent Ditch, E. G. Philp, sometime between 1971 and 1980. Detling, Maidstone (TQ/7.5), *A. D. Melvin*, 21 June 1867 (**BEL**); this is a surprising record. N.E. of Hawkhurst (TQ/763.313Q), last seen 1950s (E. G. Philp, pers. comm., 1991). Rolvenden, wood east of Halden Lane Farm (TQ/8.3L), 50+ flowering and many vegetative plants. Little Halden (TQ/8.3L), 17 flowering plants on steep north facing bank by stream near ancient woodland, plus one downstream; this is probably the same general locality as Little Oven Wood (Hanbury & Marshall 1899). Little Halden (TQ/861.326R), *F. Rose*, 1949 (**MNE**), site now destroyed .

V.c. 16, W. Kent: TQ/5.3P, Philp (1982), likely to be near High Rocks, but further details not known. High Rocks, Tunbridge Wells (TQ/5.3U), one large dense patch by railway with about 2400 plants, and two smaller patches to west with 250 plants; about 100 plants in scattered colonies on dry sandstone ridges and rocks at eastern end of rocks; more plants north of rocks by stream. Hungershall Park, Tunbridge Wells (TQ/5.3U), 300 flowering plants in dry woodland, presumably the same locality as Tunbridge Wells Common, K. E. Bull (Wallace 1954). Mount Sion (TQ/5.3Z), in a wood (Forster 1816); probably built on. *Platt (TQ/616.562), D. McClintock, c. 1960, patch in woodland and in a hedge nearby, probably escaped from garden. Palmers Farm, wood (TQ/6.3E), about 100 flowering and more vegetative plants in ancient woodland. High Wood (TQ/6.3E), scattered plants in five areas, with 60 flowering plants on verge, 100 in cleared strip, and 100 in woodland, and 300 plants on dry sandy trackside in ancient woodland, and 130 in deep grass on cleared edge of wood. Mouseden (TQ/6.3E), on stream banks in fragments of ancient woodland, three groups with 17, 12 and 75 plants, extending into tetrad J. Pembury, wood east of Larkfield Hall (TQ/6.3J), twelve plants by stream. N.W. of Lamberhurst (TQ/661.377T), E. G. Philp, last seen about 1957, not refound, area spoiled by pheasant management. TQ/7.2J, Philp (1982), further details not traced. Kent Bridge Farm (TQ/7.2P), two sites: 1120 plants on bank of ditch in wood; 40+ plants on shaded road verge to north. Winch's Plantation (TQ/7.2P), 80 flowering plants in ancient woodland, well above stream level. Peagle Wood (TQ/7.2P), a few plants on Kent side of Kent Ditch. Merriments Shaw (TQ/7.2P), several plants on Kent side of Kent Ditch (see also v.c. 14). Goudhurst (TQ/708.374D), near A262 west of, F. Rose, last seen 1950s; site now destroyed. Little Pix Hall Farm (TQ/7.3F), wood north of, only two flowering plants seen, possibly more present. Furnace Wood (TQ/7.3H), south side, one dense patch with 30 flowering plants and a few stragglers in woodland by track. Wet Wood (TQ/7.3H), several plants near stream in replanted, wet ancient woodland; extinct at another site at TQ/733.358. N of Hawkhurst, (TQ/757.313K), last seen 1950s (E. G. Philp, pers. comm., 1991); possibly same as Highgate (Hanbury & Marshall 1899). Hedgingford Wood (TQ/7.3M), two sites; north side, two patches in woodland near stream, one with 600, the other to south with 650 flowering plants, and N.E. corner, 23 plants by stream in Hornbeam wood. Hartley, Forestry Commission wood (TQ/7.3M) west of, 42 plants on edge of ride just clear of conifers, an old site to east has been lost due to conifer planting. Another site at TQ/750.384M has disappeared under conifers.

V.c. 17, Surrey: *Hog's Back (TQ/0.5), demesne of 'Greyfriars', south-facing Beech wood, one patch, J. R. Akeroyd, May 1968. *Box Hill (TQ/1.5Q), by the River Mole, Miss B. M. C. Morgan, 1966, probably planted (Lousley 1976). About 250 plants seen in 1989, though few were flowering. Grove Copse (TQ/1.3T), many plants in 1949, only one visible in 1966, D. P. Young. Timber Gill (TQ/1.3T), about 100 plants in wooded ravine. Lower Gages Farm, ravine of Fylls Brook (TQ/184.378Y), numerous small plants seen on edge of stream, Surrey Flora Committee meeting, 1967; extinct by 1989 (and probably long before) due to activities of pigs. In deep ravine near Garrett Farm, Ockley (TQ/1.3; precise farm not traced), both on Sussex and Surrey banks, *E. Straker*, 15 May 1880 (**BM**); presumed different from above sites and now extinct. (The record for Waddington (Brewer 1863) is an error for *Lathraea squamaria* (Salmon 1931).)

**V.c. 18, S. Essex*: Warley Place (TQ/5.9V), still to be found in 1992 after 55 years in the derelict garden of A. E. Wilmott's home, where it was introduced (forma *ptarmicifolia*), D. C. Bloomfield (Jermyn 1974).

V.c. 20, Herts.: Baldwins Wood (TQ/0.9E), L. J. Stearn, pre-1967; not seen 1989–1991 but possibly overlooked. Bottom Wood (TQ/0.9G), one patch with 15 flowering stems. Chorleywood, Great Greenhills Wood, west of M25 (TQ/0.9H), 200 plants (see also tetrad M). Chorleywood, west of Dell Farm (TQ/0.9I), thousands of plants; also E.N.E. of Dell Farm, over 2000+ plants on south and west side of wood. *Chorleywood Common (TQ/0.9I), 640 plants in secondary woodland N.E. of pond; probably introduced. Bullscroft Spring (TQ/0.9I), patch about 4 m^2, G. Salisbury & J. Saunders, 1990. Sarrattmill Bridge, N.W. of (TQ/0.9J), 250 flowering plants in thin strip of woodland. Limeshill Wood (TQ/0.9J), "a scattering of plants amongst *Hyacinthoides* on a steep bank", G. Salisbury, 1991. Hanging Lane Wood (TQ/0.9J), over 2000 plants widespread in woodland. Springwell, Garrett Wood (= High Wood near Rickmansworth (Webb & Coleman 1849)) (TQ/0.9L), numerous plants remaining in Beech wood, though half of the wood (mainly the Middlesex part, where it was once abundant) has been lost to a quarry. Chorleywood, Great Greenhills Wood east of M25 (TQ/0.9M), 3000–4000 in west half, and many thousands in the east half, one of the largest, continuously covered areas seen. Beechengrove Wood (TQ/0.9N), "masses over quite a large area", G. Salisbury, 1991. Loudwater (TQ/0.9N), road verge bordering large house, 150 plants possibly relict from Loudwater Wood (Webb & Coleman 1849), and possibly the same as "larch plantation above Loudwater to the north, but adjoining the road from Croxley Green to Solesbridge" (Jackson 1887). Another Jackson (1887) record "in a wood a little further towards Solesbridge Wood" probably refers to Long Spring (TQ/052.970N) (T. J. James, pers. comm., 1991). Scrubbs Wood (TQ/0.9, N/P), L. J. Stearn, presence now doubtful, and probably the same locality as Blunt Wood, 20 April 1947, R. A. Graham, also not seen recently. Sawpit Spring (TQ/059.982P), P. J. Ellinson, 1992; a small wood mostly destroyed during construction of the M25. Harrocks Wood (TQ/0.9T), 400 plants in scattered colonies. Assumed to be the same site as "wood at Red Heath", Mrs E. Shute (Webb & Coleman 1849). Whippendell Wood (TQ/0.9T), many, mostly small, scattered colonies (including Rousebarn Lane, P. J. Ellison), over 3000 plants. Lees Wood (TQ/0.9U), S. & P. Blackmore, 2 June 1978. A B.R.C. 40-column record card from "wood opposite Chandlers Cross, May 1922, P. W. Richards" (**NMW**), presumably referring to Harrocks Wood or Whippendell Wood, was allocated the grid reference TL/0.0 for the B.S.B.I. Maps Scheme (Perring & Walters 1962) rather than TQ/0.9; this appears to be an error and there are no other records for TL/0.0. There is also a record for "Brickett Wood, West Watford" (**OXF**). Bricket Wood (TL/1.0F) was in the 19th century an ancient wood (now the Building Research Station) and could conceivably have supported the species as it was species-rich, calcareous and damp, but there are no other records for this site (T. J. James, pers. comm., 1991).

V.c. 21, Middlesex: Harefield Church (TQ/0.8P), wood east of, many plants in ancient mixed woodland. Park Wood (TQ/0.9K), 100+ plants along west end of footpath in ancient wood. Jacks Lock (TQ/0.9K), copse N.E. of, last seen by R. M. Hamilton in 1972 who described it as "abundant"; wood now over-grown and not refound in 1989. Springwell, Garrett Wood (TQ/0.9L); see v.c. 20.

V.c. 22, Berks.: Last recorded in Park Wood, Bisham (SU/8.8M) (presumably same as Bisham Wood; Druce 1926), 29 April 1944, A. J. M. Bailey. A specimen in **RNG** labelled "Newbury, *C. Grant*, 1966", has a grid reference referring to the University Campus in Reading.

V.c. 23, Oxon: Recorded from Oakley Hill, near Chinnor (SU/7.9P) but probably in error (R. Fitter, pers. comm., 1990).

V.c. 24, Bucks.: Bloom Wood (SU/8.8U), about 3000 plants in ancient woodland. Horton Wood (SU/8.8U), thousands of plants in ancient Beech wood. Warren Wood (SU/871.899U), no other details available. *Cliveden, National Trust (SU/9.8C), in the gardens near the pond. Booker Common and Spring Coppice (SU/8.9F), a large population with about 800 plants flowering in ancient Beech wood. Yewtree Hill Plantation (SU/8.9I), 13 plants on edge of ancient woodland. The Coppice (SU/8.9I), 500+ plants in ancient Beech wood. Park Wood (SU/8.9J), Buckinghamshire tetrad record collected 1965–1985 (R. Maycock, pers. comm., 1988), but not refound 1991–1992. Common Wood (SU/8.9M), several thousand plants in ancient woodland, plus a few young plants on disturbed land 200 m W.S.W. Piggott's Wood (SU/8.9P), three populations with 300, 660 and 630 plants in main ancient wood, and one small colony with 20 plants on west side. Deangarden Wood, near Keep Hill (SU/8.9Q), about 500+ plants in ancient Ash-Beech woodland. The Rye (SU/8.9R), 30+ plants scattered in woodland (probably ancient). Millfield Wood (SU/8.9S), about 500 flowering plants in ancient Beech wood. Hanging Wood (SU/8.9S), 2000–3000 plants, ancient woodland. Green Wood (SU/8.9S), about 1700 plants in four small patches in ancient Beech woodland. Gomm's Wood (SU/8.9T), about 5000 plants in ancient Beech woodland. Hughenden Valley, ancient Beech woods north of Boss Lane Farm (SU/8.9T), several thousand plants. Longrove Plantations (SU/8.9T), about 500 plants in replanted woodland. Hughenden Valley, Citers Wood (SU/8.9U), Buckinghamshire tetrad record, 1978 (R. Maycock, pers. comm., 1988), not refound 1991–1992. Fennell's Wood (SU/8.9V), 400+ plants in ancient Beech wood. Deangarden Wood, near Abbey Barn Farm (SU/8.9V), about 360 flowering and more vegetative plants in ancient Ash-Beech woodland. Barrowcroft Wood (SU/8.9V), 20+ plants in ancient Ash-Beech woodland. Highfield Wood (SU/8.9W), several thousand flowering and numerous vegetative plants scattered through ancient Beech woodland. Gomm Valley (SU/8.9W), two small patches, old woodland bank in Nature Reserve, M. Young, May 1991. Kings Wood (SU/8.9W) about 800 plants in ancient Beech wood. Woolman's Wood (SU/9.8D), about 1000 plants, edge of clearing in replanted ancient woodland. Lower Pyebushes (SU/9.8U), scattered in replanted ancient Oak-Ash wood. Cut-throat Wood (SU/9.9A), scattered in ancient Beech wood, about 3000 plants. Hogback Wood (SU/9.9F), about 2400 plants in ancient woodland. Seagrave's Farm (SU/9.9G), wood N.W. of, 500 plants in ancient Beech woodland, and 120 plants to east in narrow strip of ancient woodland. Ash Grove (SU/9.9J), 3500 plants near railway in replanted ancient woodland. Keeper's Wood (SU/9.9J), about 1000 plants in new plantation of Beech and Oak. Great Beards Wood (SU/9.9L), scattered populations totalling about 6000 plants in replanted ancient woodland (some under conifers), and 100 plants in wood to north. Blue Close Wood (SU/9.9L), thousands of plants, on edge of pine plantation and likely to disappear. Owlsears Wood (SU/9.9L), 315 plants on edge of ancient wood and bank of old hedge. Bottom Wood and Starveacre Wood (SU/9.9L), 180 flowering plants in replanted ancient woodland. Stockings Farm (SU/9.9M), ancient woodland west of, three large populations with 3500, 300 and 210 plants. Wheatsheaf Wood (SU/9.9Q), 35 plants in recent Beech wood. Great Legs Wood (SU/9.9, Q & V), 2000–3000 plants in four main areas in ancient Beech wood. SU/9.9R, Buckinghamshire tetrad record collected 1965–1985, site details unavailable (R. Maycock, pers. comm., 1988). Ongar Hill Farm (SU/9.9S), wood west of, J. Pitt, 1977; not found in 1989, now overgrown. Parsonage Wood (SU/9.9T), 50+ plants in ancient Beech woodland. The Ash Beds (SU/9.9V), 370 plants by track in mixed, recent woodland. *Stowe, National Trust (SP/6.3Y), in the Japanese gardens, R. Maycock; several thousand plants of a variant approaching forma *ptarmicifolia* were seen in 1992. SP/8.0Q, Buckinghamshire tetrad record collected 1965–1985, site details unavailable (R. Maycock, pers. comm., 1988). Hyde Heath, Hyde House Wood (SP/9.0F), D. Ferguson, 1986. White's Wood (SP/9.0F), 200 plants, all vegetative, under dense Spruce canopy, and 250, also all vegetative, under Beech. White House Farm (SP/9.0K), Gracelets Wood north of, 3000 plants in old game covert. Monk's Wood (SP/9.0K), numerous plants in ancient wood and on bared strip. Elvidge Wood (SP/9.0K), ancient Beech wood west of, 500+ plants. Lower Bois, Hodds and Hilsbury Woods (SP/9.0Q); good numbers of plants spread along N. edge of ancient wood, and a few plants in N.W. corner of Lower Bois Cemetery. The Larches (SP/9.0X), only one plant seen in neglected, ancient, deciduous woodland. Newland Park (TQ/0.9B, possibly also in tetrad C), C. J. Smith, 1979, recent woodland. Carpenters Wood (TQ/0.9D), 120 plants in ancient woodland. Chenies (TQ/0.9E), 500 plants in wood adjoining ancient woodland. Chenies Bottom (TQ/0.9E), in two main groups with 52 and 60 plants plus a scattering of vegetative ones elsewhere. West Wood (TQ/0.9E), a very dense patch with 1350 plants in replanted ancient woodland. Turveylane Wood (TQ/0.9J); two small populations, one with about ten plants, the other with about 20 plants, replanted ancient woodland. Mount Wood (TQ/0.9J), three large groups plus scattered plants elsewhere in ancient woodland, about 650 plants. Denham Green, Ranston Covert (TL/0.8P), about 30 plants in ancient Beech Wood at foot of very steep slope.

V.c. 39, Staffs.: Pendeford, "hedge sides on this farm" (SJ/8.0), Pitt (1796). Blithefield, grove by the churchyard (SK/0.2), Mr Stanmers (Garner 1844); this site was thought to be a probable introduction by Perring & Walters (1962), though on what basis is not known; Pendeford is at the west end of Needwood Forest and if accepted as native at the eastern end, could well be native here too. Needwood Forest (SK/0.1 or 0.2), Garner (1844). Ridge (1922–1929) "failed to find the plant anywhere in Needwood Forest", and others have followed his caution in accepting the record. Yoxall (SK/1.2L), 40+ flowering plants on wooded road verge, replanted ancient woodland. Edees (1972) also gives "abundantly in a copse between Newchurch and Scotch Hill . . . and in the wood, formerly known as Coalpit Slade, on the east side of the road near Darleyoak Farm". *Ash Green, Trentham (SK/8.4, ?P/Q), wood of park, about 3000 plants.

**V.c. 40, Salop*: Broncroft Castle (SO/5.8), Miss M. B. Fuller, 1978–1992 (Sinker *et al.* 1985).

**V.c. 53, S. Lincs.*: Wellingore Hall Park (SK/9.5Y), 1962, Miss E. J. Gibbons. Small Hornbeam copse, with *Mercurialis perennis* and *Adoxa moschatellina*, probably escaped from the Hall gardens (Mrs I. Weston, pers. comm., 1988).

**V.c. 55, Leics.*: Glenfield, Leicester (SK/5.0I) "shady border in gardens of the Gynsills", 1971 (Primavesi & Evans 1988); this site is now partly under a hotel.

**V.c. 57, Derbys.*: Between Marple and Strines, near the River Goyt (SJ/9.8), T. Barker (Linton 1903). Long Eaton (SK/4.3J) (Clapham 1969). Sheffield (SK/3.8L), in woodland in Graves Park, first noted 12 April 1938, but no longer known (M. Shaw, pers. comm, 1992).

**V.c. 60, W. Lancs.*: Silverdale (SD/4.7S), several patches in woodland, escaped from adjoining Nursery. During a visit in 1988, Mr Kaye described *C. bulbifera* as more or less a weed, which he had dug out in masses.

**V.c. 62, N.E. Yorks.*: Scalby (TA/0.9A), "long established; the *Natural History of the Scarborough District* lists it as 'Rare. Scalby Churchyard, 1964 *et seq* . . .'. It was then in a much more restricted area than now. I assume it was originally planted on a grave . . . since it reached the wall of the churchyard it has not looked back" (T. F. Medd, pers. comm., 1988). This colony even received a mention in *The Dalesman*, January 1900 "– it thrives throughout the village" (an over-statement).

**V.c. 69, Westmorland*: Bowness (SD/4.9), W. Clitheroe, 1940 (forma *ptarmicifolia*).

**V.c. 72, Dumfriess.*: Dardarroch, Dunscore (NX/8.8N), roadside verge, C. Rogers, 14 May 1981; Mrs M. E. R. Martin, 1988 (forma *ptarmicifolia*). The status of another record from Maxwelton House requires confirmation. Hooker (1870) listed *C. bulbifera* as "doubtfully native" in Ayr (v.c. 75), Lanarks (v.c. 77) and Perth (v.cc. 87–89) but no specimens or further details have been traced. Watson (1873) attributes the Ayr record to a specimen from a James Wilson.

**V.c. 91, Kincardines.*: Glenbervie House (NO/7.8Q), very widely distributed in the garden, known since at least 1934. The biggest introduced colony.

**V.c. 95, Moray*: Dyke (NH/9.5Z), one plant, garden of Rose Cottage, M. McC. Webster, 1972, introduced with plants from Blackhills (see next record). Blackhills House (NJ/2.5U), woodland policies, M. McC. Webster, 1963 (Webster 1978).

**V.c. H9, Co. Clare*: Ballyvaughan (M/2.0), outside P. O'Kelly's house in a field and adjacent hedge, 1987.

**V.c. H21, Co. Dublin*: Malahide Castle (O/1.3), in the demesne, 1980, J. G. D. Lamb (Lamb 1983). Rathfarnham (O/1.3), Marley Park, 1981, P. J. Jackson (Jackson 1983) (forma *ptarmicifolia*).

CURRENT STATUS

Cardamine bulbifera has thus been recorded in about 200 native sites; it is probably still present in about 155 sites, has been lost from about 30 sites, and about 17 are untraceable or unchecked. Most of the native sites have disappeared due to woodland clearance, but replanting, especially with conifers, is currently the main threat to the remaining populations. It has also been recorded from about 45 introduced sites of which it is still present in 27.

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Orobanche reticulata Wallr. populations in Yorkshire (north-east England)

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ABSTRACT

In the British Isles, *Orobanche reticulata* Wallr. (Orobanchaceae) has only been recorded with certainty from Yorkshire. Its distribution and abundance within this area are reviewed, and the circumstances surrounding its original discovery and those of other early records are described. The plant, a protected species, has been recorded from at least 68 separate populations in ten 10-km squares, and 52 of these populations are extant, although many are very small; it is particularly frequent in two separate but limited riverside areas.

INTRODUCTION

Orobanche reticulata Wallr. (Orobanchaceae) occurs in the British Isles as a root parasite of thistles, especially *Cirsium* species (Asteraceae). All confirmed records are from Yorkshire (v.cc. 61, 62, 64, 65) where it occurs mainly, but not exclusively, on the magnesian limestone. In Europe its principal area of distribution is in the alpine region but there are also many outlying, isolated localities in northern Europe, including Scandinavia, the Baltic states, Holland, and north Germany (Hegi 1965; Chater & Webb 1972; Meusel *et al.* 1978). The plant also occurs in Russia, the Balkans, North Africa, and extends eastwards into western Asia.

Its restriction to such areas of Yorkshire is unique amongst British native plants, and perhaps because of this, doubts have been raised about its status (e.g. Pugsley 1926). Roman roads and settlements occur near some of the earliest known localities and so an early introduction is a possibility. However, when its British distribution is considered in the context of its overall European pattern, where similar fragmented occurrences are frequent, especially near the limits of its range, it seems most likely that the plant is genuinely native in Britain. Variability witnessed in some populations (Foley 1992) supports this view, whilst an apparent reliance on a limited host range suggests a persistent, isolated group of native populations.

O. reticulata is confirmed from 68 separate populations in ten 10-km squares, mainly in central Yorkshire (v.c. 64) where there are two principal areas of distribution: between Leeds and Wetherby and near Ripon. It also occurs at an isolated locality in v.c. 61, as well as on the extreme south-western borders of v.c. 62 and v.c. 65, but has not been recorded from v.c. 63. In the few large populations, the number of plants varies from one year to the next, but many populations are very small, often with less than ten flowering plants annually. Owing to its rarity and very limited distribution, it is a scheduled species protected under the Wildlife and Countryside Act, 1981 and has been given a *Red Data Book* rating of 11E – Endangered (Perring & Farrell 1983). Unfortunately, the host species are a great nuisance to farmers and landowners, and consequently are frequently destroyed. *O. reticulata* therefore comes under an additional threat to that from which other plants suffer.

In the field, confusion with other *Orobanche* species is unlikely although this may occur with robust *O. minor* Sm. which occasionally shares the same host. Nevertheless, *O. reticulata* is quite distinctive, being tall (up to c. 70 cm) and robust, with a fairly dense inflorescence, especially in the upper part, and with cream-coloured corollas marked distally with blue-purple glands. The corolla is cylindrical-campanulate and has a curved dorsal line which is especially characteristic amongst British broomrapes. The stigma lobes are mauve-purple and the filaments glabrous to sparsely hairy proximally, but can be somewhat glandular above. Even as a herbarium specimen, the plant is still distinctive, particularly with regard to its corolla shape, and in this state confusion is really only likely to occur with *O. rapum-genistae* Thuill., or with *O. elatior* Sutton.

Many infraspecific taxa have been described from populations in continental Europe, and these are summarised by Beck-Mannagetta (1930) and Gilli (1966), although none was recognised by Chater & Webb (1972). British plants have been referred to *O. reticulata* var. *procera* (Koch) Beck, which was differentiated from other varieties by its shorter, curved (not nearly straight) corollas. However, further work may reveal that var. *procera* cannot be maintained even at varietal level. Colour variants and forms of *O. reticulata* are much less frequent in Yorkshire than in Europe, but some records have been noted recently (Jones 1989; Foley 1992).

In Britain, typical habitats are those of its hosts, rough pastures, road verges, and especially river banks, river flood plains and associated light scrub. *Cirsium arvense* (L.) Scop. appears to be the most frequent host, but *C. vulgare* (Savi) Ten., *C. eriophorum* (L.) Scop., *C. heterophyllum* (L.) Hill and *Carduus nutans* L. are recorded, and also occasionally *Cirsium palustre* (L.) Scop. (e.g. 1932, *Vachell*, **NMW**). *Scabiosa, Knautia* (Dipsacaceae) and *Cistus* (Cistaceae) species are also said to be parasitised in Europe. As with other *Orobanche* species, some claims for host can be erroneous, since actual attachment to the roots is difficult to establish in the field. *O. reticulata* seems to be at least partially perennial in Britain, flowering in early July, with the dead flower spikes persisting for several months afterwards.

The account given below is based upon field work carried out over several years during which all extant populations were visited by the author, many on several occasions. Estimates of plant numbers were made and the various habitats assessed. Many herbarium specimens have also been examined and if necessary re-determined by the author or by F. J. Rumsey. Relevant archival records have also been consulted.

THE ORIGINAL DISCOVERY AS A BRITISH PLANT

In August 1907 H. E. Craven, a pharmaceutical chemist of Roundhay, Leeds, found an *Orobanche* at Hetchell Crags, south-west of Wetherby, which he was unable to name. It appeared to be parasitic on *Cirsium eriophorum* and was closest to *O. minor*. The following year, on seeing a letter from G. C. Druce in the *Pharmaceutical Journal* in which he referred to the Botanical Exchange Club, Craven wrote to Druce, asking for further details and enquiring whether membership of the Club would enable him to get doubtful plants named as he had a few puzzling plants, one of which was an *Orobanche*. Craven offered to send Druce some fresh specimens and this he did on 31 July 1908, having kept two plants in water, which had apparently become rather shrivelled. He also offered to send a spike pickled in formalin, as well as duplicates from his previous year's (1907) collection, for Druce to forward to Beck-Mannagetta of Prague, the authority on European *Orobanche*. A detailed description of the fresh plant and some duplicates were sent to Druce in August 1908, and Druce exhibited the *Orobanche* at the Linnean Society that autumn, convinced that it was not a known British species. During the summer of 1908, Craven also sent plants to E. M. Holmes for naming. Holmes agreed that it was not previously known in Britain but suggested it might be a hybrid; he also showed a specimen to the herbarium curator at Kew who was unable to identify the plant. However, some months later, apologising for the delay due to illness, Beck-Mannagetta replied to Druce (9 January 1909) naming the plant *Orobanche reticulata* f. *procera* (Koch) Beck (= *O. procera* Koch). An original specimen sent to Beck-Mannagetta is in his herbarium (**PRC**) and Beck-Mannagetta's letter is appended to a sheet in Druce's herbarium (**OXF**) on which the latter mounted a specimen described "First as British" – presumably one of Craven's original specimens. Other early collections by Craven are in **BM** and **MANCH**. During the summer following Beck-Mannagetta's determination of the Hetchell plants as *O. reticulata*, Craven (17 July 1909) despatched most of his remaining duplicates for Druce's retention, along with a map and a detailed sketch of the habitat at Hetchell stating that the *Orobanche* grew there and nowhere else. He also remarked that the tenant farmer had mown down all the thistles during the previous summer (1908) and that he was concerned for the future of the plant. (This point is also made in subsequent annotations to another sheet (1909, *Lees & Pickard*, **YRK**).)

Another Yorkshire botanist involved in the early recognition of the plant in Britain was F. A. Lees. On receiving Beck-Mannagetta's determination from Druce, Craven informed Lees and presumably sent him a specimen, since one is preserved in Lees' herbarium (July 1908, *Craven*, **BM**); on the label, in Lees' handwriting is the comment "*Orobanche procera*, Koch (*teste* Dr Beck, *per* Druce *ad* Craven 12.1.09)". Also attached to the sheet are three photographs of the plant at Hetchell Crags taken by J. H. Gough on 19 July 1913. On 29 July 1909, Lees, with J. F. Pickard, went to see the plant at Hetchell, and one of the three specimens which they collected is preserved (29 July 1909, *Lees & Pickard*, **YRK**). Writing to Druce on the following day, Lees commented that the parasitised *Cirsium eriophorum* appeared to be very unhealthy, and that he had established the connection from the *Orobanche* to the roots of the thistle. In this same letter Lees asked Druce to publish a description of the plant which he subsequently did (Druce 1909a), and also offered to send him specimens. Despite this, and Craven's offer of a map on 17 July, Druce, along with A. H. Evans, had already visited the site the previous month since a specimen exists which he collected at the time (30 June 1909, *Druce*, **OXF**). This is added to a sheet of material collected by Craven in 1908, although Druce (1909a) stated that his visit was in July. From his correspondence with Druce, it appears that Lees was the first person to raise the suggestion that the plant could be a Roman introduction. He was aware that close to Hetchell Crags is the Pompocali, where the Romans had their summer camp, and that there were also Roman roads and earthworks nearby.

Whilst the credit for the discovery of *O. reticulata* in Britain (and at Hetchell Crags) goes to Craven, this is perhaps not strictly correct. The plant was first found there on 16 August 1902 by J. F. Pickard (Lees' companion in July 1909) but the specimen which he collected was erroneously identified as *O. elatior* by Pickard and Lees (see notes on herbarium sheets: 1909, *Pickard*, **BM**; 1909, *Lees & Pickard*, **YRK**; 1910, *Pickard*, **BM**), and considered to be "*O. major*" by Lees (quoted by Cheetham & Sledge (1941)). Shortly afterwards, Pickard was away on business for two years (see annotation, 1909, *Lees & Pickard*, **YRK**) and presumably did not question this identification further. Craven subsequently re-found the plant at Hetchell, and not satisfied with these diagnoses (Lees 1909), had it re-determined as described above. Pickard's 1902 specimen has so far not been traced. Although evidence points to the contrary, Druce appears to have indicated that the first correct determination of the plant was his own, given directly on receipt of Craven's original specimens (Druce 1909a, 1911). However, in another statement, Druce (1909b) stated only that he was convinced it was not a British plant, and had therefore sent a specimen to Beck-Mannagetta for identification (see also Druce's letter in herb. Beck (**PRC**)). Beck-Mannagetta's reply to Druce (9 January 1909) reads as a determination rather than a confirmation, and that is probably the case.

Shortly after Craven's letter to Druce on 17 July 1909, it was thought that the *Orobanche* had been exterminated at Hetchell. This resulted from a report in the *Yorkshire Weekly Post* of an address given by J. G. Wilkinson, who was blind, to a Leeds Naturalist Club meeting. To disprove this, on 25 August 1909, Pickard and Wilkinson went to the place where Pickard saw the plant in 1902 (and also in July 1909 with Lees) and found two in flower and eleven in fruit. Pickard stated that Wilkinson considered that this locality was a different one "higher up on the slope and further on than Craven's", and Pickard was of the opinion that Craven's population had been exterminated. Even though Wilkinson was blind, he was considered reliable, and it is likely that there had been two separate populations, with Craven's being lost shortly after discovery. Examination of the general area around the present site at Hetchell, together with the sketch which Craven sent to Druce, contemporary notes on the flora, and Druce's description (1909a) of Craven's site – "a grassy slope with bushes" – all support this view. Ironically, immediately after his visit in 1909, Druce had received assurances from the landlord at Hetchell, that the thistles would be preserved.

OTHER EARLY RECORDS

Although the acceptance of *O. reticulata* as a British plant dates from the Pickard/Craven find, specimens exist from other localities well before this date. These were, however, erroneously referred to other *Orobanche* species. In the Leeds/Wetherby area a specimen was collected in 1868 from Roundhay Lime Hills (*Lees & Abbott*, **CMM**); it was identified as *O. major* (= *O. rapum-genistae*) and thought to be growing on whin (*Ulex europaeus*), but is undoubtedly *O. reticulata*. Roundhay is only a few kms from Hetchell Crags. Shortly after the Hetchell discovery, the plant was also recognised from the large and already known broomrape colony at Hook Moor, Aberford (a few kms south-east of Hetchell) whence it had variously been recorded as *O. major* and *O. minor*.

Several specimens exist from here which are thus mistakenly labelled, with one collected as *O. major* as early as 1878 (*Webster*, **CMM**). Despite assertions about the host for this specimen – "One root especially was only one or two inches from the gnarled stem of *Ulex* being far advanced to ripeness. I did not trace any actually to the root of *Ulex*, altho' I have no doubt" – and another identified as *O. minor* "on *Trifolium*" (1883, *Williamson*, **YRK**), both are nevertheless *O. reticulata*. This illustrates the difficulty in being positive about which plant is actually parasitised. The first contemporarily confirmed record at Hook Moor may be that of F. Ashwell (1916, **LES**) and there is also a specimen from the previous year (1915, *Cockerline*, **LES**), but which may not have had contemporary confirmation.

Another early record for *O. reticulata* is from Linton Common (again quite near Hetchell Crags) where it was described by the finder as *O.major*. The date on the sheet (*Pickard*, **CMM**) is unclear, being either 1901 or 1907. By 1907, Pickard might have been wary of this plant, following his involvement at Hitchell in 1902 with what he thought was *O.elatior*, and so 1901 is perhaps the more likely date. There is also a later annotation to a herbarium sheet (1909, *Lees & Pickard*, **YRK**) stating that Pickard had also found and pressed the plant at Linton Common, where it was rare, but that it was still there in 1936.

A second main centre of distribution is in the Ripon area of v.c. 64. In contrast to the Leeds/Wetherby localities for which many early records can be confirmed by herbarium specimens, there is little similar from here. The only specimen of *O. reticulata* so far traced which approximates to the date of the Pickard/Craven find at Hetchell is one described as *O. major* "on gorse?", collected by C. A. Cheetham on 18 July 1903 (*C.A.C.*, **BM**). Unfortunately the label simply states "Ripon" with no further details of the locality. This specimen is erroneously referred to *O. rapum-genistae* by Lees (Cheetham & Sledge 1941). It was not until 1939 that a localised Ripon area specimen was preserved – from Bridge Hewick (*Rob*, **YKN**), although possible evidence for the plant's early presence in the area can be gained from the old Floras. In the Ripon area, nearly all modern records for *O. reticulata* have been from riverside habitats, and the plant is now especially frequent there along an 8 km stretch of the Ure, where at least 38 separate populations are extant. This lends credence to the suspicion that some of the nineteenth century riverside Flora localities for other *Orobanche* species in this area were misidentifications for *O. reticulata*. Those given for *O. minor* near Nunwick, at Sleningford, Howe-upon-Swale, Ure Banks, Burnistone, and Bishopton (Baker & Nowell 1854; Baker 1863; Slater 1883/4; Lees 1888), and for *O. rapum-genistae* below Tanfield (Cheetham & Sledge 1941) are mostly close to extant *O. reticulata* populations, and may well have been mistaken for that plant. Misidentifications for *O. reticulata* have already been shown to occur for some nineteenth century specimens collected elsewhere as *O. major* and *O. minor*. Flora records from Roundhay and from Lotherton Moor (Hook Moor) both given by Lees (1888) must, in fact, have been *O. reticulata*, and it is very likely that the same applied near Ripon.

Unfortunately it is rare for specimens of *Orobanche* to have been preserved from localities near Ripon; ironically one of the few traced is undated (but prior to 1922) and was collected close to the Ure between Ripon and Hutton Conyers (*Lees*, **CMM**). Lees finally determined this specimen as *O. reticulata* but it is in fact *O. elatior*. An isolated occurrence lying to the east of the main area of distribution was at Backhouse's Nurseries, York (1886, *Backhouse*, **K**) where it was found in a garden on *Cirsium heterophyllum*, presumably a casual occurrence. This is probably the first correct identification of the host plant in Britain.

The first record from south-east Yorkshire (v.c. 61) was made in 1953 at North Grimston (Sledge 1954), at which site the plant is extant. In the same year it was also found at a nearby quarry (W. A. Sledge, pers. comm.), but was not seen there again until 1992 during this survey; it is not known elsewhere in v.c. 61. There are apparently only three instances of the plant being definitely recorded from v.c. 62, and two of these are rather obscure. The first is an 1852 specimen (the earliest so far traced from Yorkshire) of atypical *O. reticulata* collected from near Thirsk as *O. elatior* (*Fowler*, **OXF**). Interestingly, there is also a collection (two sheets as *O. minor*) made in the previous year from Sowerby, also near Thirsk (*Baker*, 1851, herb. Boswell-Syme, **BM**); the specimens are intermediate between *O. reticulata* and *O. minor* and may possibly represent the hybrid. This record deserves further investigation since natural hybrids of *O. reticulata* are not recorded in Britain although they have recently been deliberately cultivated (Jones 1989). Whilst Fowler's 1852 plant is distinct from those collected by Baker, it is quite possible that they could be from the same population. (Dead flower spikes, similar to the Sowerby plants, and again possibly of hybrid origin, were seen near the Ure in 1992.) The second vice-county collection of *O. reticulata* is slightly more recent and is typical, although labelled *O. minor* (1881, *Webster,* **BM**) but is unfortunately unlocalised simply as "N.E. Yorkshire" (see also Bennett 1917). Thereafter, it was not until 1984 that the plant was found in a riverside habitat in the extreme south-west of the vice-county, where a flourishing colony survives. Before about 1980 there were apparently no records from v.c. 65, but nine populations are now known, all on river margins, where only the past vagaries of the river channel have resulted in their inclusion within that vice-county.

Outside Yorkshire, there are several dubious or erroneous records for *O. reticulata*. One which may be significant is that given as *O. major* from Nottinghamshire (1835, *Cooper*, in herb. H. C. Watson, **K**). The magnesian limestone does extend southwards into that county, but some of Cooper's specimens are considered to be of dubious provenance (Rumsey & Jury 1991) and this one would benefit from independent verification. A record from Cheshire (v.c. 58) (Druce 1918; Perring & Walters 1962; Perring & Farrell 1983) is erroneous since the specimen is *O. minor* (1918, *Dallman*, **OXF**), as is an earlier one from Guildford (v.c. 17) quoted by Druce (1918) (1916, *Kennedy*, **OXF**). Another error is that for Falmouth Dock (v.c. 1) in 1917 which again was *O. minor* (F. J. Rumsey, pers. comm.). A record for var. *pallidiflora* (Wimm. & Grab.) Beck based on a specimen collected from Brecon (v.c. 42) in 1905 (*Knight*, **BM**) has also been shown to be an error (Pugsley 1940; Graham 1957; Rumsey & Jury 1991); a duplicate from this collection is in **PRC**. Reports from E. Norfolk (v.c. 27) (Jones 1989) including one of an *Orobanche* parasitising *Cirsium vulgare* are thought to be errors for other species (A. L. Bull, pers. comm.).

DISTRIBUTION AND HABITAT

The magnesian limestone formation occurs as a narrow band running north-south from Durham to Nottinghamshire. In the area of distribution of *O. reticulata* it is rarely more than 10 km wide, and is crossed in a roughly eastwards direction by the rivers Swale, Ure, Nidd, Wharfe and Aire. Magnesian limestone is well-known for its species-rich flora.

10-km squares and tetrads (2 × 2-km squares) for which there are confirmed records for *O. reticulata* are mapped in Fig. 1 and Fig. 2 respectively, and fall within an area approximately 50 km square. The two principal centres of distribution in the vicinity of Leeds/Wetherby and Ripon, the disposition of the magnesian limestone formation and the principal rivers of the area, can all be clearly seen.

Following the recognition of *O. reticulata* as a British plant there was a lull in the discovery of new localities until the 1930s find by the river at Bridge Hewick, Ripon. Since then, other riverside ones have been found some distance upstream from this site, many of which survive, and the plant is particularly frequent in that area. Downstream also, new localities have occasionally come to light, including one on the Ouse (formed by the confluence of the Ure and the Swale) found in 1984, the first confirmed modern record for v.c. 62; there are, however, no definite records near the Swale itself. Apart from a small population just south of Ripon and away from the Ure, all other post-1930 colonies in this northern (Ripon) area are on river banks or flood plains, and it seems clear that rivers play an important role in dispersing seed. Also, plants often occur close to river banks and eventually may be dislodged by water erosion. It is quite possible that these together with their host will sometimes become established elsewhere. Favoured habitats for *O. reticulata* are near the upper flood limit by the river bank, and especially the flat pasture borders nearby; occasionally they grow some distance from the river but in places where winter flooding occurs. These are also the areas where the host species are plentiful.

In the southern (Leeds/Wetherby) area most newly-found localities are again in similar habitats on the banks of the Wharfe, where propagation or dispersal has presumably occurred in a similar manner. Population sizes can vary, but some appear to persist for many years with just a few plants annually. The Linton Common locality is such an example. Here, even at the beginning of this century only a few plants were recorded, and the same is the case today. Similarly at Hetchell Crags where the plants occur on the magnesian overlay of the gritstone substrate and well away from the river, numbers have apparently never been high. Cheetham & Sledge (1941) quoted a contemporary account of F. A. Lees in which he stated that an increase in thistles had been observed at Hetchell Crags between 1870 and 1879 but that he was certain that the broomrape was not present

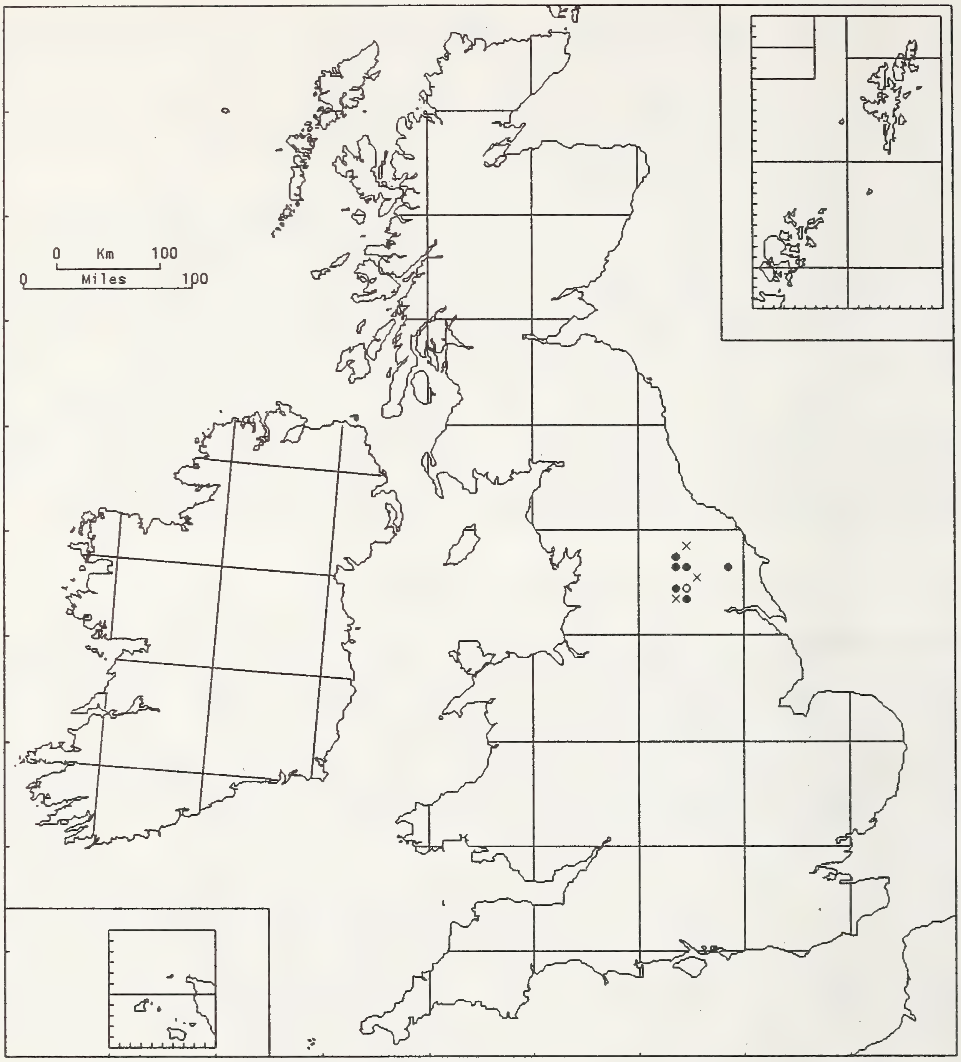

FIGURE 1. The British distribution of *O. reticulata* shown on a 10-km square basis for which there are confirmed records: ● 1991 onwards; ○ 1901–1990; × up to 1900.

during that time; this suggests a relatively recent colonisation just prior to its discovery there in 1902. During the 1920s about 20 plants were known at Langwith Scrub (W. A. Sledge, pers. comm.) and today similarly small numbers still persist close by.

At Hook Moor, the classic site was unfortunately ploughed out about 1940, but surprisingly, and despite reservations expressed at the time (Sledge 1942), what is still the largest British population occurs on road embankments within the vicinity. Earth from the former site may have been removed and used in construction of the present embankments and thus led to the plant's presence there, although natural recolonisation cannot be ruled out. Being on steep slopes, this is very well drained and is also multi-aspect. It is rather different from the moister riverside localities favoured elsewhere, and as the plant thrives here, it suggests that it may be a preferred habitat to the more opportunistic riverside ones. Close to this re-colonised area, there is at least one, more natural, yet very small population on an arable field border, probably a remnant of the former pre-1940 colony.

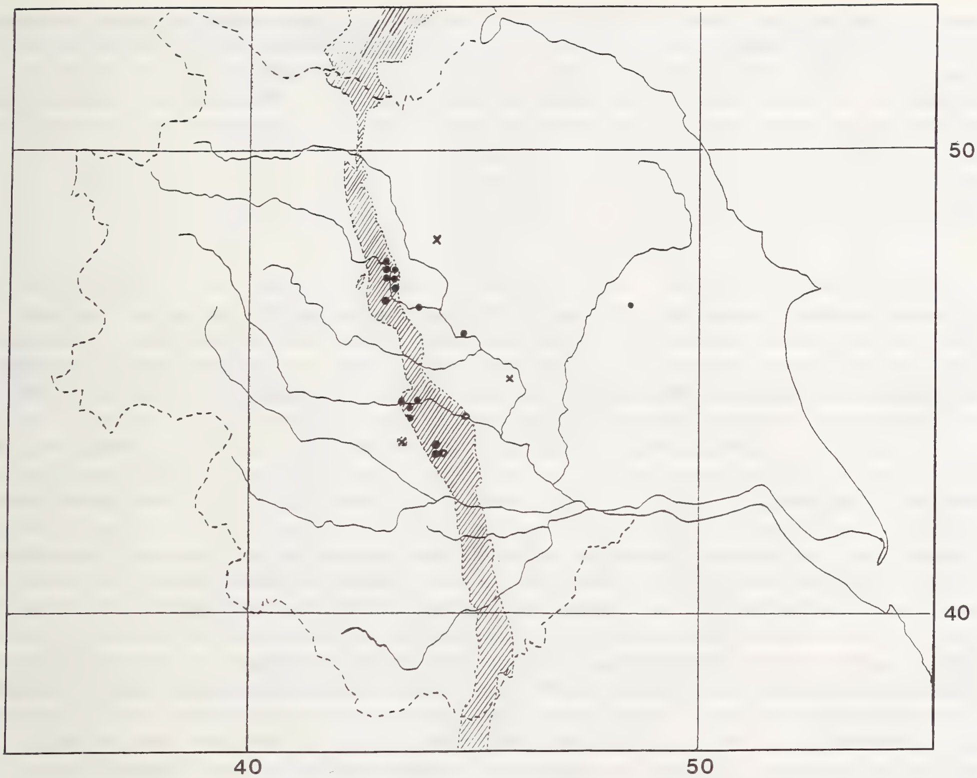

FIGURE 2. The British distribution of *O. reticulata* showing tetrads from which there are confirmed records: ● 1991 onwards; ○ 1901–1990; × up to 1900; the major river pattern and the disposition of the magnesian limestone (hatched) are also indicated.

Roundhay limehills are mainly commercially developed nowadays and the plant is presumably long extinct. Craven, the original discoverer in Britain, lived at Roundhay at the turn of the century and would presumably have recorded it if he had known it there, and so it had perhaps gone even in his day. Nothing is known of the plant's habitat or frequency there, but Roundhay and Hook Moor are both well away from major rivers, and could be remnants of an earlier area of distribution, from which it has subsequently expanded.

All the localities mentioned occur on, or just eastwards of, the magnesian limestone formation. Those to the east of it are usually close to major rivers and their occurrence there is likely to be a result of downstream dispersal by water into habitats rich in alluvial deposits. No records for *O. reticulata* have been traced to the west (upstream) of the magnesian limestone, and this reinforces the argument for the downstream river dispersal through and away from this formation. However, a magnesian limestone soil is not an essential requirement as shown by the plant's occurrence in v.c. 61 on the chalk at North Grimston, where it formerly thrived (W. A. Sledge, pers. comm.) but is now much less abundant. This locality is separated from all others and distant from any rivers, and its presence there could possibly be from accidental introduction, since it has only been known since 1953.

Within the last 60 years or so, *O. reticulata* appears to have become more widely distributed in Yorkshire than formerly, but whether this is due to a genuine expansion of range or results from being previously overlooked, is uncertain. Some populations are highly stable, appearing on the same area of thistle year after year, but others are more dynamic. These latter may change in size and spatial distribution, apparently dying out (at least temporarily) in one part of the population, only to appear a short distance away. Whether this depends on the vigour of the host or on some other local factor, is not clear. Observations in the field indicate that it is not the most dense stands or the most robust thistles which are parasitised, but often smaller plants in scattered groups, although it is not clear whether this state is caused by, rather than the cause of the parasite's distribution. However, even in the most favoured localities *O. reticulata* can remain highly localised, with vast numbers of the host plant remaining un-parasitised, and it is assumed that critical ecological factors control its ultimate viability.

SUMMARY

Of the 68 recorded populations of *O. reticulata*, at least 52 survive. The majority are on the magnesian limestone formation and whilst this might not be an essential ecological requirement, calcareous soils are favoured. Many populations have been found recently, but it is uncertain whether these are newly-formed, or are much older and had been overlooked or even misidentified. Many are small in numbers, but this is no indication of length of colonisation, since some colonies are known to have persisted for over 70 years whilst consisting of only a few plants.

Of the extant populations, more than 85% are within the influence of river flood water and dispersal and population formation by such means must clearly take place. Interestingly, these are mostly restricted to two short reaches of the Ure and Wharfe and it is difficult to explain the absence of similar records from the Nidd, which crosses the magnesian limestone between these two rivers. Maybe a population has never developed sufficiently close to the Nidd to allow other riverside ones to become established by water-borne means? Two other Yorkshire rivers which cross the magnesian limestone also lack confirmed records in their vicinity, but the Swale does so over a very narrow exposure and well to the north of the plant's restricted area of distribution, whilst the Aire although closer, is heavily industrialised. It is interesting that *Potamogeton* × *suecicus* K. Richter is apparently also restricted in England (excluding the River Tweed on the Scottish border) to largely similar reaches of the Ure and Wharfe, and is again not recorded from other rivers within the area. New populations of *O. reticulata* will doubtless continue to form in favoured riverside localities but colonisation elsewhere is likely to be rare, and if it occurs off the limestone, may originate from inadvertent introduction.

The main threats to its survival result from the deliberate destruction of its hosts, from adverse agricultural practices, and through engineering operations such as road construction. Some populations may be lost when river banks are eroded, whilst gravel extraction is yet another threat. Nevertheless it appears to be relatively resilient, occasionally reappearing at sites from which it was thought to be extinct. There is much scope for investigation of the autecology and population dynamics of *O. reticulata*.

RECORDED LOCALITIES AND RELEVANT HERBARIUM SPECIMENS

Whilst it is recognised that the number of flowering spikes can fluctuate annually and that two or more may sometimes represent just a single plant, an attempt has been made to estimate a typical size for each population. This is indicated using the following notation: A = 1–10 plants; B = 11–50; C = 51–200; D = 201–1000; E = 1000+; X = probably extinct. Even if in fairly close proximity to others, populations are considered to be separate if they are clearly observed as such in the field even when consisting of just one or two plants. All populations shown as extant (A–E) have been checked since 1991.

Localities which are *not* on the magnesian limestone formation are indicated by (*); those well away from the influence of river flood water by (#).

Being a protected species, precise details of the populations are not given here, but have been deposited at English Nature, York, and the Biological Records Centre, Monks Wood.

Herbarium specimens quoted earlier in the text are not usually repeated here, but their existence is indicated by the code (Hb) inserted after the locality name. Others of relevance are listed after each locality entry and although not exhaustive, they represent the majority of the more interesting, historical specimens held in major national, or locally important herbaria. The fact that *O. reticulata* is a *Red Data Book* plant is stressed and therefore further collections should not be made, but the specimens quoted used for reference or examination. Where specimens have been redetermined these are shown in this section as follows: (i) by F. J. Rumsey, (ii) by M. J. Y. Foley.

Notts., v.c. 56:
Based upon the single unlocalised (Hb) record of a specimen of doubtful provenance.
S.E. Yorks., v.c. 61:
SE/8.6, North Grimston (* #), found in 1953 (Sledge 1954) on chalk, well away from magnesian limestone and river influence. Recently decreased, but still survives (B); herbarium specimens: 1953, *Sledge* (**CMM**, **RNG**). In 1953 also recorded at a nearby quarry but not seen again until 1992 (B). It is possible that there has been a recent introduction nearby at Wharram.
N.E. Yorks., v.c. 62:
SE/4.6, Linton-on-Ouse (*), first found in 1984, probably formed from a population further upstream (B). There is also an unlocalised herbarium specimen from north-east Yorkshire (Hb) collected as *O. minor* (ii).
SE/4.8, near Thirsk (* #) in 1852, based upon atypical specimens (*Fowler*, **OXF**). Two other sets of specimens collected near here (at Sowerby) in 1851 (*Baker*, **BM**) may be of hybrid origin and are possibly from the same population. Apparently not recorded since (X).
Mid-W. Yorks., v.c. 64:
SE/3.3 Roundhay Lime Hills (#), the early specimen as *O. major* (ii), (1868, *Lees & Abbott*, **CMM**) is the only record traced. The site is now mostly developed and industrialised (X).
SE/3.4, East Keswick A, first noted in 1990 in a rough pasture (C). The following year several interesting variants were observed (Foley 1992); East Keswick B, overgrown scrub, known since about 1985 (B); Hetchell Crags (Hb), calcareous grassland above the gritstone escarpment, the locality from which the first identified British *O. reticulata* specimens were collected by Craven in 1907 (B). It is probable that two populations formerly existed here, one becoming extinct in 1909 (X); herbarium specimens from Hetchell include: 1907, *Craven* (**MANCH**); 1908, *Craven* (**OXF**); 1908, *Druce* ex *Craven* (**PRC**); 1908, *Craven* (**BM**, **CGE**); 1908, *Craven* (**OXF**); 1909, *Lees & Pickard* (**CMM**); 1909, *Pickard* (**LES**, **CGE**); 1910, *Palmer* (**BM**); 1913, *Horrell* (**LES**); 1919, *Cockerline* (**LES**); 1951, *Boniface* (**NMW**); 1966, *Hodgson* (**LANC**); Whitwell, north bank of river, first found in 1991 by P. P. Abbott (A); Langwith Scrub, known from this riverside locality since the 1920s (W. A. Sledge, pers. comm.) and thought extinct, but a few plants were found close by in 1991 (A). Lees' (1888) record for *O. major* at Langwith Woods is very likely an error for *O. reticulata* and there are also herbarium specimens probably from here: 1917, *Horrell* (**OXF**, **LES**); Linton Common (Hb), recorded just after the beginning of this century, and still present in small numbers (A).
SE/3.6, South Ripon (#), an area of limestone grassland, where occasional plants have been found since 1989 including a single plant in 1992 (A); Roecliffe (*), a rough riverside pasture, first recorded in 1969 in small numbers. Thought to be extinct, but four plants were found close by in 1992 (A).
SE/3.7, near Queen Mary's Dubbs, five populations found in 1992, but a further one lost to ploughing some years earlier (A, A, A, A, B, X); Ripon Parks, formerly several populations with five still remaining on the flood plain of the Ure on Ministry of Defence land. Two others were lost when the ground was ploughed in the early 1980s. Fasciated plants have been recorded from this locality (A, A, A, A, C, X, X); Norton Conyers A, east bank of the Ure, ten populations mostly found in 1992, one of which possibly contained hybrid plants (× *O. minor*) (A, A, A, A, A, A, B, B, B, B); near Nunwick, four populations found recently (A, A, B, B); north of Ure Bank found in 1992 (A); Bridge Hewick (Hb) where two separate populations flourished about 1940–1950 on opposite banks of the Ure. Rob (1953) commented that the plant had decreased here, but there were about 70 plants at one population in 1954 (H. J. M. Bowen, pers. comm.). Apparently extinct at one of the old localities but four populations were found near the other in 1992 (A, A, A, B, X). Herbarium specimens from Bridge Hewick include: 1952, *Bangerter* (**BM**); 1954, *Rob* (**YKN**); 1954, *Bowen* (**RNG**). Other specimens only partially localised and probably from near here are: Ripon, as *O. major* (i), 1903, *C.A.C.* (**BM**); near Ripon, 1956, *Branson* (**E**, **RNG**).
SE/4.3: Hook Moor (#) (Hb), one of the classic sites from which specimens can be found in most major herbaria (often under the alternative locality names of Micklefield or Lotherton Moor), one such early specimen dating from 1878. Formerly widespread prior to the site being ploughed

in about 1940. Since then good populations have developed on road embankments within the vicinity, plants or seed possibly having been brought in with the soil during road construction, or even formed by natural re-colonisation. Probably the strongest British population (D, possibly E); there are two other nearby localities: a probable relict population on an arable field border. (A), and another on a road embankment to the north (A). Three other records in the period 1952–1972 from other areas of Hook Moor (#) have not been recently confirmed (X, X, X). Herbarium specimens include: as *O. eu-minor* (ii), 1881, *Webster* (**BM**); as *O. minor* (i), 1881, *Webster* (**E**); 1892, *Foggitt* (**BM**); 1919, *Sledge* (**CMM**); 1922, *Barnett (***LES**); 1922, *Roper* (**LDS**); 1929, *Jones* (**LDS**); 1930, *Foggitt* (**BM**); 1932, *Vachell* (**NMW**); 1932, *Vachell & Knowling* (**NMW**); 1936, *Sledge* (**LIV**, **RNG**); 1936, *Jackson* (**K**); 1937, *Lousley* (**LIV**, **RNG**, **K**); 1937, *Woodhead* (**LANC**); 1938, *Chapple* (**OXF**); 1939, *Lousley* (**NMW**); 1946, *Lousley* (**E**, **RNG**); 1946, *Libbey* (**LTR**); 1949, *Raven* (**LTR**); 1953, *Frankland* (three sheets) (**LIV**); 1988 (photographs only), *Rumsey* (**RNG**). There is an unlocalised specimen probably from here: near Leeds, as *O. rubra* (i), 1922, *Rogers* (**CGE**).

SE/4.4, near Tadcaster, the sole record is based upon a semi-localised herbarium specimen collected in 1935 (*W.R.W.*, **K**) and now presumed extinct (X); near the Dunsforths, rumoured to have been found here in the mid-1980s, but no definite records traced.

SE/5.5: The Nurseries near York (* #), based on Backhouse's 1886 specimen (**K**). At this date, Backhouse's nurseries were in what are now the south-western suburbs of the city. Presumably a casual introduction with no records since (X).

N. W. Yorks., v.c. 65:

SE/3.7, Badger Bank, five separate populations on the east bank of the Ure (A, A, A, A, B); Norton Conyers B, east bank of the Ure, first found in 1988, including one broken, fasciated plant, *Norris & Lloyd-Evans* (**LES**) (A); North Stainley, on a nature reserve on the west side of the Ure. Recorded here in 1984, this population has apparently died out, but a second one appeared close by in 1992 (A). There is a further population a short way downstream (A); Low Batts, discovered here about 1980 (B).

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Skunkweed (*Navarretia squarrosa* (Eschsch.) Hook. & Arn.) and other Polemoniaceae in Britain

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ABSTRACT

The discovery of a large population of Skunkweed, *Navarretia squarrosa* (Eschsch.) Hook. & Arn. (Polemoniaceae) in Windsor Great Park, Berks. (v.c. 22) has prompted further investigation into this little known alien, which is described, illustrated and discussed in conjunction with related species. A key is given to separate four relevant genera.

INTRODUCTION

Skunkweed, *Navarretia squarrosa* (Eschsch.) Hook. & Arn. (Polemoniaceae), has a long history of periodic occurrence in Britain but is not treated in recent Floras (Clapham *et al.* 1987; Stace 1991). In early July 1990, M.F.G. was informed that a large population of *N. squarrosa* had been discovered on private land within Windsor Great Park (v.c. 22, Berks.). On investigation it was found that the colony of several thousand plants was thickly scattered on more or less bare sandy ground which had until recently been a rubbish dump. This site had been sown the previous autumn with a grass and wild-flower amenity mixture, the grass seed of which had originated from Oregon. Germination of the sown mixture had been almost non-existent and instead the area was sparsely covered by mainly mosses and several early colonising species such as *Spergularia rubra* (L.) J. & C. Presl and *Gnaphalium uliginosum* L. It was interesting to note that grasses were almost absent. The whole area was almost flat with a few slight hollows which presumably held water during the winter. In June these were covered with the annual White Forget-me-not *Plagiobothrys scouleri* (Hook. & Arn.) I. M. Johnst., a member of the Boraginaceae which is also a native of western North America (Stace 1991).

In 1991 both *N. squarrosa* and *P. scouleri* reappeared in considerable numbers suggesting that seed had been successfully set the previous year. However, long-term persistence is unlikely, as the ground will probably become overgrown again. In mid-June only small seedlings of *N. squarrosa* were present and on walking through these plants their foetid smell, resembling petrol or rotten eggs, was very prominent.

DESCRIPTION OF *NAVARRETIA SQUARROSA*

The genus *Navarretia* (Polemoniaceae) contains 30 annual species of which 29 are native to western N. America and one is native to Chile and Argentina (Mabberley 1987). Many species of *Navarretia* look somewhat similar and the following description defines *N. squarrosa*.

Navarretia squarrosa (Eschsch.) Hook. & Arn., *Bot. Beechey's Voy.* **8**: 368 (1839). Fig. 1.
Synonyms: *Hoitzia squarrosa* Eschsch., *Mém. Acad. Sci. St Pétersb.* **10**: 283 (1826); *Gilia pungens*

FIGURE 1. *Navarretia squarrosa* (Eschsch.) Hook. & Arn., Skunkweed.

Douglas ex Hook., *Bot. Mag.* **57**: t. 2977 (1830); *Gilia squarrosa* (Eschsch.) Hook. & Arn., *Bot. Beechey's Voy.* **4**: 151 (Oct. 1833); *Aegochloa pungens* (Douglas ex Hook.) Benth., *Edward's Bot. Reg.* **19**: sub pl. 1622 (1 Oct. 1833); *Navarretia pungens* (Douglas ex Hook.) Hook., *Fl. Bor. Am.* **2**: 75 (1838).

Erect annual 5–35 cm, with usually one main stem, rather stout and rigid, the lateral branches more or less well developed producing a top-heavy plant narrowing to a slender base; all parts except flowers glandular-viscid, with a strong, unpleasant odour (hence the vernacular name). Leaves alternate, sessile, 1·5–3·5 × 1–2·5 cm, varying from bipinnate to pinnately and palmately dissected, the linear lobes spinescent. Flowers in capitate, bracteate clusters; calyx tube 7–10 mm, scarious between the ribs, with unequal, subulate, spinescent lobes; corolla 7–13 mm, infundibuliform, blue to whitish, barely exceeding the calyx; stamens 5, slightly unequal, inserted in corolla throat; stigmas 3. Capsule ellipsoid, 3-locular, each loculus with 6–8 or more ovules. Seeds 0·6–0·8 mm, dark brown, irregularly angled-ovoid, rugose. Native to western N. America, from Vancouver Island in the north, south to California (Hitchcock *et al.* 1959).

Cantua pungens Torrey, *Ann. Lyc. Nat. Hist. N. York* **2**: 221 (1828) was described on the basis of a specimen collected by Edwin P. James in 1820, in the valley of the Loup Fork (Nebraska). This is obviously not the same specimen as the type of *Gilia pungens* Douglas ex Hook. (collected by David Douglas on the Multnahomack River, California); because the respective type descriptions of *C. pungens* and *G. pungens* differ in several important points (e.g. *C. pungens*: flowers solitary, axillary; *G. pungens*: flowers in capitate clusters), *C. pungens* is not considered to be synonymous with *Navarretia squarrosa*, although *Index Kewensis* considered it to be so (R. R. Mill, pers. comm.). The type locality of *C. pungens* is also far outside the geographical range of *N. squarrosa.*

Voucher specimens of *Navarretia squarrosa* and *Plagiobothrys scouleri* have been deposited in **RNG, E, herb. E.J.C.** and **herb. M.F.G.** Specimens of *N. squarrosa* were also collected and distributed by the University of Reading through the Société pour l'Échange des Plantes Vasculaires de l'Europe et du Bassin Méditerranéen. It is interesting to note that the oils within the plant are volatile and pressed specimens soon totally lose their foetid odour. *N. squarrosa* seems to be very poorly represented in the literature and in herbaria as a British adventive. For example, there are no specimens held by **BM**, **CGG** and **K**.

HISTORY OF OCCURRENCE IN BRITAIN

1828–1830

The species was probably first cultivated in Britain in 1829 or 1830, when plants were raised by the Horticultural Society of London from seed collected by David Douglas in North America. He collected seed from plants growing on moist ground in mountain valleys near to the sources of the Multnahomack river, one of the southern branches of the Columbia river in western North America. Plants from this collection were subsequently illustrated in the *Botanical Magazine*, tab. 2977 (Hooker 1830) and although not garden worthy, references to *Navarretia squarrosa* have persisted in horticultural literature to the present day (Huxley 1992).

1915–1933

The species was first collected as an alien by Miss I. M. Hayward in August 1915 under Ladhope Bridge, Galashiels, Selkirks., v.c. 79, where it was growing on shingle beside Gala Water and had presumably been introduced with wool shoddy (Druce 1916; Hayward & Druce 1919). It was determined by A. Thellung as *Gilia pungens* Douglas ex Hook. & Arn. Some eight years later it was collected from Sleaford, S. Lincs., v.c. 53, by Miss Landon where it was thought to have been introduced with chicken corn (Druce 1924); again determined by Thellung, this time as *G. squarrosa* Hook. & Arn. (**OXF**). The same year it was also collected from Hythe Quay, Colchester, N. Essex, v.c. 19, where it was thought to have been introduced with malting refuse. Plants were still being recorded from the same locality the following year (Brown 1930, **OXF**). The next recorded occurrence was reported by Miss C. M. Rob from Topcliffe, near Thirsk, N. E. Yorks., v.c. 62, where it came up in a newly made lawn. In this case the plant may have been introduced with sawn wood which originated from California and was used for constructing the doors of the house (Pearsall 1934).

1978–1979

Nearly half a century passed before the species was seen again in Britain, this time as a weed in a rose bed by Mrs M. Baecker at Carr Bank, Milnthorpe, Westmorland, v.c. 69, in 1978 and 1979 (Clement 1979, **herb. E.J.C.**).

OCCURRENCE ELSEWHERE

Navarretia squarrosa has also been recorded as a bird seed alien in the Netherlands (Ooststroom & Reichgelt 1963) and as a ruderal in Denmark (Hansen 1979). Outside Europe it is recorded in the floras of New Zealand and Australia, having first been noted early in the century by Black (Robertson 1957); it persists there to the present day (Toelken 1986; Webb *et al*. 1988).

OTHER POLEMONIACEAE IN BRITAIN

There is only one member of the Polemoniaceae native to Britain and Ireland. Jacob's Ladder, *Polemonium caeruleum* L., occurs in limestone grassland, on screes, on rock ledges and on the borders of woodland in northern England and is reported (Stace 1991) as a sporadic garden escape elsewhere. However, B. Wurzell (pers. comm.) warns that since a number of similar *Polemonium* species, varieties and hybrids are grown in gardens, no wild plant of such provenance should be attributed to *P. caeruleum* without careful verification. Stace (1991) also lists *Phlox paniculata* L., another North American species, as sporadically naturalised on rough and waste ground in England. At the last published tally (Druce 1928), twelve alien Polemoniaceae were listed, the genus *Gilia* contributing most taxa. None of these was included in the two more recent lists of British plants (Dandy 1958; Kent 1992). *Phlox drummondii* Hook. and *P. subulata* L. have been observed as adventives on urban wasteland (B. Wurzell, pers. comm.)

KEY TO THE GENERA OF POLEMONIACEAE OCCURRING IN BRITAIN

The following key may aid the identification of three of the commonest genera most likely to be confused with *Navarretia*:

1. Calyx green and herbaceous throughout .... 1. *Polemonium*
1. Calyx with prominent scarious or hyaline intervals between the green and more herbaceous costae 2
2. Staminal filaments very unequally inserted; leaves opposite .... 2. *Phlox*
2. Staminal filaments equally or almost equally inserted; leaves alternate 3
3. Calyx-lobes obviously unequal; leaf segments spine-tipped .... 3. *Navarretia*
3. Calyx-lobes equal or nearly so; leaf-segments not spine-tipped ....4. *Gilia*

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Who was the author of *Montbretia crocosmiiflora?*

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ABSTRACT

Montbretia crocosmiiflora, the basionym of *Crocosmia* × *crocosmiiflora* (Iridaceae) was published by Victor Lemoine in *The Garden*, 1880, not by E. Morren; the correct citation of the current name is *Crocosmia* × *crocosmiiflora* (Lemoine) N.E.Br.

INTRODUCTION

Montbretia crocosmiiflora is the basionym of the currently accepted name for the well-known garden plant, *Crocosmia* × *crocosmiiflora* (Iridaceae), which has escaped and become widely naturalized in coastal parts of the British Isles (Stace 1991; Nelson 1993). Although the generic name *Montbretia* has long since been abandoned, it remains in everyday use as the vernacular name especially for the naturalized plant. *C.* × *crocosmiiflora* is an artificial hybrid created by Victor Lemoine of Nancy, France, who pollinated *C. pottsii* (Baker) N. E. Br. with pollen from *C. aurea* (Hook.) Planch.; the seedlings first bloomed in August 1880.

For many years standard botanical accounts (e.g. de Vos 1984) credited publication of *Montbretia crocosmiiflora* to C. J. Edouard Morren (1881), and the usual citation of the hybrid's name was *Crocosmia* × *crocosmiiflora* (Lemoine ex E. Morren) N. E. Br. (cf. de Vos 1984). Kostelijk (1984) pointed out that Morren's account, published in *La Belgique Horticole* **31** late in 1881 to accompany plate 472, was predated by a note printed in the October 1881 number (118) of *The Floral Magazine*, edited by Richard Dean, but Kostelijk (1984) and Wijnands (1986) omitted to note that the September issue of the same periodical had an earlier account, reading as follows

> ". . . Montbretia crocosmaeflora, a novelty sent by Mons. Lemoine, Nancy, France; much the same in colour as M. Pottsii, but perhaps a little more yellow, and the flowers larger."

Kostelijk (1984) proposed altering the citation to *C.* × *crocosmiiflora* (Lemoine ex Burb. & Dean) N. E. Br.; this was noted by Wijnands (1986), and taken up by Trehane (1989), Stace (1991) and Kent (1992) among others.

EARLY DESCRIPTIONS OF LEMOINE'S HYBRID

Kostelijk's bibliographic search was not exhaustive. The following are even earlier accounts in which the binomial *Montbretia crocosmiiflora* was used:

The Garden 21 August 1880 (p. 188)

> "New Hybrid Montbretia. – Mons. V. Lemoine, of Nancy, sends us a new bulbous plant, which he has obtained by fertilising Montbretia Pottsi . . . with Tritonia (Crocosma [sic]) aurea. The progeny Mons. Lemoine proposes to name Montbretia crocosmaeflora. The flowers, he says, are four or five times the size of M. Pottsi; and this successful cross he considers to be the starting point for the production of a race of beautiful hardy varieties. The flowers sent are borne in the same manner on the spike as those of M. Pottsi, but they are much larger and of a deeper colour. The cross seems to be precisely intermediate between the two parents."

The Garden 30 July 1881 (p. 125)

> "Montbretia crocosmaeflora, similar in every respect to M. Pottsi [sic] . . . but more robust in habit, and having larger flower-spikes."

The Gardener's Chronicle 30 July 1881 (p. 153)

"Mr Barron also showed Montbretia crocosmaeflora [sic], one of Mons. Lemoine's novelties, much the same colour as M. Potsii [sic], perhaps a little more yellow, but the flowers larger – a very good plant . . ."

The Garden 27 August 1881 (p. 203)

"MONTBRETIA CROCOSMAEFLORA – A very promising plant with orange and red flowers, very bright, but somewhat withered owing to its journey from Nancy . . . From M. Lemoine."

DISCUSSION

The first quotation from *The Garden* (**18**: 188, dated 21 August 1880) must have been written very shortly after the seedlings bloomed for the first time; it contains a diagnosis that is adequate under the *International Code of Botanical Nomenclature* (Greuter *et al.* 1988; Art. 32.2) to validate the binomial *Montbretia crocosmiiflora*. It must be stressed that both the binomial and at least part of the description are explicitly attributed to Lemoine, and the passage is written in the present tense. But, by including the clause "Mons. Lemoine proposes to name . . .", does the author perhaps fall foul of Art. 34.1, that a name is "not validly published . . . when it is merely proposed in anticipation of . . . a particular circumscription"?

The two subsequent notes, both published almost one year later on 30 July 1881, do not contravene any articles of the current *I.C.B.N.* and thus the binomial was validly published as early as 30 July 1881 – unless description in the issue of *The Garden* of 21 August 1880 is *not* ruled out.

Deciding which of the 30 July 1881 issues of the separate periodicals was the first published seems a pointless exercise, but they predate *The Floral Magazine* notices by at least one month, so that the protologue of *Montbretia crocosmiiflora* may be credited to one or other of these, or both. At this period *The Gardener's Chronicle* was edited by M. T. Masters, and *The Garden* by its founder, William Robinson, and thus possible citations might include 'Lemoine ex Masters', and 'Lemoine ex W. Robinson'.

The publication of names in reports of horticultural shows is a matter that is not addressed by the *I.C.B.N.* There is no reason to reject names, accompanied by diagnostic statements, when included in such reports, except when they contravene particular articles of the code. Under the *I.C.B.N.* (Art. 29, Berlin 1988), publication in non-scientific newspapers was forbidden after 1 January 1953; thereby there is the implication that before that date publication of binomials in such periodicals is valid. The descriptions of *Montbretia crocosmiiflora* quoted above appeared in reports of the Royal Horticultural Society's exhibition on 26 July 1881, and it is possible that London newspapers of 27 July contained reports in which there were descriptions – I have made *no* attempt to trace any such reports. It is even possible that French periodicals and newspapers contained even earlier reports of the first flowers in August 1880, for example.

The consequences of this conundrum is that it is impossible unambiguously to assign *Montbretia crocosmiiflora* to a single author. Both Masters and Robinson were describing the same plant, having seen the same specimens on the same day, although it cannot be established that Masters or Robinson personally wrote the news items concerned; they were the editors of the respective periodicals, and one of their journalists could have contributed the show reports. Furthermore, because of the real possibility that newspapers printed in August 1880 and July 1881 carried descriptions and the binomial, it may be impossible to determine if the original place of publication was really *The Gardener's Chronicle* or *The Garden*.

CONCLUSIONS

Each of the quoted descriptions is of the same, indeed the original hybrid, so the best solution to this conundrum is to accept that the name was first devised and used by Victor Lemoine, that it was published validly in *The Garden* on 21 August 1880, and that because the clause "proposes to name" is in the present tense this diagnosis need not be regarded as provisional and thus contrary to Art. 34.1. Thus the citation should read:

Crocosmia × crocosmiiflora (Lemoine) N. E. Br., *Transactions of the Royal Society of South Africa* **20**: 264 (1932).

Basionym: *Montbretia crocosmiiflora* Lemoine, *The Garden* **18**: 188 (21 August 1880) [as '*crocosmaeflora*']; *The Garden* **20**: 125 (30 July 1881); *The Gardener's Chronicle* **16** (n.s.): 153 (30 July 1881); *The Garden* **20**: 203 (27 August 1881); *The Floral Magazine* no. 117 (September 1881); *The Floral Magazine* no. 118, tab. 472 (October 1881); *La Belgique Horticole* **31**: 229, tab. 14 (1881) [with formula "× *Montbretia aureo-pottsi*"].

TYPIFICATION OF *MONTBRETIA CROCOSMIIFLORA*

de Vos (1984) designated the illustration published in *La Belgique Horticole* **31** (tab. 14) as the lectotype of *Montbretia crocosmiiflora* Lemoine ex Morren, but this is not acceptable (see *I.C.B.N.* Art. 7) and must be rejected. In this instance the published illustration cannot be a lectotype but could be selected as a neotype, as long as there are no herbarium specimens preserved of the original materials received from Lemoine by Robinson in August 1880. However, better candidates for selection as neotypes would be herbarium specimens prepared from the material displayed at the Royal Horticultural Society in July 1881.

ORTHOGRAPHY

The earliest notes used either 'crocosmiaeflora' or 'crocosmaeflora'. These are improperly formed compounds; under the *I.C.B.N.* (Art. 73), the epithet should be corrected to 'crocosmiiflora', as is standard practice.

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Short Notes

CONTRIBUTIONS TO A CYTOLOGICAL CATALOGUE OF THE BRITISH AND IRISH FLORA, 3

This note continues our series presenting the results of a cytological survey of British and Irish vascular plants (Hollingsworth *et al.* 1992). Here we report the chromosome numbers of 88 species from 95 populations. A suffix 'S' denotes supernumerary chromosomes. Only one plant per population was counted, except where stated. All counts were made on squashes of root-tips. Voucher specimens have been deposited in **LTR**.

Ajuga reptans L., 2n = 32: Leics., v.c. 55, Swithland Wood, SK/53.12.
Alchemilla glaucescens Wallr., 2n = c. 110: Westmorland, v.c. 69, Crosby Gill, NY/61.11.
Alchemilla xanthochlora Rothm., 2n = c. 107: W. Lancs., v.c. 60, near Carnforth, SD/507.706.
Allium scorodoprasum L., 2n = 16: W. Lancs., v.c. 60, Potts Corner, SD/41.57.
Andromeda polifolia L., 2n = 48: Westmorland, v.c. 69, Meathop Moss, 3 km N.E. of Lindale, SD/44.81.
Apium inundatum (L.) Reichb.f., 2n = 22: Caerns., v.c. 49, Cilan, near Abersoch, SH/29.24.
Barbarea vulgaris R.Br., 2n = 16: W. Lancs., v.c. 60, River Lune, near Lancaster, SD/488.640.
Brassica napus L. subsp. *oleifera* (DC.) Metzger, 2n = 38: Dorset, v.c. 9, c. 1·5 km W. of Burton Bradstock, SY/47.89.
Calystegia soldanella (L.) R.Br., 2n=22: Caerns., v.c. 49, Pwllheli, SH/37.34.
Cardamine amara L., 2n = 16: W. Lancs., v.c. 60, near Carnforth, SD/507.706.
Carex acutiformis Ehrh., 2n = 38: W. Lancs., v.c. 60, Lancaster University campus, SD/48.57.
Chrysosplenium oppositifolium L., 2n=42: W. Lancs., v.c. 60, near Millbeck footbridge, SD/648.638.
Circaea lutetiana L., 2n = 22: Dorset, v.c. 9, Kingcombe Meadows, c. 1·5 km N.E. of Toller Porcorum, SY/55.99; W. Lancs., v.c. 60, near Millbeck footbridge, SD/648.638.
Crataegus monogyna Jacq. subsp. *nordica* Franco, 2n = 34: Caerns., v.c. 49, Penarwel valley, near Llanbedrog, SH/32.32.
Crithmum maritimum L., 2n = 20: Dorset, v.c. 9, Weymouth, landward side of Fleet Lagoon, SY/66.76.
Dactylorhiza purpurella (T. & T. A. Stephenson) Soó, 2n = 80: W. Lancs., v.c. 60, SD/5.7.
Daphne laureola L., 2n = 18: Dorset, v.c. 9, Todber, ST/79.19.
Dryopteris filix-mas (L.) Schott, 2n = 164: W. Lancs., v.c. 60, near Yealand Conyers, SD/509.745.
Equisetum telmateia Ehrh., 2n = c. 216: Caerns., v.c. 49, track from Carreg to Porth Oer (Whistling Sands), SH/16.29.
Eryngium maritimum L., 2n = 16: Caerns., v.c. 49, Pwllheli, south beach, SH/37.34.
Euonymus europaeus L., 2n = 32: Dorset, v.c. 9, Winterborne Kingston, SY/86.97.
Euphorbia peplus L., 2n = 16: Dorset, v.c. 9, Portland, Church Ope Cove, SY/69.70.
Fraxinus excelsior L., 2n = 46: Leics., v.c. 55, Outwoods, Jubilee Wood, SK/511.165; Leics., v.c. 55, Swithland Wood, SK/53.12; W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/480.776.
Geum rivale L., 2n = 42: W. Lancs., v.c. 60, near Forton, SD/486.534.
Geum urbanum L., 2n = 42: W. Lancs., v.c. 60, near Lancaster, SD/473.594.
Glaucium flavum Crantz, 2n = 12: Dorset, v.c. 9, c. 1·5 km W. of Burton Bradstock, SY/47.89.
Hydrocotyle vulgaris L., 2n = 96: W. Lancs., v.c. 60, Leighton Moss R.S.P.B. reserve, near Silverdale, SD/488.757.
Hypericum androsaemum L., 2n = 40: W. Lancs., v.c. 60, near Lancaster, SD/473.594.
Hypericum elodes L., 2n = 16: S. Devon, v.c. 3, Dartmoor, SX/66.80.

Kickxia elatine (L.) Dumort., 2n = 36: Dorset, v.c. 9, near Blandford Forum, ST/88.06.
Lamium album L., 2n = 18: W. Lancs., v.c. 60, W. of Heysham, SD/427.616.
Lemna gibba L., 2n = 40: Cambs., v.c. 29, River Delph, bridge c. 6 km E. of Chatteris, TL/470.858.
Lemna minor L., 2n = 40: Cambs., v.c. 29, River Delph, bridge c. 6 km E. of Chatteris, TL/470.858.
Ligustrum vulgare L., 2n = 46: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/483.775.
Lithospermum officinale L., 2n = 28 + 1S: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/479.776.
Littorella uniflora (L.) Asch., 2n = 24: Caerns., v.c. 49, Mynydd Cilan, SH/29.24.
Lotus pedunculatus Cav., 2n = 12: W. Lancs., v.c. 60, River Lune, near Lancaster, SD/483.628; Westmorland, v.c. 69, Lowick Common, SD/292.847.
Luzula pilosa (L.) Willd., 2n = 66: W. Lancs., v.c. 60, near Millbeck footbridge, SD/648.638.
Lysimachia nummularia L., 2n = 43: W. Lancs., v.c. 60, near Capernwray, SD/528.714.
Lysimachia vulgaris L., 2n = 84: W. Lancs., v.c. 60, River Lune, near Lancaster, SD/484.641.
Malva sylvestris L., 2n = 42: Dorset, v.c. 9, c. 1·5 km W. of Burton Bradstock, SY/47.89; W. Lancs., v.c. 60, near Bank Houses, W. of Cockerham, SD/430.531.
Marrubium vulgare L., 2n = 34: Dorset, v.c. 9, Bats Head, SY/79.80.
Medicago lupulina L., 2n = 16: Dorset, v.c. 9, c. 1·5 km W. of Burton Bradstock, SY/47.84 (two plants); W. Lancs., v.c. 60, River Lune estuary, edge of new sports centre, near Lancaster, SD/463.624.
Menyanthes trifoliata L., 2n = 54: W. Lancs., v.c. 60, near Lancaster, SD/458.612.
Myosotis stolonifera (DC.) Gay ex Leresche & Levier, 2n = 24: Westmorland, v.c. 69, Lowick Common, SD/292.847.
Myrica gale L., 2n = 48: Dorset, v.c. 9, Hartland Moor N.N.R. (W. side of road), c. 4 km S.E. of Wareham, SY/96.85.
Nepeta cataria L., 2n = 36: Dorset, v.c. 9, between Blandford Forum and Thornicombe, ST/87.04.
Nymphoides peltata Kuntze, 2n = 54: Cambs., v.c. 29, Block Fen gravel pit, near Chatteris, TL/431.839.
Oenanthe crocata L., 2n = 22: W. Lancs., v.c. 60, estuary of River Lune, near Lancaster, SD/460.621.
Ononis repens L. subsp. *repens*, 2n = 60: Caerns., v.c. 49, Abersoch, N. end of Porth Fawr, SH/31.27.
Oxalis acetosella L., 2n = 22: Dorset, v.c. 9, Kingcombe Meadows, c. 1·5 km N.E. of Toller Porcorum, SY/55.99.
Parietaria judaica L., 2n = 26: Dorset, v.c. 9, Portland Church Ope Cove, SY/69.70.
Persicaria amphibia (L.) Gray, 2n = 96: W. Lancs., v.c. 60, near Carnforth, SD/507.706.
Persicaria bistorta (L.) Samp., 2n = 48: S. Lancs., v.c. 59, Rochdale, Norden, Lower Mancroft Gate Farm, SD/841.148; Westmorland, v.c. 69, near Arnside, SD/457.767.
Persicaria maculosa Gray, 2n = 22: W. Lancs., v.c. 60, near Lancaster, SD/465.624.
Petasites hybridus (L.) P. Gaertner, B. Mey. & Scherb., 2n = 60: W. Lancs., v.c. 60, near Quernmore, SD/508.599.
Pimpinella saxifraga L., 2n = 40: Dorset, v.c. 9, Fontmell Down, c. 5 km S.S.E. of Shaftesbury, ST/88.18.
Polystichum aculeatum (L.) Roth, 2n = 164: W. Lancs., v.c. 60, near Lancaster, SD/473.594.
Populus nigra L. subsp. *betulifolia* (Pursh) W. Wettst., 2n = 38: W. Lancs., v.c. 60, near Lancaster, SD/454.615.
Potentilla palustris (L.) Scop., 2n = 35: Westmorland, v.c. 69, Lowick Common, SD/292.847.
Primula veris L., 2n = 22: W. Lancs., v.c. 60, near Silverdale, SD/470.749.
Prunella vulgaris L. (white-flowered), 2n = 28: Westmorland, v.c. 69, Broughton Beck, SD/285.825.
Ranunculus flammula L. subsp. *flammula*, 2n = 32: W. Lancs., v.c. 60, Heysham Moss, dismantled sidings, SD/422.604.
Ranunculus penicillatus (Dumort.) Bab. subsp. *pseudofluitans* (Syme) S. Webster var. *vertumnus* C. Cook, 2n = 48: Mid-W. Yorks., v.c. 64, Bishop Monkton, SE/32.66.
Ribes nigrum L., 2n = 16: Westmorland, v.c. 69, near Arnside, SD/477.782.
Ribes rubrum L., 2n = 16: W. Lancs., v.c. 60, near Lancaster, SD/473.594.

Rosa arvensis Hudson, 2n = 14: W. Lancs., v.c. 60, near Lancaster, SD/459.613.
Rumex obtusifolius L. subsp. *transiens* (Simonkai) K. H. Rech., 2n = 40: Surrey, v.c. 17, Richmond, River Thames, TQ/1.7.
Ruppia maritima L., 2n = 20: W. Lancs., v.c. 60, near Carnforth, SD/482.702.
Salix viminalis L., 2n = 38: W. Lancs., v.c. 60, W. of Heysham, SD/428.612.
Samolus valerandi L., 2n = 26: W. Lancs., v.c. 60, near Carnforth, SD/483.704.
Sanguisorba minor Scop. subsp. *minor*, 2n = 28: W. Lancs., v.c. 60, Leighton Moss R.S.P.B. Reserve, near Silverdale, SD/489.758.
Sanicula europaea L., 2n = 16: W. Lancs., v.c. 60, Leighton Moss R.S.P.B. Reserve, near Silverdale, SD/489.759.
Scirpus sylvaticus L., 2n = 62: W. Lancs., v.c. 60, River Lune, near Lancaster, SD/485.638.
Sedum forsterianum Smith, 2n = c. 90: Rads., v.c. 43, Stanner Rock, 4 km N.W. of Kington, SO/26.58.
Silene vulgaris Garcke subsp. *vulgaris*, 2n = 24: W. Lancs., v.c. 60, River Lune, near Lancaster, SD/488.640.
Sonchus oleraceus L., 2n = 32: Dorset, v.c. 9, c. 1·5 km W. of Burton Bradstock, SY/47.89.
Sorbus aucuparia L., 2n = 34: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/481.776.
Spirodela polyrhiza (L.) Schleiden, 2n = 40: Cambs., v.c. 29, River Delph, bridge c. 6 km E. of Chatteris, TL/470.858.
Stachys arvensis (L.) L., 2n = 10: Dorset, v.c. 9, Chamberlayne's Heath, c. 8 km N. of Wool, SY/83.91.
Stachys officinalis (L.) Trev., 2n = 16: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/478.773.
Taxus baccata L., 2n = 24: Dorset, v.c. 9, Hod Hill, near Blandford Forum, ST/85.10.
Thalictrum flavum L., 2n = 84: W. Lancs., v.c. 60, estuary, near Carnforth, SD/493.714.
Trifolium medium L., 2n = 80: W. Lancs., v.c. 60, Gait Barrows N.N.R., near Silverdale, SD/478.772.
Valeriana dioica L., 2n = 16: W. Lancs., v.c. 60, above Saltmire Bridge, by canal, SD/519.754.
Veronica anagallis-aquatica L., 2n = 36: Dorset, v.c. 9, near Sydling St Nicholas, ST/63.00.
Veronica beccabunga L., 2n = 18: Westmorland, v.c. 69, near Arnside, SD/477.782.
Veronica officinalis L., 2n = 36: Caerns., v.c. 49, Garn Fadryn, SH/27.35.

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POLYGONUM MARITIMUM L. IN EAST SUSSEX (V.C. 14)

On 18 June 1992 a number of plants of *Polygonum maritimum* L. (Polygonaceae), Sea Knotgrass, were discovered growing on the beach at Brighton, East Sussex by one of us (A. S.). This was an exciting find as this very rare plant has never before, to our knowledge, been recorded from East Sussex (v.c. 14) and was last recorded in West Sussex (v.c. 13) by W. Borrer, although no station is given and there is apparently no specimen in his herbarium. A previous record from Bognor in 1854 by Professor I. B. Balfour was thought by H. C. Watson to be *Polygonum oxyspermum* C. A. Meyer & Bunge ex Ledeb. subsp. *raii* (Bab.) D. A. Webb & Chater, and consultation of the herbarium of the Royal Botanic Garden, Edinburgh (**E**) confirms this.

Following notification to English Nature, under the terms of the Wildlife & Countryside Act 1981, as a fully protected species under Schedule 8, a specimen was collected (**herb. P. A. Harmes**) and confirmed by Dr J. R. Akeroyd. About 14 plants were found, of which eleven or so were growing together in a clump, seeming at first glance to be a single plant. They ranged in size from seedlings, with stems no more than 8 cm, up to mature plants with stems 60 cm in length. The plants were procumbent and were in flower and fruit, which continued throughout the summer and they were still flowering in late November. They grew well above the high tide mark and seemed to have a preference for areas of fine shingle. The presence of a number of plants growing in a clump suggests that this species may have been flowering here un-noticed in previous years, and had seeded itself.

The small shingle beach where the plants were found was already well-known for its botanical interest and supports a number of plants found nowhere else along this coast. Species recorded here already include *Atriplex glabriuscula*, *A. littoralis*, *A. portulacoides* (*Halimione portulacoides*), *Crambe maritima*, *Cakile maritima*, *Raphanus raphanistrum* subsp. *maritimus*, *Beta vulgaris* subsp. *maritima*, *Honkenya peploides*, *Spergularia media*, *Calystegia soldanella*, *Crithmum maritimum*, *Glaucium flavum*, *Tripleurospermum maritimum*, *Parapholis strigosa*, *Elymus atherica* (*E. pycnanthus*) and *Catapodium marinum*. Nomenclature follows Stace (1991).

The beach is largely composed of flint pebbles with patches of fine shingle or sand, as well as areas with some humus cover. It is only about 110 m in length and, at its widest, about 50–60 m down to the high tide mark, with vegetation restricted to about half of the area. For such a small site it has a surprisingly rich maritime flora. The beach is enclosed on three sides by a groyne, the sea wall and the western breakwater of Brighton Marina. This breakwater is about 640 m long and was completed in about 1972. The beach in its present form and position probably dates from this time and if this is the case, then all the plants here are recent colonists.

A build-up of shingle above the high tide mark has probably occurred here as the western breakwater prevents its eastern drift. It seems also that this breakwater traps great amounts of jetsam which is washed or blown on to the beach above the shingle ridge, where it tends to accumulate. The jetsam consists of plastic, polystyrene, wood, ropes, nets, tar and cans as well as plant material, including *Fucus vesiculosus* L. (Bladder-wrack), fruit and seeds, and accumulates in lower-lying parts of the beach to form a rich mulch in which seeds can be seen germinating. As the Channel current (North Atlantic Drift) and the prevailing wind through the summer come from the south-west, it seems quite possible that seed of *P. maritimum* could have originated from sites in Cornwall or S. Hants., or from the Channel Isles or Northern France. Less likely is the possibility that seeds were brought in by birds; Greenfinches are the only seed-eating species (apart from Sparrows) which frequent the beach.

P. maritimum is a characteristic species of the coasts of the Mediterranean region and is at the northerly edge of its range in southern England. The recent confirmation of this plant at three other stations in mainland Britain, together with records from S. E. Ireland and the Netherlands, suggest that it may be extending, or at least consolidating, its range and this might be related to the hotter, more Mediterranean-type summers that we have experienced in the south of England in recent years (Akeroyd 1991). If this is the case, then we may see it turning up on other suitable beaches in this country in the future. Table 1 shows the number of plants known in mainland Britain (excluding the Channel Isles).

TABLE 1. *POLYGONUM MARITIMUM* L. IN BRITAIN

Location	Number of plants in colony
W. Cornwall (v.c. 1), Gunwalloe	250
E. Cornwall (v.c. 2), Lantic Bay	1
S. Hants. (v.c. 11), Christchurch	49
E. Sussex (v.c. 14), Brighton	14

There are other factors which have enabled coastal plants to become established at this locality. Unlike many other shingle beaches in Brighton, this one is not regularly bulldozed, perhaps because there is no access. It is not used much by the public and the amount of sea-borne rubbish as well as the tar deter most people. Past threats to the beach have come from plans to extend Volk's Electric Railway, from Southern Water's proposal to dump chalk, as well as from over-zealous beach cleaning. These are hopefully no longer a threat, though beach parties and camp fires still occur. Brighton Borough Council has, however, recently declared the beach a Site of Nature Conservation Importance and there is a proposal to extend the adjacent S.S.S.I. to include this site. We hope these measures will protect the plants here and we will be monitoring the site to see if *P. maritimum* survives and increases.

ACKNOWLEDGMENTS

We should like to express our gratitude to the following for their assistance in the compilation of this note: Dr J. R. Akeroyd, Mrs M. Briggs, P. Bowman, Miss R. Murphy, D. Pearman, Mrs O. M. Stewart and R. Walls. Mrs C. J. Tatar kindly typed the manuscript.

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WHITE-BLOSSOMED *PINGUICULA GRANDIFLORA* LAM. (LENTIBULARIACEAE) IN THE BURREN, COUNTY CLARE, IRELAND

Pinguicula grandiflora Lam. (Leith Uisce, Kerry (or Large-flowered) Butterwort) has been reported occasionally from Ireland with white flowers. There are late 19th century records, the earliest by 'Veronica' (a nom-de-plume used by Frederick W. Burbidge, curator of Trinity College Botanic Garden, Dublin (cf. Nelson 1987)) being published in *The Garden* on 11 September 1886: "As peculiar to Ireland, or nearly so, we have . . . Pinguicula vulgaris var. grandiflora [i.e. *P. grandiflora*], in white, rosy lavender and dark violet forms" ([Burbidge] 1886). Scully (1916) recorded that in Co. Kerry while "colour variants are very rarely met with . . . forms with pure white flowers are . . . occasionally seen and have been gathered in the Gap of Dunloe by *Lady Godfrey* and on the east side of Caragh Lake by *Capt. Creaghe-Haward* . . . pale lilac forms . . . by Mrs. Jenner from the Gap of Dunloe, and are recorded in the *Irish Nat[uralist] 1906*, p. 154, as occurring also on the shores of the Lower Lake, Killarney." No one has reported white-blossomed Kerry Butterwort in more recent decades.

In 1903 *P. grandiflora* was discovered by Professor Ambrose Birmingham at Lisdoonvarna, Co. Clare (Nelson & Walsh 1991), a habitat to the north of the long-known ones in counties Cork and Kerry. In 1949, even further north, near Ballyvaughan, another colony was found (Heslop-Harrison 1949), and in 1973, at about the same latitude, yet another (Roden 1984). These latter colonies, growing in the environs of springs issuing from Carboniferous limestone, are within the region known as The Burren (Webb & Scannell 1983; Nelson & Walsh 1991).

In 1956, D. A. Webb collected a plant of *P. grandiflora* "with very pale, almost white flowers" near Ballyvaughan and sent it to Steiger (1987) – nothing more is recorded about this plant, although Webb & Scannell (1983) reported that "for several years around 1970, a small proportion of the plants . . . had flowers of a very pale lilac colour, but searches in 1974 and 1975 failed to rediscover them."

During the summers of 1989, 1990, and 1991 in one of The Burren populations, white-flowered plants were seen and photographed by the present author, on the first occasion in company with Mr and Mrs J. Leonard. The flowers were entirely white, without any purple or pink marks or tints; however in 1990 a very young bud of one particular plant, just as it began to rise above the rosette, had a light pink flush but this was not apparent on the fully open flowers at anthesis. In 1989 and 1990 plenty of seed was produced and shed by the white-blossomed plants.

Steiger (1987) published a photograph of a series of flowers of *P. grandiflora* variants, including examples named *P. grandiflora* f. *pallida* (Gaudin) Casper and *P. grandiflora* subsp. *rosea* (Mutel) Casper. In f. *pallida* the corolla throat was purple, and in subsp. *rosea* not only was the calyx purple but the corolla throat was lined with darker pink. The white-blossomed Burren examples did not have coloured markings on the corolla and the calyx is entirely devoid of red pigment. A search of the literature (see e.g. Casper 1962, 1966) suggests that no entirely white variant of *P. grandiflora* has been described hitherto. *P. grandiflora* subvar. *albescens* Rouy (1909: "*corolle blanche lavée de rose*") could be interpreted as including The Burren variant. (Schlauer (1986) listed "*P. grandiflora* Lam. var. *albescens* Rouy" but I can find no trace of any legitimate publication of the combination at varietal level.) However Rouy's subvariety has been relegated to synonymy under *P. grandiflora* subsp. *rosea* (Casper 1962, 1966) which certainly cannot encompass white-flowered plants ("*corollae . . . fauce violacea vel pallida violacea-pilosa . . .*"; Casper 1962: 85).

To designate the variant with a white corolla as a variety is extravagant, and thus I proposed elsewhere (Nelson & Walsh 1991: 214, 318) that these occasional white-flowered plants should be placed within a distinct form, *P. grandiflora* f. *chionopetra*. I suggest (without having any specimens to confirm the proposition) that f. *chionopetra* may also still occur in Co. Kerry, having been reported from that county before 1903 by Scully (1916).

Pinguicula grandiflora Lam. forma **chionopetra** E. C. Nelson **forma nova.**

Corolla candidissima, vel aliquando alabastrum novellum colore roseo suffusum; calyx flavovirens nihil rufescens vel purpurascens.

Corolla pure white, or at most the very young unopened flowers tinted pink; calyx yellow-green without red or purple tints.

Holotypus: 35 mm Kodachrome 64 colour transparency (no. 16, 25.05.90; accession number 1991.1) [precise locality withheld], County Clare, 12 May 1990, *E. C. Nelson* (**DBN**).

The epithet *chionopetra* is derived from *chion* (snow) and *petra* (rock), alluding to the white flowers and the unique rocky habitat; it is equally appropriate for plants from Co. Kerry should this form be collected there again.

A colour photograph is designated as the holotype because, for conservation reasons, I considered it was unacceptable to remove material from the solitary plant for preservation as an herbarium specimen. This is permissible under the *International Code of Botanical Nomenclature*, Art. 9, whereby an illustration may be a type of an infraspecific name.

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CORKSCREW RUSH (*JUNCUS EFFUSUS* L. FORMA *SPIRALIS* (J. McNAB) HEGI) (JUNCACEAE) IN IRELAND AND BRITAIN

Henderson (1992) suggested that the spiral-stemmed variant of *Juncus effusus* L. (Juncaceae), found in western Scotland and the Northern Isles of Scotland, represents a taxon different from the "original", long-cultivated one variously called, in common parlance, Corkscrew Rush, Irish Rush, or Spiral Rush. He also stated, incorrectly, that the latter had only been reported once from the wild.

The corkscrew rush (*J. effusus* var. *spiralis* J. McNab) was first collected by David Bishop (a Scot, one-time curator of Belfast Botanic Garden – see Anon. 1849; Nelson 1984, 1987) in "the wilds of Connemara", western Ireland, before 1849 and not in "Northern Ireland . . . in 1869" as noted by Henderson (1992) repeating McNab's (1873a, 1873b) faulty recollection. The exact date of discovery cannot now be ascertained but Bishop died in 1849, so he must have collected the Corkscrew Rush some time earlier. Indeed, the first report of the variant appeared in an obituary of Bishop (Anon. 1849):

> "this extraordinary plant was exhibited at a meeting of the Botanical Society of Edinburgh, from the collection at Dalkeith, by Mr. James M'Nab, and created great interest . . ."

I cannot trace a report of this particular exhibit. Several decades later, in April 1873, James McNab read a brief account of the Corkscrew Rush to the Botanical Society in Edinburgh (McNab 1873a, 1873b), and indicated that it had been on display at the British Association for the Advancement of Science's 1871 meeting in Edinburgh; again I cannot trace any specific mention of the rush's appearance at the Association.

Henderson (1992) separated the western Scottish Spiral Rush from the Irish one by stating that the latter has "quite erect [stems] . . . much more obviously spiral six to eight turns as against two or three [in Scottish plants]", but this is not the case. I have examined living individuals of the Irish Corkscrew Rush, as cultivated in the National Botanic Gardens, Glasnevin, and nursery-grown plants (source unknown) (September 1992); these possessed stems with as many as 14 complete rotations in the spiral, ranging to stems with a single attenuated rotation (the stem was merely curved), as well as erect, untwisted stems. The largest proportion of the spiral stems (50%) had fewer than five rotations; only 33% had 5–9 rotations. The stems projected at all angles, the less spiralled ones tending to spread almost horizontally (i.e. these were suberect) because of the spiral. Thus cultivated plants, propagated vegetatively from long-established Irish stock, do not have the characteristics suggested by Henderson (1992); his variety is dubiously distinct from the cultivated plant.

Several herbarium specimens in the Royal Botanic Garden, Edinburgh (see below), have remarkable corkscrewing stems, but clearly these particular stems were selected because of their form; they do not represent accurately the habit and range of spiralling in the original clone. The earliest illustration of the Corkscrew Rush from Ireland (*The Gardeners' Chronicle and Agricultural Gazette*, 10 May 1873: 647 (McNab 1873a; reprinted in McNab 1873b: 503)) showed a plant with erect and spreading stems, some markedly spiralled but many merely curved (Fig. 1), exactly as in those cultivated plants I have examined. A photograph published by Tutenberg (1905) also clearly displays variation in habit. Those authors presumably had plants derived from Bishop's original collection.

As for Irish populations, Praeger (1934: 406), repeating records of this taxon from Inishturk (Co. Mayo, v.c. H27) off the Connemara coast (Praeger 1907: 123 – "the form with spreading stems was several times observed"), stated that it had

> "spreading loosely spiral stems . . . The spiral rush just mentioned would appear to be an Atlantic

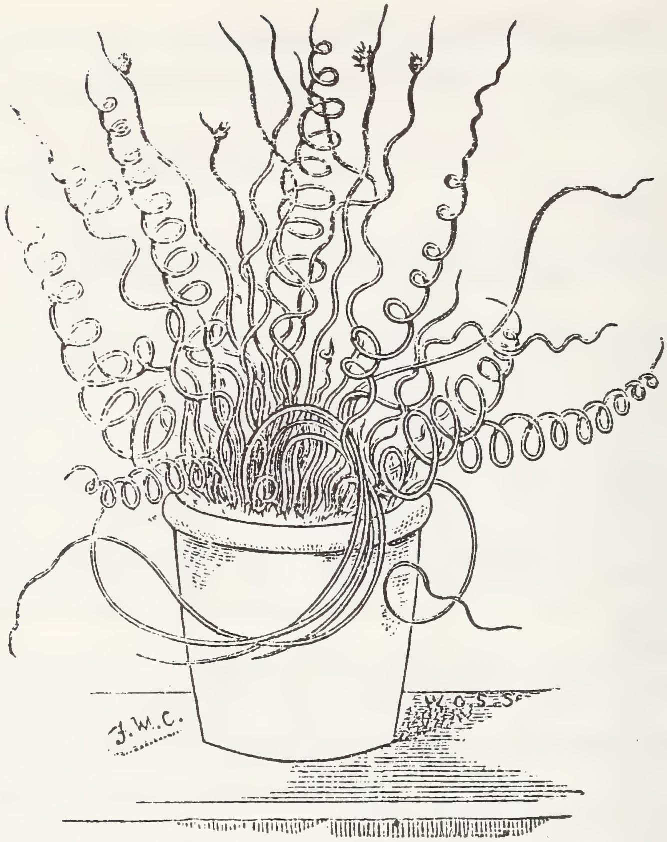

FIGURE 1. Corkscrew Rush, *Juncus effusus* L. forma *spiralis* (McNab) Hegi; illustration published in *The Gardeners' Chronicle and Agricultural Gazette*, 10 May 1873: 647 (designated as neotype herein).

form: it is common on many of the Irish western islands, and is stated to be abundant in Orkney . . ."

Praeger (1934: 424) also repeated records from Inishmurray (Co. Sligo, v.c. H28) –

"Perhaps the most curious plant of the island was a diffuse form of *Juncus conglomeratus* [= *J. effusus*; fide Praeger (1934)], the stems of which, instead of growing erect in a compact clump as usual, spread out at every angle, from horizontal to vertical, giving the whole plant a very strange appearance . . . this curious rush was abundant in damp places with the typical form." (Praeger 1896: 178)

– and from Achill Island (Co. Mayo, v.c. H27; Praeger 1934: 408) –

"Near Sraheens village occurred a form with widely spreading stems, many of them spirally curved, with several convolutions. I have gathered the same form from Inishmurray, Co. Sligo. Mr Beeby informs me that in Orkney these spiral forms are frequent." (Praeger 1904: 285)

Spence (1906, 1914, 1919) reported spiral-stemmed *J. effusus* from Orkney (v.c. 111), and Druce (1922: 524) and Scott & Palmer (1987: 343) recorded this variant from Shetland (v.c. 112); the latter authors suggested that the spiralling stems are deformed by wind –

"'*Juncus effusus* var. *spiralis* McNab', recorded from various localities by Druce [1922], was surely no more than a wind-blown state with slightly curved stems, not the monstrosity with corkscrew-like stems which James McNab grew . . ."

The Spiral Rush has been recorded in Surrey (v.c. 17) (see list of specimens below, and Leslie 1981), and collected in Carmarthenshire (v.c. 44, see below).

For at least a century, botanists have assigned to McNab's variant all plants of *J. effusus* producing spiral stems. Having examined herbarium material and living plants, I have been unable to detect any difference between the variable Irish original and Henderson's newly described taxon. Perhaps a case can be made on the basis of habit – that western Scottish plants lack any erect stems – but the range of variation within 'populations' of vegetatively propagated plants is so substantial that such an argument could not be justified. I conclude, therefore, that all plants of this species with spiral stems, irrespective of the degree of spiralling or angle of inclination, should be placed, as generally done by previous authors, within the same taxon. Henderson's varietal epithet is deemed unnecessary and is here relegated to synonymy.

The status of the Spiral Rush is debatable. McNab (1873b) and Henderson (1992) reported that seedlings have spiralling stems so it is a distinct genotype. While horticulturists have considered it little more than a cultivar (*J. effusus* 'Spiralis' is then the valid name; cf. Nelson 1984), its occurrence in the wild, especially in western Ireland and Scotland, suggests that it deserves recognition as a botanical variety or form. As the variant is clearly distinguished from the common rush only by its spiral stems, both erect and spreading, I suggest it is best treated as a botanical form; it does not warrant recognition at varietal level.

Hegi (1909: Bd 2: 147, fig. 274) was the first author to employ the epithet 'spiralis' at form level (*Juncus effusus* f. *spiralis*). Hegi did not attribute the epithet to any author and did not cite McNab's original paper, but it is unlikely that he was doing anything other than employing McNab's well-known epithet for the cultivated Irish plant at a revised rank; he was not describing a new taxon. To argue that Hegi was describing a new taxon is unhelpful, because his epithet 'spiralis' becomes illegitimate (Arts. 24. note 1: 64.4) and a new epithet becomes necessary for the form. Praeger (1934: entry no. 406) also used *J. effusus* f. *spiralis*; he did not acknowledge Hegi but did refer to Spence's note (1919) which in turn referred to an earlier account (Spence 1906) that contains explicit mention of McNab's description (1873b). The synonymy may be summarised as follows:

Juncus effusus L. forma *spiralis* (J. McNab) Hegi, *Illustrierte Flora von Mittel-Europa*, 1909: Bd. 2(16), 147.
Basionym: *J. effusus* var. *spiralis* J. McNab, *Gard. Chron.* 10 May 1873: 647, fig. 125; *Trans. bot. Soc. Edinb.* **11** (1873): 502–504.
Neotype: [here designated] icon in *Gard. Chron.* 10 May 1873: 647, fig. 125.
Synonym: *J. effusus* var. *suberectus* D. M. Henderson, *Watsonia* **19** (1992): 133–134.
Holotype: Big Sand, Gairloch, W. Ross, v.c. 105, 6 December 1988, *D. M. Henderson* (**E**!).

Other specimens examined:
Sandy edge of site of Frensham Great Pond, Surrey, v.c. 17, [19 August 1943], *A. J. Wilmott 19430819* (**BM**); "grouse moor . . . Carmarthenshire Vans", v.c. 44, 12 August 1904, *E. Milner-Jones* (**K**); Orkney, v.c. 111, 1 September 1906, *M. Spence* (**E**); Deerness, Orkney, v.c. 111, September 1908, *M. Spence* (**BM**); Rannsdale, Orphir, Mainland, Orkney, v.c. 111, 10 September 1923, *H. H. Johnston 2474* (**E**, **BM**, **K**); Sutherland, Flotta, Orkney, v.c. 111, 15 August 1932, *J. Sinclair 762* (**E**); Mainland, Shetland, v.c. 112, June 1890, *R. M. Barrington* (**DBN**); roadside, Lax Firth, Mainland, Shetland, v.c. 112, 27 July 1950, *J. E. Lousley* (**K**); by burn of Sandibanks, Scalloway, Mainland, Shetland, v.c. 112, 25 July 1950, *J. E. Lousley* (**K**); near Sraheens, Achill Island, v.c. H27, 30 July 1904, *R. Ll. Praeger* (**DBN**); boggy place centre of island [Inishtrahull, Co. Donegal], v.c. H34, 16 August 1939, *D. J. Sullivan* (**DBN**).
Cultivated specimens:
Edin[burgh] Bot. Garden, September 1876, *F.M.W.* (**E**); Botanic Garden [Edinburgh], 1886, (**E**); Wakehurst Place, Sussex (acc. no. 000–69–19251), 20 July 1980, *S. Andrews* (**K**); sine loc. ('Herb. Hort. Kew'), Aug. 1881 (**K**).

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Plant Records

Records for publication must be submitted to the appropriate Vice-county Recorder (see *B.S.B.I. Year Book for 1993*), and *not* the Editors. The records must normally be of species, hybrids or subspecies of native or naturalized 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 normally 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 vascular plants of the British Isles* by D. H. Kent (1992), from which the species' numbers, taxonomy and nomenclature are taken. The B.S.B.I. is to set up a procedure to register changes to this list, and a number of records of additional species have been held over until the new arrangements are in place. The Ordnance Survey national grid reference follows the habitat and locality. 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 are field records if no other source is stated.

Records from the following vice-counties are included in the text below: 2, 4–6, 9, 11, 14, 17, 21, 22, 24–30, 35, 38, 39, 41–53, 57–59, 64, 67–73, 75, 77–81, 83, 85–87, 89, 93, 98–103, 108.

The following signs are used:

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

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

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

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

4/1.1. Equisetum hyemale **42**, Brecs.: Stream-bank near Hay-on-Wye, SO/243.404. W. J. H. Price, 1992. 2nd record. **98**, Main Argyll: Stony flush, Coire Dearg, Fraochaidh, NN/043.518. R. Leishman *et al.*, 1992. 2nd record. **108**, W. Sutherland: Banks of burn, Allt na h-Airbhe, NC/12.23. P. A. & I. M. Evans, 1992, **herb. I.M.E.** 2nd confirmed post-1930 record.

4/1.8 × 9. Equisetum palustre × E. telmateia (E. × font-queri) ***11**, S. Hants.: Roadside, South Baddesley, Boldre, SZ/349.966. M. W. Rowe, 1991, **E**, det. C. N. Page.

9/1.1. Pilularia globulifera ***108**, W. Sutherland: Loch Borralan, NC/26.10. E. Charter, 1983. Shallow water, Cam Loch, NC/22.12. P. A. & I. M. Evans, 1992, **herb. I.M.E.** 1st and 2nd records.

11/1.1 × 2. Polypodium vulgare × P. interjectum (P. × mantoniae) ***64**, Mid-W. Yorks.: Hackfall Wood, Grewelthorpe, SE/23.77. D. J. & J. S. Tennant, 1991, det. R. H. Roberts. ***75**, Ayrs.: Cliffs, Ailsa Craig, NX/02.99. B. Zonfrillo, 1992, det. A. McG. Stirling.

11/1.2. Polypodium interjectum ***64**, Mid-W. Yorks.: Near Beezley Falls, Ingleton, SD/70.74. D. J. Tennant, 1979. Scotton Banks, Knaresborough, SE/33.57. D. J. Tennant, 1985. 1st and 2nd records, both det. R. H. Roberts.

15/2.5c. Asplenium trichomanes subsp. pachyrachis ***67**, S. Northumb.: Calcareous rock wall, Hareshaw Linn near Bellingham, NY/842.854. J. M. Ide, 1992, **BM**, det. A. C. Jermy.

15/2.6. Asplenium trichomanes-ramosum ***46**, Cards.: Wheelpit and shafts of leadmine, Esgair-Fraith, SN/741.912. S. P. Chambers & J. A. Martin, 1992.

17/1.1. Polystichum setiferum **59**, S. Lancs.: Base of wall near Chorlton Brook, Chorlton, SJ/813.931. D. Bishop, 1991. 1st post-1930 record.

17/3.2 × 3. Dryopteris filix-mas × D. affinis (D. × complexa) ***58**, Cheshire: Trackside, Roman Lakes, Marple, SJ/968.876. B. Porter, 1992, **NMW**, det. H. Corley.

17/3.3b. DRYOPTERIS AFFINIS subsp. CAMBRENSIS *83, Midlothian: Rocky moorland slope N. of White Craig, NT/072.543. D. R. McKean, 1992, det. A. C. Jermy.

17/3.8 × 9. DRYOPTERIS CARTHUSIANA × D. DILATATA (D. × DEWEVERI) *83, Midlothian: Marshy area in wood, Hermands Birchwood S.W.T. Reserve near West Calder, NT/0.6. A. F. Dyer, 1986, **E**, conf. C. N. Page.

26/2.2. NUPHAR PUMILA *73, Kirkcudbrights.: Kirriereoch Loch, NX/364.866. O. M. Stewart, 1991, **E**.

†28/6.1 × var. ACONITUM NAPELLUS × A. VARIEGATUM (A. × CAMMARUM) *44, Carms.: Roadside verge, Llangunnor Road, Carmarthen, SN/422.196. G. Hutchinson, 1990, **NMW**. *50, Denbs.: Roadside, Trefnant, SJ/056.712. G. Battershall, 1992.

28/13.7. RANUNCULUS PARVIFLORUS **24**, Bucks.: Grazed turf by old gravel pit S. of Ritchings Park, TQ/038.782. D. Green, 1992. 1st post-1930 record.

28/13.14. RANUNCULUS REPTANS *98, Main Argyll: Sandy silt on loch shore, Loch Awe near Collaig, NN/022.204. B. H. Thompson, 1992, **LTR**, det. R. J. Gornall.

28/17.3. THALICTRUM FLAVUM **45**, Pembs.: Tall fen, Castlemartin Corse, SR/899.997. F. A. Abraham, 1992. 2nd record.

†29/2.1. MAHONIA AQUIFOLIUM *77, Lanarks.: Roadside bank between Biggar and Coulter, NT/0.3. A. C. & P. Macpherson, 1992.

†30/1.1. PAPAVER ORIENTALE *73, Kirkcudbrights.: Disused quarry E. of Haugh of Urr, NX/805.673. O. M. Stewart, 1992.

†31/2.2 CORYDALIS CAVA **6**, N. Somerset: Dominant plant in ground flora, Terrace Wood, Ston Easton, ST/630.540. S. Preddy, 1992. 1st record since 1922 record from Ston Easton.

40/2.1 × †2. ALNUS GLUTINOSA × A. INCANA (A. × PUBESCENS) *46, Cards.: Wet alder wood and adjacent waste ground, Llanilar railway station, SN/628.752. A. O. Chater, 1992, **NMW**.

†40/2.2. ALNUS INCANA *50, Denbs.: Roadside wood, Llanfair Dyffryn Clwyd, SJ/169.506. J. A. Green, 1992.

†43/3.1. ATRIPLEX HORTENSIS *58, Cheshire: Shore just above tideline, Hoylake, SJ/210.890. V. Gordon, 1992.

43/3.4. ATRIPLEX LONGIPES *77, Lanarks.: Tidal shore of R. Clyde, Linthouse, Glasgow, NS/53.66. P. Macpherson, 1985, **herb. P. M.**, det. J. M. Mullin. Not refound.

43/4.1a. BETA VULGARIS subsp. MARITIMA **75**, Ayrs.: Shingle near mouth of Pinbain Burn, Lendalfoot, NX/138.916. A. McG. Stirling, 1992. Only extant locality.

43/6.4. SALICORNIA OBSCURA *6, N. Somerset: Bare mud of lower salt marsh, St George's Wharf, Easton-in-Gordano, ST/495.779. M. A. R. & C. Kitchen, 1991, det. F. Rose.

43/6.6. SALICORNIA FRAGILIS *6, N. Somerset: Pebbly, sandy bare area in lower salt marsh, St George's Wharf, Easton-in-Gordano, ST/492.775. M. A. R. & C. Kitchen, 1991, det. F. Rose.

†46/1.4. ARENARIA BALEARICA **43**, Rads.: Silty concrete top of unfinished dam, Dolymynach Reservoir, SN/909.619. R. G. Woods, 1992. 2nd record.

46/7.11. CERASTIUM PUMILUM **50**, Denbs.: Limestone grassland, Rhyd y Foel, SN/917.777, and Colwyn Bay, SN/830.799. Both G. Battershall, 1992. 1st and 2nd post-1930 records.

46/9.1. MOENCHIA ERECTA *41, Glam.: By paths through *Agrostis curtisii* heath on S.-facing hillside E. of Nottill, SS/537.885. Q. O. N. Kay, 1992, **NMW**. **44**, Carms.: Dry, S.-facing bank near Cynghordy, SN/820.390. I. K. Morgan, 1992, **NMW**, conf. G. Hutchinson. 2nd post-1930 record.

46/17.3. SPERGULARIA MARINA *80, Roxburghs.: Edge of A6088 road near Southdeanrig, NT/646.085. Edge of A68 road near Mossburnford, NT/663.155. Both M. E. Braithwaite, 1992, **herb.**

R. W. M. Corner. 1st and 2nd records. **81**, Berwicks.: Edge of A697 road near Carfraemill, NT/517.526. M. E. Braithwaite, 1992, **herb. M.E.B.** 1st inland record.

†46/18.1. LYCHNIS CORONARIA *__51__, Flints.: Track leading to disused sand pit near Ddôl Uchaf N.R., Ysceifiog, SS/140.715. J. Hughes, 1992.

†46/22.2. SAPONARIA OCYMOIDES *__28__, W. Norfolk: Steep wooded bank, King's Lynn, TF/625.189. R. M. Payne, 1992.

46/25.5. DIANTHUS DELTOIDES *__79__, Selkirks.: Rocky basic pasture, Tinnis Top, Old Tinnis, NT/383.292. D. J. Methven, 1992, conf. R. W. M. Corner.

†47/1.7. PERSICARIA AMPLEXICAULIS *__39__, Staffs.: Rough grassland by A515, Draycott in the Clay, SK/159.295. J. Clarke, 1992, **herb. B. R. Fowler**.

47/1.11 × 14. PERSICARIA MACULOSA × P. HYDROPIPER (P. × INTERCEDENS) *__30__, Beds.: Bank of R. Great Ouse, Great Barford, TL/13.52. J. G. & C. M. Dony, 1987, **LTN**, conf. J. Timson.

47/1.12. PERSICARIA LAPATHIFOLIA **80**, Roxburghs.: Field margin, Clarilaw, Hawick, NT/525.184. M. E. Braithwaite, 1992, **herb. R. W. M. Corner**, det. J. R. Akeroyd. 1st confirmed post-1930 record.

47/1.16. PERSICARIA MINOR **44**, Carms.: Edge of pond, Gwaith Go-Bach Pond, Dinefwr Castle Woods, SN/619.221. I. K. Morgan, 1992, **NMW**, det. G. Hutchinson. 2nd record. **67**, S. Northumb.: Stony lake margin, Greenlee Lough, NY/772.695. G. A. & M. Swan, 1992, **herb. G.A.S.**, det. J. R. Akeroyd. 2nd record.

47/4.1. POLYGONUM MARITIMUM *__14__, E. Sussex: Stable shingle beach, W. side of Brighton Marina, TQ/33.03. A. Spiers, 1992, **herb. P. A. Harmes**, conf. J. R. Akeroyd. 15 plants. (see pp. 271–273.)

47/4.5. POLYGONUM BOREALE *__73__, Kirkcudbrights.: Vegetable patch, New Abbey, West Maryfield, NX/970.664. O. M. Stewart, 1991, conf. D. R. McKean. Still present in 1992. Turnip field, Milnmark, NX/657.820. O. M. Stewart, 1992, **E**, conf. J. R. Akeroyd. 1st and 2nd records. **103**, Mid Ebudes: Ground trampled by cattle, The Reef, Tiree, NM/006.449. B. H. Thompson, 1990, **GLAM**, det. B. T. Styles. 2nd record.

47/5.†1 × †2. FALLOPIA JAPONICA × F. SACHALINENSIS (F. × BOHEMICA) *__50__, Denbs.: Waste ground, Wrexham, SJ/338.490. K. Watson, 1992, conf. V. Gordon. *__59__, S. Lancs.: Waste ground beneath Pier, Southport, SD/833.177. V. Gordon, 1992, det. A. P. Conolly.

47/8.13b. RUMEX CRISPUS subsp. LITTOREUS *__58__, Cheshire: Boulder clay sea-cliffs, Thurstaston, SJ/23.83. G. M. Kay, 1992. *__98__, Main Argyll: Coastal shingle and rock, Loch Gilp, NR/86.85. A. McG. Stirling & B. H. Thompson, 1992. Rocky shore, W. coast of Kerrera, NM/80.29. B. H. Thompson, 1992. 1st and 2nd records.

47/8.13b × 18. RUMEX CRISPUS subsp. LITTOREUS × R. PULCHER (R. × PSEUDOPULCHER) *__25__, E. Suffolk: Stable shingle, Aldeburgh, TM/46.56. G. D. Kitchener, 1992, **herb. G. D. K.**, conf. J. R. Akeroyd. Recorded here in 1976 by J. R. Akeroyd & C. D. Preston. 1st ever record of this hybrid with subsp. *littoreus* as *R. crispus* parent.

47/8.13 × 19. RUMEX CRISPUS × R. OBTUSIFOLIUS (R. × PRATENSIS) *__103__, Mid Ebudes: Garden, Isle of Erraid, NM/30.20. J. W. Clark, 1992, **E**, det. D. R. McKean.

47/8.20. RUMEX PALUSTRIS *__24__, Bucks.: Dry, overgrown ditch between Colnebrook and Sutton, TQ/025.781. D. Green, 1992, **AYM**.

48/1.10d. LIMONIUM BRITANNICUM subsp. CELTICUM *__69__, Westmorland: On limestone, Frith Hall, estuary of R. Leven, SD/3.7. W. H. Pearsall, 1916, **YRK**. Stonework of Arnside railway viaduct, SD/4.7. C. Webb, 1988, **LANC**. 1st and 2nd records of species, both det. M. Ingrouille.

51/1.7b. HYPERICUM MACULATUM subsp. OBTUSIUSCULUM *__81__, Berwicks.: Woodland edge near Carfraemill, NT/510.529. M. E. Braithwaite, 1992, **herb. M.E.B.** 1st record since 1938 and only extant locality.

51/1.12. Hypericum pulchrum **75**, Ayrs.: Ailsa Craig, NS/01.00. B. Zonfrillo, 1992, **GL**. 1st record from Ailsa Craig.

52/1.1. Tilia platyphyllos †***50**, Denbs.: Hedge, Colwyn Bay, SH/837.778. G. Battershall, 1992.

53/1.1. Malva moschata †***98**, Main Argyll: Area of hard-standing, Loch Ederline, NM/870.029. A. McG. Stirling & B. H. Thompson, 1992.

†53/1.2. Malva alcea ***41**, Glam.: Waste ground, Sully, ST/163.679. S. G. Lambert, 1991, **NMW**, det. D. McClintock. 1st Welsh record.

†53/1.6. Malva pusilla ***28**, W. Norfolk: Waste ground by track in Oxborough Wood, TF/722.012. J. E. Caffney, 1992, det. N. K. B. Robson.

53/3.1. Althaea officinalis **28**, W. Norfolk: Dikeside, Marshland St James, TF/503.103. R. M. Payne, 1992. 2nd record.

57/1.4 × 6. Viola riviniana × V. canina (V. × intersita) ***73**, Kirkcudbrights.: Disused railway, Waterside, NX/723.676. O. M. Stewart, 1992, det. A. J. Silverside.

57/1.6. Viola canina **83**, Midlothian: Forest ride, Gladsmuir, NT/919.572. J. Muscott, 1992. 1st post-1930 record.

†57/1.11 × 12 × alt. Viola × wittrockiana ***71**, Man: Dumped garden rubbish, Ramsey Mooragh, SC/451.955. L. S. Garrad, 1989.

61/2.2 × 3. Salix fragilis × S. alba (S. × rubens) ***47**, Monts.: River bank, Cilcewydd, Welshpool, SJ/227.034. I. C. Trueman, 1991, det. C. A. Sinker.

†61/2.6. Salix daphnoides **44**, Carms.: Coastal dunes, Pembrey Forest, SN/405.012. R. D. Pryce *et al.*, 1992, **NMW**, det. G. Hutchinson.

61/2.9 × 12. Salix viminalis × S. aurita (S. × fruticosa) ***47**, Monts.: River bank, Cilcewydd, Welshpool, SJ/226.033. I. C. Trueman, 1991, det. C. A. Sinker.

61/2.10 × 12. Salix caprea × S. aurita (S. × capreola) ***46**, Cards.: Scrub on riverbank, Afon Rheidol by Glanyrafon Industrial Estate, SN/614.804. A. O. Chater, 1991, **NMW**, conf. R. D. Meikle.

61/2.12 × 15. Salix aurita × S. phylicifolia (S. × ludificans) ***83**, Midlothian: Marsh by Gala Water, Heriot House, NT/40.54. R. Learmouth, 1992, **herb. R.L.**, det. R. D. Meikle.

†61/2.13. Salix eriocephala ***46**, Cards.: Amongst *Molinia caerulea* on bank of Afon Ystwyth, Llanfarian, SN/588.778. S. P. Chambers & A. O. Chater, 1992, **NMW**, conf. R. D. Meikle.

†62/7.1. Erysimum cheiranthoides ***46**, Cards.: Newly reconstructed verge of A44(T), Lovesgrove, SN/631.811. A. O. Chater, 1992, **NMW**.

62/12.5. Rorippa sylvestris ***93**, N. Aberdeen: Waste ground, Insch, NJ/629.278. D. Welch, 1992, **ABD**, conf. T. C. G. Rich.

†62/16.1. Aubrieta deltoidea **50**, Denbs.: Disused quarry N. of Bryn Euryn, SH/8.8. R. Lewis, 1992. 2nd record.

62/21.4. Draba muralis †***52**, Anglesey: Disused limestone quarry near Llangoed, SH/60.81. D. F. Evans, 1991.

62/22.3. Erophila glabrescens ***79**, Selkirks.: Rocks by R. Tweed below Yair Bridge, NT/459.325. ***80**, Roxburghs.: Rocky pasture, Smailholm Craigs, NT/637.347. Both R. W. M. Corner, 1991, **herb. R.W.M.C.**, det. T. T. Elkington.

62/30.3. Lepidium heterophyllum **28**, W. Norfolk: Field edge, Marham, TF/732.103. J. Williamson, 1992, det. K. A. & G. Becket. 2nd record.

62/30.5. Lepidium ruderale **70**, Cumberland: Gullery, S. end of Rockcliffe Marsh, NY/310.626. D. Hawker, 1992, **LANC**. Disturbed roadside verge, Brunstock, Carlisle, NY/426.592. P. Burton, 1992, **LANC**. 1st records since 1908.

†62/30.8. Lepidium draba **81**, Berwicks.: Railway bank, Reston, NT/878.619. A. R. Jermyn, 1992. 1st record since 1892. Side of A6112 road between Duns and Grantshouse, NT/812.645. M. E. & P. F. Braithwaite, 1992. 2nd extant locality.

†62/30.8b. Lepidium draba subsp. chalepense *__6__, N. Somerset: Salt marsh, St George's Wharf, Portbury, ST/500.780. M. A. R. & C. Kitchen, 1991, det. T. C. G. Rich. *__29__, Cambs.: Waste area at corner of arable field, Morden Grange chalkpit, TL/295.401. A. Showler, 1992, det. T. C. G. Rich.

†62/36.1. Erucastrum gallicum *__5__, S. Somerset: Disturbed roadside bank, Bayford, ST/728.290. I. P. Green, 1992. Gravel heap, Henstridge Marsh, ST/754.200. I. P. Green, 1992. 1st and 2nd records.

†62/37.1b. Coincya monensis subsp. recurvata **44**, Carms.: Penrhyngwyn, Machynys, Llanelli, SS/517.973. I. K. Morgan, 1992. **NMW**, det. G. Hutchinson. 2nd record.

†62/38.1. Hirschfeldia incana *__42__, Brecs.: Roadside verge near Brecon, SO/067.278. M. Porter, 1991. *__71__, Man: Tip S.W. of Point of Ayre, NX/460.040. B. A. Tregale, 1988.

63/1.3. Reseda lutea *__93__, N. Aberdeen: Disused gravel pit, Memsie, NJ/985.620. D. Welch, 1991, **ABD**.

64/1.1b. Empetrum nigrum subsp. hermaphroditicum **73**, Kirkcudbrights.: Rocky ground on E. side of Carlin's Cairn, Corserine, NX/498.882. R. W. M. Corner, 1992, **E**. 2nd record.

65/13.2. Vaccinium microcarpum *__93__, N. Aberdeen: *Sphagnum* flush, Buck of Cabrach, NJ/417.238. R. W. M. Corner, 1991, **herb. D. Welch**. 2nd record.

66/1.3. Pyrola rotundifolia *__93__, N. Aberdeen: Acidic flush, Buck of Cabrach, NJ/413.239. R. W. M. Corner, 1992. 1st localised record.

67/1.1b. Monotropa hypopitys subsp. hypophegea †**58**, Cheshire: Large colony in old tree nursery, Priory Gardens Reserve, Sale, SJ/802.926. A. & S. Bell, 1992. Only extant locality.

69/1.2. Primula elatior *__24__, Bucks.: Ancient woodland over calcareous clay, Bovington Great Wood, TL/002.052. R. Mabey, 1977. Heather Grove, SP/994.055. R. Mabey, 1977–1989. 1st and 2nd records.

69/1.3. Primula veris **73**, Kirkcudbrights.: Short turf near shore, Burnfoot, NX/742.446. O. M. Stewart, 1991. Only extant locality.

†69/4.4. Lysimachia ciliata **98**, Main Argyll: Damp ground by Loch Ederline, NM/870.029. A. McG. Stirling & B. H. Thompson, 1992. 2nd record.

69/8.1. Samolus valerandi *__24__, Bucks.: Margin of lake formed after gravel extraction, Great Linford, SP/845.439. C. Machaddie, R. Maycock & A. Woods, 1991.

†72/1.1. Escallonia macrantha *__49__, Caerns.: Woodland edge, Coed Tan yr Allt between Pontwgan and Rowen, SH/761.717. R. Lewis, 1992, **NMW**, det. R. G. Ellis & G. Hutchinson.

†72/2.4. Ribes sanguineum *__98__, Main Argyll: Forest roadside, Minard Castle, NR/970.951. B. H. Thompson, 1992.

†73/1.3. Crassula helmsii *__30__, Beds.: Pond near Podington, SP/937.628. M. Powell, 1988, **LTN**, conf. C. R. Boon. *__70__, Cumberland: Water 70 cm deep, Lord's Bay, Derwent Water, NY/266.218. G. Halliday, 1992, **LANC**, det. C. D. Preston.

†73/5.7. Sedum spurium *__28__, W. Norfolk: On concrete, Ickburgh, TL/823.950. K. A. Beckett, 1992.

†73/5.10. Sedum rupestre *98, Main Argyll: Steep bank between road and seashore near Kilchoan, Loch Melfort, NM/803.131. B. H. Thompson, 1992. Churchyard wall between North Connel and Ardchattan, NM/944.359. B. H. Thompson, 1992. 1st and 2nd records.

†74/4.1. Darmera peltata *73, Kirkcudbrights.: Marshy ground, Carruchan, NX/949.734. O. M. Stewart, 1992.

†75/3.1 × 3. Spiraea salicifolia × S. douglasii (S. × pseudosalicifolia) *29, Cambs.: By footpath leading from road between Swavesey and Over, TL/368.701. J. C. A. Rathwell, 1992. **CGE**. 1st confirmed record.

†75/3.2. Spiraea alba **70**, Cumberland: Roadside hedge, Aikshaw, Westnewton, NY/124.463. E. Marper, 1992, **LANC**, det. A. J. Silverside. 1st record since 1876 collection from same site.

†75/3.2 × 3. Spiraea alba × S. douglasii (S. × billardii) *75, Ayrs.: Side of A736 at Bloak Moss, Kilwinning, NS/36.45. J. Flanagan & K. Cruikshank, 1976, **herb. A. J. Silverside**. det. A. J. S. Overgrown river shingle, R. Stinchar near Colmonell, NX/1.8. A. McG. Stirling, 1991, **E**, det. A. J. Silverside. 1st and 2nd records.

†75/3.6. Spiraea canescens *46, Cards.: Rocky scrub, Allt Goch quarries, Cwrtnewydd, SN/491.483. A. O. Chater, 1991, **NMW**.

†75/8.6. Rubus parviflorus *50, Denbs.: Deciduous wood, Gresford, SJ/340.542. K. Watson, 1992, det. V. Gordon.

†75/8.8. Rubus phoenicolasius *4, N. Devon: Sourton Quarry, SX/523.896. L. J. Margetts, 1992, **herb. W. H. Tucker**. *77, Lanarks.: Pebbly shore of Canting Basin, Old Princes Dock, Glasgow, NS/56.65. P. Macpherson, 1991, **herb. P.M.**, det. A. Newton.

75/8.16. Rubus briggsianus *5, S. Somerset: Forest ride, Staple Hill, ST/23.16. L. J. Margetts, 1991, det. A. Newton.

75/8.45. Rubus crudelis *27, E. Norfolk: Hedgerow by lane near woodland, Saxthorpe, TG/11.32. A. L. Bull, 1992, **herb. A.L.B.**, det. A. Newton. Extension of range c. 160 km northwards.

†75/8.55. Rubus laciniatus *4, N. Devon: Car park, Tiverton, SS/960.128. B. Benfield, 1992.

75/8.98. Rubus curvispinosus *21, Middlesex: Bushy slope and open woodland, East Heath, Hampstead, TQ/28.86. D. E. Allen, 1992, **BM**, conf. A. Newton.

75/8.117. Rubus polyanthemus **75**, Ayrs.: Shingle shore near the pier, Ailsa Craig, NX/02.99. B. Zonfrillo, 1992, **GL**, det. A. McG. Stirling. 1st Ailsa Craig record.

78/8.123. Rubus septentrionalis *11, S. Hants.: Under gorse, Rockford Common, SU/17.08. D. E. Allen, 1986, **herb. D.E.A.**, det. A. Newton. **75**, Ayrs.: Ailsa Craig, NX/0.9. B. Zonfrillo, 1992, **GL**, det. A. McG. Stirling. 1st Ailsa Craig record.

75/8.134. Rubus armeniacus *98, Main Argyll: Side of road to Bonawe Ferry, Taynuilt, NN/0.3. A. McG. Stirling, 1992.

75/8.136. Rubus hylophilus *11, S. Hants.: Among gorse, Hamble Common, SU/484.059. D. E. Allen, 1992, **BM**, det. A. Newton.

75/8.142. Rubus ulmifolius **75**, Ayrs.: Near the lighthouse, Ailsa Craig, NX/024.997. B. Zonfrillo, 1992, **GL**, det. A. McG. Stirling. 1st Ailsa Craig record.

75/8.156. Rubus leucostachys *25, E. Suffolk: By path through woodland, Martlesham, TM/257.464. A. L. Bull, 1991, **herb. A.L.B.**, conf. A. Newton. *27, E. Norfolk: Secondary woodland, Pretty Corner, Sheringham, TG/15.41. A. L. Bull, 1992, **herb. A.L.B.**, conf. A. Newton.

75/8.172. Rubus mucronatoides *42, Brecs.: Deciduous wood, Llandefaelog-fach, SO/028.324. M. Porter, 1990, **herb. M.P.**, conf. A. Newton.

75/8.206. RUBUS ANISACANTHOS *27, E. Norfolk: *Tilia cordata* wood, Hockering Wood, TG/0.1. A. L. Bull, 1992, **herb. A.L.B.**, det. A. Newton.

75/8.224. RUBUS BLOXAMII *42, Brecs.: Ride in plantation, Crychan Forest N. of Glan Dulas, SN/87.42. M. Porter, 1991, **herb. M.P.**, det. A. Newton.

75/8.270 RUBUS HYLOCHARIS *11, S. Hants.: Wood margin, Johnston's Coppice, Purbrook, SU/689.078. D. E. Allen, 1992, **BM**, det. A. Newton.

75/8.305. RUBUS BRITANNICUS *11, S. Hants.: Gundymoor Wood, Havant, SU/69.07. D. E. Allen, 1992, **BM**, det. A. Newton. *27, E. Norfolk: Wood margin, Wolferton Park, TG/16.31. A. L. Bull, 1992, **herb. A.L.B.**, det. A. Newton.

75/8.313. RUBUS NEMOROSUS *42, Brecs.: Riverbank, Llanhamlach, SO/078.274. M. Porter, 1991, **herb. M.P.**, conf. A. Newton.

75/9.2. POTENTILLA PALUSTRIS 5, S. Somerset: Elworthy, ST/065.240. P. R. Green, 1992. 2nd record.

75/9.13 × 15. POTENTILLA ERECTA × P. REPTANS (P. × ITALICA) *73, Kirkcudbrights.: Steep grassy bank, Little Raebury, NX/704.436. O. M. Stewart, 1991, **E**, det. D. R. McKean.

†75/18.3. ACAENA OVALIFOLIA *98, Main Argyll: Forest roadside above Benmore Gardens, NS/137.856. B.H. Thompson, 1990, conf. P. F. Yeo.

75/19.10b. ALCHEMILLA FILICAULIS subsp. VESTITA 46, Cards.: Neutral grassland in meadow by Ddol-wen, S.E. of Aberaeron, SN/467.611. A. O. Chater, 1992, **NMW**. 2nd record.

75/21.4 × 11. ROSA ARVENSIS × R. STYLOSA (R. × PSEUDORUSTICANA) *29, Cambs.: Narrow ride, Triangle Ride, Hayley Wood, TL/291.532. C. D. Preston & A. L. Primavesi, 1992, **CGE**, det. A.L.P.

75/21.4 × 12. ROSA ARVENSIS × R. CANINA (R. × VERTICILLACANTHA) *29, Cambs.: Parish boundary hedge S.E. of Wood Farm, Hardwick, TL/365.571. C. D. Preston & A. L. Primavesi, 1992, **CGE**, det. A.L.P. *46, Cards.: Roadside bank N.W. of Blaen-twrch, SN/677.501. A. O. Chater, 1990, **NMW**, det. A. L. Primavesi.

75/21.5. ROSA PIMPINELLIFOLIA *29, Cambs.: Swaffham Prior, TL/5.6. Dr Jermyn, 1826 & 25.6.1827, **CGE**, det. A. L. Primavesi. Confirmation of records hitherto thought dubious.

†75/21.7. ROSA 'HOLLANDICA' *46, Cards.: Scrub on waste ground near site of Llanilar Station, SN/625.753. A. O. Chater, 1992, **NMW**.

75/21.11. ROSA STYLOSA 35, Mons.: Rough grassy common, Snowball Common, Portskewett, ST/499.884. T. G. Evans, 1991, conf. G. G. Graham. Trackside, Minnetts Wood, ST/453.895. T. G. Evans, 1992, **herb. T.G.E.**, conf. G. G. Graham. 1st and 2nd post-1930 records.

75/21.11 × 12. ROSA STYLOSA × R. CANINA (R. × ANDEGAVENSIS) *29, Cambs.: Side of ditch, Fen Road, Bassingbourn, TL/325.449. P. D. Sell, 1982, **CGE**, det. A. L. Primavesi. *35, Mons.: Streamside and grassy bank, S. E. Carleon below Christchurch, ST/342.897. T. G. Evans, 1990, **herb. T.G.E.**, det. G. G. Graham. 1st Welsh record.

75/21.11 × 14. ROSA STYLOSA × R. OBTUSIFOLIA *29, Cambs.: Hedge N.W. of Park Farm Cottages, Stetchworth, TL/660.565. C. D. Preston & S. E. Yates, 1992, **herb. A. L. Primavesi**, det. A.L.P.

75/21.12 × 13a. ROSA CANINA × R. CAESIA subsp. CAESIA (R. × DUMALIS) *46, Cards.: Hedge S. of Blaenpistyll, Tremaen, SN/232.475. A. O. Chater, 1985, **NMW**, det. A. L. Primavesi.

75/21.12 × 13b. ROSA CANINA × R. CAESIA subsp. GLAUCA (R. × DUMALIS) *28, W. Norfolk: Edge of track N. of Hockwold cum Wilton, TL/739.893. C. D. Preston, 1992, det. A. L. Primavesi. *35, Mons.: Lower White Castle, SO/38.16. T. G. Evans, 1992, **herb. T.G.E.**, det. G. G. Graham. *47, Monts.: Hedge, Llanwnog, SO/04.94. A. Franks & J. Clarke, 1991, det. A. L. Primavesi.

75/21.12 × 14. Rosa canina × R. obtusifolia (R. × dumetorum) ***29**, Cambs.: Hedge along footpath between Burton End and Leys Wood, TL/626.494. C. D. Preston & A. L. Primavesi, 1992, **CGE**, det. A.L.P.

75/21.12 × 18. Rosa canina × R. rubiginosa (R. × nitidula) ***29**, Cambs.: Milton Country Park, TL/48.62. G. M. S. Easy, 1992, **CGE**, det. A. L. Primavesi.

75/21.13b. Rosa caesia subsp. glauca ***35**, Mons.: Parkland, E. Blackwood, ST/17.96. R. Fraser, 1990, **herb. T. G. Evans**, det. G. G. Graham.

75/21.15. Rosa tomentosa ***35**, Mons.: Narrow wood, Llantarnam Abbey, ST/305.927. T. G. Evans, 1992, **herb. T.G.E.**, det. G. G. Graham. 2nd post-1930 record.

75/21.15 × 16. Rosa tomentosa × R. sherardii (R. × suberectiformis) ***46**, Cards.: Hedge, Derlwyn W.N.W. of Tregaron, SN/662.605. A. O. Chater, 1992, **NMW**, det. G. G. Graham.

75/21.16. Rosa sherardii **9**, Dorset: By old track, Stalbridge, ST/74.17. L. J. Margetts & J. Ounsted, 1992, det. G. G. Graham. 2nd record.

75/21.16 × 19. Rosa sherardii × R. micrantha ***46**, Cards.: Hedge W. of Capel Maen-y-groes, New Quay, SN/384.589. A. O. Chater, 1992, **NMW**, det. G. G. Graham.

†75/22.3. Prunus cerasifera ***49**, Caerns.: Copse between Tan-y-groes and Tal-y-cafn Bridge, SH/783.718. R. Lewis, 1992, **NMW**, det. R. G. Ellis & G. Hutchinson.

†75/22.12. Prunus serotina ***26**, W. Suffolk: Scrub on grass heath, Barnham Cross Common, TL/867.817. K. A. Beckett, 1992.

†75/22.14. Prunus laurocerasus ***49**, Caerns.: Edge of woodland opposite Maenan Abbey Hotel, SH/79.65. R. Lewis, 1992. Small copse between Tan-y-groes and Tal-y-cafn Bridge, SH/78.71. R. Lewis, 1992. 1st and 2nd post-1930 records.

†75/28.21. Sorbus croceocarpa ***47**, Monts.: Trackside hedge. Brooks, SO/146.996. P. J. M. Nethercott, 1991.

†75/28.23. Sorbus latifolia ***25**, E. Suffolk: Between road and dyke, Wolsey Bridge, Wangford, TM/47.76. Suffolk Wildlife Trust member, 1990, **CGE**, det. P. D. Sell.

†75/32.40. Cotoneaster sternianus ***11**, S. Hants.: Foot of gravelly bank of A35, Markway Hill, SU/244.026. R. P. Bowman, 1992, **herb. R.P.B.**, det. J. Fryer. ***83**, Midlothian: Edge of golf course, Levenhall, Musselburgh, NT/35.73. D. R. McKean, 1988, **E**, det. J. Fryer.

75/35.7 × 8. Crataegus monogyna × C. laevigata (C. × macrocarpa) ***77**, Lanarks.: Overgrown hedge, Sunnyside, S.E. of Hamilton High Parks, NS/74.51. A. McG. Stirling, 1979, **herb. P. Macpherson**, conf. B. Wurzell.

†77/7.1d. Anthyllis vulneraria subsp. carpatica **†*77**, Lanarks.: Grassy waste ground, Garden Festival site, Glasgow, NS/56.65. P. Macpherson, 1992, **herb. P.M.**, det. J. R. Akeroyd (as var. *pseudovulneraria*).

77/7.1e. Anthyllis vulneraria subsp. lapponica ***75**, Ayrs.: Coast, Ardrossan, NS/2.4. G. A. C. Macpherson, 1963, **herb. P. Macpherson**, det. J. R. Akeroyd.

77/14.1. Vicia orobus **75**, Ayrs.: Slown's Cairn, Glenmuck, NS/510.033. E. L. Birse, 1958. 2nd record.

†77/15.6. Lathyrus tuberosus ***58**, Cheshire: Canal bank, Hassall Green, SJ/771.587. J. E. Hawksford, 1992.

†77/15.7. Lathyrus grandiflorus ***58**, Cheshire: Bank of old railway, Portwood, Stockport, SJ/904.915. E. & O. Kearns, 1992, det. G. M. Kay.

77/15.12. Lathyrus nissolia **†42**, Brecs.: Roadside verge near Brecon, SO/073.275. M. Porter, 1991. 2nd record. **†58**, Cheshire: Railway embankment, Wardle, Nantwich, SJ/603.580. G. M. Kay, 1992. Only persistent population.

77/18.2a. MEDICAGO SATIVA subsp. FALCATA †***50**, Denbs.: Colwyn Bay by-pass, SH/823.787. J. A. Green, 1990, **NMW**.

77/19.1. TRIFOLIUM ORNITHOPODIOIDES **44**, Carms.: Colliery tip, Morlais Colliery, Llangennech, SN/571.021. I. K. Morgan, 1992, **NMW**, conf. G. Hutchinson. 2nd record.

†77/19.19a. TRIFOLIUM INCARNATUM subsp. INCARNATUM **52**, Anglesey: Disturbed soil above shore E. of Amlwch Port, SH/46.93. J. Clarke, 1991. 2nd record. ***80**, Roxburghs.: Turnip field N. of Synton Mossend, NT/478.213. M. E. Braithwaite, 1992, **herb. R. W. M. Corner**. 1st record except for wool aliens.

†77/22.2. LABURNUM ALPINUM **44**, Carms.: Hedge along B4333 E. of Dangoilan, SN/342.332. I. K. Morgan, 1992, **NMW**, det. A. O. Chater. 2nd record.

†77/23.2. CYTISUS MULTIFLORUS ***81**, Berwicks.: Rocky bank above railway, Penmanshiel, NT/796.671. M. E. & P. F. Braithwaite, 1992, **herb. M.E.B.**

77/26.2. ULEX GALLII **80**, Roxburghs.: Bank above Rule Burn E. of Ruletownhead, NT/619.129. M. E. Braithwaite, 1992, **herb. R. W. M. Corner**. 1st confirmed record for over a century.

†79/2.2. MYRIOPHYLLUM AQUATICUM ***29**, Cambs.: Ditch, Willingham, TL/408.703. C. D. Preston & S. E. Yates, 1992.

79/2.4. MYRIOPHYLLUM ALTERNIFLORUM **24**, Bucks.: Recently cleared pond, Naphill Common, SU/845.964. D. Showler, 1992. 1st post-1930 record.

84/1.1 × 3. EPILOBIUM HIRSUTUM × E. MONTANUM (E. × ERRONEUM) ***39**, Staffs.: Rough grassland slope, Fauld Crater, SK/183.277. I. Brown, 1986, det. T. D. Pennington. ***83**, Midlothian: Verge of A7 N. of Fountainhall, NT/41.52. R. Learmouth, 1990, **E**, det. T. D. Pennington.

84/1.3 × †8. EPILOBIUM MONTANUM × E. CILIATUM ***64**, Mid-W. Yorks.: Trackside, Burley-in-Wharfedale, SE/165.473. Yorkshire Naturalists' Union excursion, 1992, det. T. D. Pennington.

84/1.4. EPILOBIUM LANCEOLATUM †**28**, W. Norfolk: Gravelly garden, Stradsett, TF/669.053. R. M. Payne, 1992. 2nd record. **38**, Warks.: Dry diorite dust at pool margin in quarry, Atherstone, SP/306.958. J. W. Partridge, 1990, **WAR**, det. T. D. Pennington. 2nd record. ***45**, Pembs.: Slate quarry spoil, Teifi Marshes, Cardigan, SN/189.451. A. O. Chater, 1992.

84/1.5. EPILOBIUM TETRAGONUM ***68**, Cheviot: Margin of lake, Nelly's Moss Lakes, NU/081.023. G. A. Swan, 1991, **herb. G.A.S.**, det. T. D. Pennington. 1st confirmed record.

84/4.2. OENOTHERA FALLAX **25**, E. Suffolk: Verge of Viewpoint Road, Landguard Common, TM/28.32. A. Copping, 1992, **herb. E. & M. Hyde**. 2nd record. ***46**, Cards.: Disused railway, Llanfarian, SN/591.778. S. P. Chambers, 1992, det. J. C. Bowra.

†85/2.1. AUCUBA JAPONICA ***71**, Man: Trollaby Lane, SC/352.784. L. S. Garrad, 1971. Hedge, Ballachurry, Andreas, SC/402.968. M. Devereau, 1989. 1st and 2nd records.

88/1.1. EUONYMUS EUROPAEUS ***71**, Man: Deep river gorge between limestone and Manx Slate rocks, Santon Gorge, SC/297.695. B. A. Tregale *et al.*, 1990.

†89/1.1 × per. ILEX AQUIFOLIUM × I. PERADO (I. × ALTACLERENSIS) ***46**, Cards.: Mixed deciduous woodland, Penglais Woods, Aberystwyth, SN/590.821. A. O. Chater, 1992.

91/2.9. EUPHORBIA LATHYRIS †***73**, Kirkcudbrights.: Shingle on shore, Carsethorn, NX/991.599. O. M. Stewart, 1992. Present for at least three years here.

91/2.12. EUPHORBIA PORTLANDICA ***101**, Kintyre: Coastal sand dunes, Carskey Bay, NR/661.078. M. E. Mitchell & A. J. Silverside, 1991.

†93/1.1. VITIS VINIFERA ***46**, Cards.: Bank of Afon Rheidol N.W. of Pont Pen-y-bont, Penparcau, SN/590.806. A. O. Chater, 1992, **NMW**.

†102/1.4. Oxalis exilis *26, W. Suffolk: Garden paths, Bacton Green, TM/035.656. R. Addington, 1991, **herb. E. & M. Hyde**.

103/1.9. Geranium sanguineum †*46, Cards.: Grassy roadside verge, Penparc, SN/201.479. A. O. Chater, 1992, **NMW**.

†103/1.17. Geranium macrorrhizum *77, Lanarks.: Grassy waste ground, Garden Festival Site, Glasgow, NS/56.64. P. Macpherson, 1992, **herb. P.M.** Spreading.

103/1.20. Geranium purpureum †*71, Man: Garden, The Grove Rural Life Museum, N. Ramsey, SC/444.955. L. S. Garrad, 1990. Established for over 60 years.

†106/1.1. Hedera colchica *6, N. Somerset: Steep-sided combe, Combe Lane, Glastonbury, ST/507.391. P. R. Green, 1992. *43, Rads.: Wood, Garth Dingle Wood, Llowes, SU/189.420. R. G. Woods, 1992.

†107/4.2. Eryngium planum *77, Lanarks.: Grassy bank, Garden Festival Site, Glasgow, NS/56.65. P. Macpherson, 1991, **herb. P.M.**, det. D. R. McKean. Spreading.

107/6.2. Anthriscus caucalis **81**, Berwicks.: Sandy roadside bank, Pease Bay, NT/793.707. M. E. & P. F. Braithwaite, 1992, **herb. M.E.B.** 1st record since 1893.

†107/14.1. Aegopodium podagraria **75**, Ayrs.: Near lighthouse, Ailsa Craig, NX/024.998. B. Zonfrillo, 1992, **GL**. 1st Ailsa Craig record.

107/17.1. Crithmum maritimum *59, S. Lancs.: Artificial shingle beach derived from builders' rubble, Hightown, SD/295.023. V. Gordon, 1992.

107/26.3. Bupleurum tenuissimum **51**, Flints.: Side of R. Dee, Shotton, SJ/311.693. G. R. Sloman, 1992. 1st post-1930 record.

107/34.2. Carum verticillatum *22, Berks.: Species-rich meadow, Winkfield, SU/911.721. J. L. Francis & A. L. Morton, 1992, **RNG**, conf. S. L. Jury.

108/3.3. Centaurium littorale *51, Flints.: Dune slacks between Point of Ayr and the Warren, Talacre, SJ/111.851. P. Frost, 1991, det. F. Ubsdell. 1st post-1930 record.

111/3.2 × †4. Calystegia sepium × C. silvatica (C. × lucana) *48, Merioneth: Thicket, Gloddfa Road, Barmouth, SH/615.157. P. M. Benoit, 1992, **NMW**. 1st confirmed record.

†111/3.3. Calystegia pulchra *28, W. Norfolk: Hedge, Litcham, TF/889.173. K. A. Beckett, 1992.

113/2.1. Nymphoides peltata †*46, Cards.: Ditch in marsh near Brimstone Wildlife Centre, Penuwch, SN/609.630. I. S. Francis, 1992. Slow-flowing meanders of Afon Aeron at Winllan, Trefilan, SN/567.573. A. O. Chater & I. S. Francis, 1992. 1st and 2nd records.

116/2.1. Echium vulgare **73**, Kirkcudbrights.: Reclaimed land, Mutehill, NX/686.486. O. M. Stewart & A. White, 1992. Only extant locality.

116/4.3. Symphytum tuberosum †**47**, Monts.: Churchyard, Penstrowed, SO/070.916. C. A. Small, 1991. 2nd record.

†116/7.1. Cynoglottis barrelieri *25, E. Suffolk: Well established in sandy waste ground, Lewis Lane, Stutton, TM/138.348. E. M. Hyde, 1992, **herb. E. & M. Hyde**, det. E. J. Clement.

†116/10.1. Trachystemon orientalis **49**, Caerns.: Under trees by R. Ro near Rowen, SH/762.717. R. Lewis, 1992. 2nd record.

116/15.9. Myosotis ramosissima **73**, Kirkcudbrights.: Sandy ground near shore, Mossyard, NX/549.515. O. M. Stewart, 1992. 2nd extant locality.

†116/16.1. Omphalodes verna *71, Man: Overgrown cemetery, Braddan New Cemetery, SC/365.772. L. S. Garrad, 1991.

118/1.5 × 6. Stachys sylvatica × S. palustris (S. × ambigua) *50, Denbs.: Damp grassland, Llay, SJ/325.553. K. Watson, 1992.

†118/4.1c. Lamiastrum galeobdolon subsp. argentatum *48, Merioneth: Near Pen-y-Cefn, Dolgellau, SH/722.185. R. G. Ellis, 1987, **NMW.** *71, Man: Small wooded area by stream, Ballavitchell Road, Crosby, SC/328.799. L. S. Garrad, 1982. Still present in 1991. Streamside, Agneash, Lonan, SC/432.863. L. S. Garrad, 1988. 1st and 2nd records. *80, Roxburghs.: Bank of R. Teviot at Hornshole Bridge, Hawick, NT/533.167. M. E. Braithwaite, 1992.

118/9.1. Marrubium vulgare **44**, Carms.: Grey dunes, Pembrey Burrows, SN/435.002. I. K. Morgan & R. D. Pryce, 1992. Only extant locality.

†118/13. rac × nep. Nepeta racemosa × N. nepetella (N. × faassenii) *50, Denbs.: Railway bank, Llandulas, SH/9.7. G. Battershall, 1992.

118/23.4. Mentha suaveolens †*59, S. Lancs.: Grassland, Martin Mere Wildfowl Trust reserve, SD/42.14. P. J. Wisniewski, 1991.

118/25.4. Salvia verbenaca †75, Ayrs.: Banks, Ardstinchar Castle, NX/086.825. A. McG. Stirling & A. Rutherford, 1992. Only extant locality, where first recorded before 1903.

120/1.2. Callitriche truncata *9, Dorset: Ornamental lake, Forde Abbey Lake, ST/ 359.049. H. J. M. Bowen, 1992.

120/1.4. Callitriche platycarpa **25**, E. Suffolk: Ditch S. of New Dyke, Shipmeadow, TM/ 388.907. C. D. Preston & N. F. Stewart, 1989. 1st post-1930 record.

†121/1.6. Plantago arenaria *4, N. Devon: In great quantity on new roadside verges of A399, Berrynarbor, SS/567.473. W. H. Tucker, 1992, conf. B. Wurzell.

124/1.2. Verbascum virgatum †*59, S. Lancs.: Waste ground between Higginshaw and Manchester, SD/934.057. A. Frank & P. Tolfree, 1988.

†124/1.5. Verbascum phlomoides *38, Warks.: Waste ground, Longford, Coventry, SP/ 34.84. J. Robbins, 1981, **WAR**, det. I. K. Ferguson. Waste ground, Leamington Spa, SP/324.649. J. W. Partridge, 1986, **WAR**, det. P. J. Copson.

124/1. †5 × 7. Verbascum phlomoides × V. thapsus (V. × kerneri) *29, Cambs.: Waste ground, Hauxton Gravel Pits, TL/437.521. G. M. S. Easy & P. H. Oswald, 1992, **herb. G.M.S.E.** With both parents.

†124/4.1. Mimulus moschatus **98**, Main Argyll: Coastal flush, Achnacloich, Loch Etive, NM/959.342. B. H. Thompson, 1992. 2nd record.

†124/11.2. Cymbalaria pallida *50, Denbs.: Old wall, Eglwys Bach, SH/823.665. B.S.B.I. excursion, 1991.

†124/13.3. Linaria purpurea **75**, Ayrs.: Kilwinning, NS/3.4. B. Simpson, 1975. Rubbish tip, Doon Bridge, Dalmellington, NS/461.059. A.McG. Stirling & O. M. Stewart, 1992. 1st and 2nd records.

†124/16.18. Veronica peregrina **2**, E. Cornwall: Base of old wall, Lostwithiel, SX/145.605. E. Griffiths, 1991. 1st record since 1923.

†124/16.25. Veronica longifolia **73**, Kirkcudbrights.: Bank of R. Cree S. of Creebridge, NX/412.653. O. M. Stewart, 1992. 2nd record.

124/18.1. Sibthorpia europaea *9, Dorset: Moist ground in streamside wood, Hewood Bottom, ST/363.030. B. Edwards, 1992, conf. C. D. Preston.

124/20.5b. Euphrasia arctica subsp. borealis **83**, Midlothian: Heathy grassland near Stow, NT/46.41. M. Little, 1985, **E**, det. A. J. Silverside. 1st post-1930 record.

124/20.19. Euphrasia scottica **81**, Berwicks.: Base-rich flush, Whalplaw Burn, NT/548.568. M. E. Braithwaite & D. G. Long, 1992, **herb. M.E.B.**, det. A. J. Silverside. 2nd record.

124/24.1. Rhinanthus angustifolius †*35, Mons.: Artificial grassy bank, Greenmeadow Community Farm, ST/27.96. C. Titcombe *et al.*, 1992, det. C. T. & T. G. Evans. 2nd Welsh record.

125/2.1. Orobanche purpurea *9, Dorset: On *Achillea millefolium*, Small Mouth, Portland, SY/67.75. J. Pyatt, 1992, det. F. J. Rumsey. 1st confirmed record. †*17, Surrey: On *Achillea millefolium*, Royal Botanic Gardens, Kew, TQ/1.7. T. A. Cope & B. R. Spooner, 1992. Not deliberately introduced.

128/2.4. Utricularia stygia *98, Main Argyll: Oligotrophic loch, Corran Lochan, NS/216.953. A. McG. Stirling & B. H. Thompson, 1990, **E**. Edge of mire pool, Altan Airigh Mhic Chainnich, NN/032.112. B. H. Thompson, 1992, det. A. McG. Stirling & B.H.T. 1st and 2nd records.

†129/1.4. Campanula persicifolia *51, Flints.: Dune grassland, Talacre Dunes, Point of Ayr, SJ/120.849. R. G. Ellis, 1988, **NMW**, det. G. Hutchinson.

129/1.12. Campanula trachelium †*64, Mid-W. Yorks.: Stonework of old bell pit, Grass Wood, Grassington, SD/988.655. M. Hanson, 1991. 1st confirmed record, previous reports being errors for *C. latifolia*.

†129/9.1. Downingia elegans *26, W. Suffolk: New golf course, Elveden, TL/8.8. P. G. Lawson, 1992, conf. E. J. Clement (from photograph).

†131/3. orb × mic. Symphoricarpos orbicularis × S. microphyllos (S. × chenaultii) *46, Cards.: Bank of Nant Ardal, Llanilar, SN/623.751. S. P. Chambers, 1992, **NMW**.

133/1.3. Valerianella rimosa *27, E. Norfolk: Cornfield, High Kelling, TG/1.4. Mrs Gomersal, 1939, det. G. Foggitt. Recorded here until 1945.

†135/1.2. Echinops exaltatus *99, Dunbarton: Waste ground, Forth & Clyde Canal E. of Temple Lock, Glasgow, NS/55.69. G. McGhee, 1989, **E** (photograph), det. D. R. McKean.

135/2.1. Carlina vulgaris *98, Main Argyll: Dry, S.-facing ledges on cliffs of raised shore platform, Rubha Seanach, Kerrera, NM/80.25. B. H. Thompson, 1992, **herb. B.H.T.**

135/3.1. Arctium lappa *46, Cards.: Rough grass and scrub, Teifi Marshes, Cardigan, SN/182.455. A. O. Chater, 1992, **NMW**.

135/3.2a. Arctium minus subsp. pubens 46, Cards.: Edge of paddock E. of St Dogmaels Abbey, SN/168.459. A. O. Chater, 1992. 2nd record. *50, Denbs.: Roadside, Holt, SJ/401.538. K. Watson, 1992. 1st confirmed record.

†135/11.2. Centaurea montana 49, Caerns.: Overgrown cemetery, Llangelynin Church, SH/771.735. R. Lewis, 1992. 2nd record and only extant locality.

135/16.3. Leontodon saxatilis 98, Main Argyll: Dry, gravelly road verge, Poliphail, NR/933.692. E. Stewart & B. H. Thompson, 1992, **herb. B.H.T.**, conf. A. McG. Stirling. Only extant locality.

135/22.1. Lactuca serriola 44, Carms.: Newly built roadside verge, Machynys, SS/511.987. I. K. Morgan, 1992, **NMW**, conf. G. Hutchinson. 1st record since 1912. 46, Cards.: Building site by St Anne's churchyard, Penparcau, SN/592.799. A. O. Chater, 1992, **NMW**. 2nd record.

135/26.2. Crepis mollis 81, Berwicks.: Base-rich rocky knowe, Brunta Burn, NT/595.505. M. E. & P. F. Braithwaite, 1992, **herb. M.E.B.** 1st record since 1924.

135/28.25. Hieracium stewartii *93, N. Aberdeen: By R. Deveron, Ardmiddle, NJ/687.494. D. Welch, 1991, **herb. D.W.**, det. D. J. McCosh.

135/28.33. Hieracium lissolepium *79, Selkirks.: Rocks by R. Tweed, Yair Bridge, NT/45.32. D. J. McCosh, 1990, **E**.

135/28.83. Hieracium caesiomurorum *93, N. Aberdeen: Shady rock ledge in gorge, Craig Castle, NJ/472.247. D. Welch, 1990, **herb. D.W.**, det. D. J. McCosh.

135/28.91. HIERACIUM OISTOPHYLLUM *48, Merioneth: Scree, Penant Dyfi, Upper Dovey Valley, SH/9.2. P. H. Raven, 1961, **BM**, det. D. J. McCosh.

135/28.92. HIERACIUM SILVATICOIDES *89, E. Perth: Gorge, Allt Feith Lair, Fealar, NO/00.79. D. J. McCosh, 1990, **BM**.

†135/28.115. HIERACIUM SCOTOSTICTUM *24, Bucks.: Old beech wood, Lucas Wood, High Wycombe, SU/874.934. A. Showler, 1992, det. J. Bevan.

135/28.142. HIERACIUM ORIMELES *86, Stirlings.: Rocks by waterfall, Loup of Fintry, NS/66.88. D. J. McCosh, 1991, **CGE**, det. P. D. Sell. *87, W. Perth: Balquharn Glen, Alva, NS/86.97. D. J. McCosh, 1989, **E**, det. P. D. Sell.

135/28.145. HIERACIUM SCOTICUM *102, S. Ebudes: Coastal rocks near Allt na Gile, Jura, NR/47.78. D. J. McCosh, 1991, **herb. D.J.McC.**, det. P. D. Sell.

135/28.171. HIERACIUM EBUDICUM *102, S. Ebudes: Sea cliffs near Glen Trosdale, Jura, NM/67.00. D. J. McCosh, 1991, **CGE**, det. P. D. Sell.

135/28.180. HIERACIUM BRITANNICIFORME *100, Clyde Is.: Base of felsite cliff, Creag Dubh, Bennan Head, Arran, NR/997.207. A. R. Church, 1988, **herb. D. J. McCosh**, conf. P. D. Sell.

135/28.185. HIERACIUM EUSTOMON *46, Cards.: Base of sea cliff, Penbryn, SN/2.5. J. H. Salter, 1928, **NMW**, det. J. Bevan.

135/28.191. HIERACIUM IRICUM 103, Mid Ebudes: Rough grassland, Cornaigbeg, Coll, NM/234.630. A. Walker, 1991, **herb. J. Clark**, det. A. McG. Stirling. 1st Coll record.

135/28.196. HIERACIUM HEBRIDENSE *102, S. Ebudes: Waterfall in gorge, Allt nan Dearc, Jura, NR/67.98. D. J. McCosh, 1991, **herb. D.J.McC.**, det. P. D. Sell.

135/128.198. HIERACIUM SHOOLBREDII *72, Dumfriess.: Rock by Spoon Burn, Moffat, NT/153.107. D. J. McCosh, 1988, **CGE**, conf. P. D. Sell.

135/28.209. HIERACIUM VENNICONTIUM *86, Stirlings.: Cliffs W. of Spout of Ballochleam, NS/6.9. D. J. McCosh, 1991, **herb. D.J.McC.**, det. P. D. Sell. *87, W. Perth: Main crags, Craig Horn, Alva, NN/8.0. D. J. McCosh, 1988, **PTH**. *102, Mid Ebudes: Coastal rocks N. of Allt Bun an Eas, Jura, NR/45.76. N. F. Stewart, 1991, **E**, det. P. D. Sell.

135/31.1. ANTENNARIA DIOICA *81, Berwicks.: Dry bank, Dye Water between Byrecleuch and Trottingshaws, NT/63.58. K. Robeson & S. Williams, 1992. 2nd extant locality.

†135/40.4. SOLIDAGO GIGANTEA *81, Berwicks.: Bank of R. Whiteadder below Paxton, NT/93.53. M. E. Braithwaite, 1992, **herb. M.E.B.**

†135/41.4 × 5. ASTER NOVI-BELGII × A. LANCEOLATUS (A. × SALIGNUS) *39, Staffs.: Grassland, Christian Fields N. of Lichfield, SK/111.113. B. R. Fowler, 1992. *73, Kirkcudbrights.: Grassland near shore, Gillfoot, NX/976.554. O. M. Stewart, 1980, **E**, det. P. F. Yeo. Banks of R. Cree below Creebridge, NX/4.6. O. M. Stewart, 1992. 1st and 2nd records.

†135/41.5. ASTER LANCEOLATUS *73, Kirkcudbrights.: Banks of R. Cree below Creebridge, NX/4.6. O. M. Stewart, 1992.

†135/44.1. CONYZA CANADENSIS *81, Berwicks.: Roadside verge by Chesterfield Caravan Park, NT/772.700. M. E. Braithwaite, 1992, **herb. M.E.B.** 83, Midlothian: Flourishing colony on waste ground near Victoria Dock, Leith Docks, NT/268.768. O. M. Stewart, 1989. 1st record since 1905.

†135/44.2. CONYZA SUMATRENSIS *41, Glam.: Garden weed, Coed Glas Road, Llanishen, Cardiff, ST/168.817. D. Hart, 1991, **NMW**. 1st Welsh record.

†135/51.1. SANTOLINA CHAMAECYPARISSUS 41, Glam.: Roadside embankment, Penarth Road, Leckwith, Cardiff, ST/169.738. J. P. Curtis, 1980, **NMW**, det. D. McClintock (as subsp. *tomentosa* (Pers.) Arcangeli). 2nd record, 1st since 1946.

†135/57.1. Leucanthemella serotina **25**, E. Suffolk: Coastal dunes, Minsmere, TM/478.661. E. Beaumont, 1991, det. R. M. Burton. 2nd record.

135/60.1 × 2. Tripleurospermum maritimum × T. inodorum ***46**, Cards.: Grassy slope by sewage works, Aberystwyth harbour, SN/582.813. A. O. Chater, 1992, **NMW**.

†135/61.4. Cotula squalida ***83**, Midlothian: Weed in closely mown lawn, Royal Botanic Garden, Edinburgh, ST/24.75. D. R. McKean, 1989, **E**, det. D.R.McK. & J. Cullen. A population of female plants, apparently established for at least 30 years.

135/62.†1 × 10. Senecio cineraria × S. jacobaea (S. × albescens) ***50**, Denbs.: Waste ground, Colwyn Bay, SH/856.776. G. Battershall, 1992. ***99**, Dunbarton: Side of footpath, John Street, Helensburgh, NS/29.82. A. Rutherford, 1992, **E**, conf. A. McG. Stirling.

135/62.10 × 11. Senecio jacobaea × S. aquaticus (S. × ostenfeldii) ***81**, Berwicks.: With both parents on riverside, Abbey St Bathans, NT/763.617. M. E. Braithwaite, 1992, **herb. M.E.B.**

†135/71.2. Petasites japonicus ***75**, Ayrs.: Grassy roadside bank near Knockdolia Castle, Ballantrae, NX/12.85. A. McG. Stirling & A. Rutherford, 1992.

135/86.1. Eupatorium cannabinum **83**, Midlothian: Steep, wet slope near Crichton Castle, NT/379.613. D. R. McKean, 1992. 1st post-1930 record.

136/1.1. Butomus umbellatus ***43**, Rads.: Shallow water at edge of R. Wye, Cabalva, Clyro, SO/233.457. D. R. Drewett & D. C. Boyce, 1992.

138/2.1. Stratiotes aloides †**28**, W. Norfolk: Pond in chalk pit, Wells-next-the-sea, TF/929.429. P. R. Banham, 1986. Muddy stream, Caldecote, TF/73.02. M. Keene, 1992. Only extant localities.

†138/3.1. Egeria densa ***41**, Glam.: Amongst *Typha latifolia* in small pond, Fairwater Park Pond, Cardiff, ST/143.778. M. E. Gillham, 1988, **NMW**, det. D. A. Simpson. 2nd Welsh record.

†138/4.2. Elodea nuttallii ***50**, Denbs.: With *E. canadensis* in R. Dee near Rodens Hall, SJ/416.489. K. Watson, 1990, **NMW**. ***73**, Kirkcudbrights.: In R. Dee near Threave Island, NX/743.624. N. F. & O. M. Stewart, 1990.

142/1.5 × 9. Potamogeton lucens × P. perfoliatus (P. × salicifolius) ***28**, W. Norfolk: Dike, Hilgay, TL/642.978. H. Williamson, 1991, det. C. D. Preston.

142/1.9 × 19. Potamogeton perfoliatus × P. crispus (P. × cooperi) ***70**, Cumberland: Shallow water at edge of R. Eden, Carlisle, NY/41.56. C. D. Preston, 1989, **CGE**, and G. Halliday, 1992, **LANC**, conf. C. D. Preston.

142/1.20 × 21. Potamogeton filiformis × P. pectinatus (P. × suecicus) ***85**, Fife: Abundant at edge of bay, Loch Fitty, NT/126.913. P. Hollingsworth & C. D. Preston, 1992, **CGE**.

†147/2.1. Lysichiton americanus **99**, Dunbarton: Marshy ground, shore of Loch Lomond near Boturich Castle, NS/38.84. J. Mitchell *et al.*, 1992. 2nd record.

148/2.3. Lemna trisulca ***78**, Peebless.: Ornamental pond, Baddinsgill, NT/1.5. D. J. McCosh, 1992.

†148/2.4. Lemna minuta ***46**, Cards.: Garden pond, Cenarth, SN/266.417. A. O. Chater, 1992, **NMW**, conf. A. C. Leslie.

151/1.6. Juncus foliosus ***99**, Dunbarton: Peaty ditch, Carman Muir, Cardross, NS/36.78. A. McG. Stirling, 1992, **E**.

151/1.13 × 14. Juncus articulatus × J. acutiflorus (J. × surrejanus) ***80**, Roxburghs.: Fen margin, Branxholme Wester Loch, NT/419.108. R. W. M. Corner, 1991, **herb. R.W.M.C.**, det. C. A. Stace.

152/3.5. Eleocharis quinqueflora 2, E. Cornwall: Small coastal stream between Doyden Point and Port Quin, SW/968.805. M. G. C. Atkinson, 1992, det. L. J. Margetts & R. J. Murphy. 1st post-1930 record.

152/4.1. Bolboschoenus maritimus *108, W. Sutherland: Shallow brackish pool, Rubha Ruadh, Loch Laxford, NC/168.571. R. E. C. Ferreira, 1984.

152/7.2. Scirpus tabernaemontani *108, W. Sutherland: *Phragmites australis* swamp in shallow, brackish water, Upper Invernaver Saltings, NC/709.598. R. E. C. Ferreira, 1986.

152/8.2. Isolepis cernua *70, Cumberland: Eroded bank at top of beach, Silecroft, SD/1.8. M. M. Gill, 1992, **LANC**. 1st authenticated record.

†152/11.2. Cyperus eragrostis *58, Cheshire: Shallow pool in old railway sidings, Crewe, SJ/705.555. J. E. Hawksford, 1992, **herb. G. M. Kay**, det. E. J. Clement.

152/13.2. Rhynchospora fusca *108, W. Sutherland: Bog, Laxford Bridge, NC/23.46. R. E. C. Ferreira, 1980, **E**.

152/16.5. Carex otrubae *108, W. Sutherland: Brackish pool, Loch a' Mhuilinn N.N.R., NC/15.39. R. E. C. Ferreira, J. G. Roger & S. Angus, 1980.

152/16.10. Carex arenaria 39, Staffs.: Disused railway sidings, Bushbury, Wolverhampton, SJ/916.022. B. R. Fowler, 1992, **herb. B.R.F.** 2nd record.

152/16.11. Carex disticha 43, Rads.: Damp peaty hollow, Newmead Farm, Llanelwedd, SO/050.536. S. M. Gooch, 1992. 2nd record.

152/16.13. Carex divisa *45, Pembs.: Damp roadside near the sea 0·5 km N. of Dale, SM/808.066. J. W. Donovan, 1992, det. A. O. Chater.

152/16.20. Carex elongata *35, Mons.: Boggy ditch, Coed Robert Wood near Raglan, SO/397.098. R. Fraser, 1992, **herb. T. G. Evans**, det. A. O. Chater & T.G.E.

152/16.23. Carex hirta *108, W. Sutherland: Tall fen grassland, Eriboll Farm, NC/435.569. R. E. C. Ferreira & J. G. Roger, 1978, **E**. Marsh at mouth of Strathy River, NC/835.656. R. E. C. Ferreira, 1978. 1st and 2nd records.

152/16.24. Carex lasiocarpa 26, W. Suffolk: Hopton Fen N.R., TL/990.800. M. J. Ausden, 1991, conf. A. C. Jermy. Only extant locality.

152/16.25. Carex acutiformis 93, N. Aberdeen: Alder woodland by river, Glass, NJ/463.403. D. Welch, 1992, **ABD**, det. A. O. Chater. 1st post-1930 record.

152/16.29. Carex vesicaria *108, W. Sutherland: *Carex rostrata* mire, mouth of Strathnaver River, NC/451.503. R. E. C. Ferreira, 1980.

152/16.32. Carex sylvatica 108, W. Sutherland: Edge of river, Loch Druim Suardalain, NC/12.21. P. A. & I. M. Evans, 1992, **herb. I.M.E.** 2nd record.

152/16.39. Carex laevigata 81, Berwicks.: Shaded flush by Bruntaburn Wood, NT/595.511. M. E. Braithwaite, 1992, **herb. M.E.B.** 1st record since 1892.

152/16.46c. Carex viridula subsp. viridula 26, W. Suffolk: Lakenheath Poor's Fen N.R., TL/702.827. M. Harding, 1992, conf. A. C. Jermy. Only extant locality.

152/16.64. Carex aquatilis 108, W. Sutherland: Edge of Ledmore River, NC/22.12. P. A. & I. M. Evans, 1992, **herb. I.M.E.** 2nd post-1930 record.

†153/3.1. Sasa palmata *83, Midlothian: shady ditchside in woodland, Cramond, NT/177.768. J. Cook & D. R. McKean, 1991, **E**.

153/12.4. Festuca altissima *81, Berwicks.: Wooded burnside, Brunta Burn, NT/596.505. M. E. Braithwaite, 1992, **herb. M.E.B.**, det. D. R. McKean.

153/12.6. Festuca arenaria *46, Cards.: Embryo dune, S. end of Ynys-las Dunes, SN/605.928. A. O. Chater, 1992, **NMW**, conf. C. A. Stace.

153/12.9. Festuca vivipara *83, Midlothian: Scree slope, Arthur's Seat, Edinburgh, NT/267.730. R. Saville, 1990, **E**, det. D. R. McKean. 1st record since 1824.

†153/12.15. Festuca brevipila *39, Staffs.: Disused railway near Common Lane, Wombourne, SO/870.924. C. B. Westall, 1991, **herb. B. R. Fowler**, det. M. A. Wilkinson.

153/12.1 × †13.2. Festuca pratensis × Lolium multiflorum (× Festulolium braunii) *69, Westmorland: Wet area by path, Dalton-in-Furness, SD/224.739. P. Burton, 1989, **LANC**.

153/12.2 × 13.1. Festuca arundinacea × Lolium perenne (× Festulolium holmbergii) *99, Dunbarton: Grassy pathside near Duchess Woods, Helensburgh, NS/286.833. A. McG. Stirling & A. Rutherford, 1992, **E**.

153/13.1 × †2. Lolium perenne × L. multiflorum (L. × boucheanum) *2, E. Cornwall: Arable field, Hudsland Farm E. of Kilhampton, SS/283.125. T. W. J. D. Dupree & R. M. H. Hodgson, 1992, det. P. J. O. Trist.

153/14.5. Vulpia unilateralis *9, Dorset: Five Barrow Hill, SY/876.838. H. J. M. Bowen *et al.*, 1992.

153/16.2. Puccinellia distans **50**, Denbs.: Edge of forest road, Llanfiangel Glyn Myfyr, SJ/032.510. J. A. Green, 1989, det. G. Hutchinson. 2nd record. *80, Roxburghs.: With *Spergularia marina* on gravel by A68 road, Carter Bar, NT/697.068. M. E. Braithwaite, 1992, **herb. R. W. M. Corner**.

153/18.6. Poa angustifolia *69, Westmorland: Side of railway, Appleby-in-Westmorland, NY/681.211 and NY/666.247. R. W. M. Corner, 1992, **LANC**, det. J. Edmondson. 1st and 2nd records. **70**, Cumberland: Railway bank, Lazonby, NY/545.404. R. W. M. Corner, 1992, **LANC**, det. J. Edmondson. *75, Ayrs.: Ailsa Craig, NX/0.9. B. Zonfrillo, 1992, **GL**, det. A. McG. Stirling. *83, Midlothian: Dry grassland, Sunnybank Place, Edinburgh, NT/276.743. A. J. Silverside & E. H. Jackson, 1989, **herb. A.J.S.** **99**, Dunbarton: Grassy waste ground, Erskine Bridge, NS/46.72. A. McG. Stirling, 1992, **E**. 2nd record.

153/20.1. Catabrosa aquatica *98, Main Argyll: Silty sand with freshwater seepage, bay below Balure near Benderloch, NM/876.382. B. H. Thompson, 1992, **CGE**, conf. A. McG. Stirling. Muddy, cattle-trodden ground with freshwater seepage, Bran Phuirt, Lynn of Lorn, NM/883.410. B. H. Thompson, 1992, conf. C. D. Preston. 1st and 2nd records.

153/22.1. Sesleria caerulea *57, Derbys.: Calcareous grassland on skeletal soil, Monk's Dale, SK/136.736. H. Buckingham, 1989, conf. R. Smith. Extension of range 80 km southwards.

153/31.2. Koeleria macrantha **75**, Ayrs.: Ailsa Craig, NX/0.9. B. Zonfrillo, 1992, **GL**, det. A. McG. Stirling. 1st Ailsa Craig record.

153/32.3. Deschampsia flexuosa **29**, Cambs.: Edge of woodland ride, Gamlingay Wood, TL/243.536. T. C. E. Wells, 1991. Only extant locality.

153/39.8. Agrostis vinealis **43**, Rads.: Dry acidic grassland, Camnant, SO/080.835. R. G. Woods, 1992. 2nd record.

138/40.2. Calamagrostis canescens *24, Bucks.: Edge of ride through hazel coppice, Leckhamstead Wood, SP/727.403. R. J. Hornby, L. M. Jones-Walters & J. Spencer, 1989.

153/50.2. Bromus commutatus **42**, Brecs.: Meadow N. of Llanwrtyd Wells, SN/860.487. S. Gooch, 1990, **herb. M. Porter**, det. T. A. Cope. 2nd record.

153/51.2. Bromopsis benekenii **42**, Brecs.: Limestone gorge N. of Cefn Coed, SO/024.087. T. C. G. Rich, 1992. 2nd record, 1st since 1899.

†153/53.1. Ceratochloa carinata *2, E. Cornwall: Waste ground by track, Saltermill, SX/430.637. A. Atkinson, 1991, conf. L. J. Margetts.

153/54.1. Brachypodium pinnatum ***49**, Caerns.: Limestone grassland, Great Orme, SH/7.8. P. W. Ball, 1959, **LIV**. 1st confirmed record. †**83**, Midlothian: Heath near limestone ballast from railway, Cobbinshaw Loch, NT/019.591. R. Saville, 1992, **E**, det. D. R. McKean. 2nd record.

153/59.4. Hordeum secalinum **46**, Cards.: Roadside hedgebank W. of Llanfihangel-y-Creuddyn, SN/658.761. A. O. Chater, 1992, **NMW**. 2nd record.

†153/66.1. Cynodon dactylon ***39**, Staffs.: Well established on former railway sidings, Wolverhampton, SJ/916.022. B. R. Fowler, 1992, **herb. B.R.F.**

153/67.1 × †3. Spartina maritima × S. alterniflora (S. × townsendii) ***98**, Main Argyll: Silty tidal inlet, An Sailean, Benderloch, NM/895.402. B. H. Thompson, 1990, det. T. A. Cope. Plants recorded in 1984 at NM/888.418. and 902.418. as *S. anglica* were presumably this taxon.

154/1.1d. Sparganium erectum subsp. oocarpum ***46**, Cards.: Ditch at edge of *Typha* swamp, Pentwd Marshes, Cardigan, SN/184.449. A. O. Chater & A. P. Fowles, 1990.

158/7.1. Colchicum autumnale [**73**, Kirkcudbrights.: Delete record published in *Watsonia* **19:** 151 (1992); plant is *Crocus nudiflorus*.]

158/20.2 × †3. Hyacinthoides non-scripta × H. hispanica **50**, Denbs.: Grassland, Bryn Euryn, Colwyn Bay, SH/832.798. G. Battershall, 1992.

†158/24.4. Allium neapolitanum ***27**, E. Norfolk: Grassy hedgebank, Eaton Hill, Norwich, TG/20.06. E. T. Daniels, 1991. Known here for 25 years. ***71**, Man: Hedgebank, Bride Hills, NX/447.005. M. Devereau, 1991. Known here for several years.

†158/24.9. Allium paradoxum **73**, Kirkcudbrights.: Bank of R. Urr, W. of Haugh of Urr, NX/801.660. O. M. Stewart, 1992. 2nd record.

158/24.11. Allium oleraceum **58**, Cheshire: River bank, Catton Hall near Frodsham, SJ/545.773. G. M. Kay, 1992. 2nd record.

†158/24.12. Allium carinatum ***53**, S. Lincs.: Saxilby Road, Skellingthorpe, SK/92.72. M. Hill, 1992, conf. I. Weston. [**58**, Cheshire: Delete record published in Newton, A. (1991) *Supplement to Flora of Cheshire* p. 39; plant is *A. oleraceum*.]

158/24.13. Allium ampeloprasum var. babingtonii †***50**, Denbs.: Railway bank, Llandulas, SH/918.783. G. Battershall, 1992. 1st record of species.

158/24.14. Allium scorodoprasum **99**, Dunbarton: Shore N. of Ardmore Point, NS/32.79. A. Rutherford, 1990. 2nd record.

†159/5.2. Iris sibirica **77**, Lanarks.: Damp wood, Busby, NS/58.55. P. Macpherson, 1991, **herb. P.M.**, det. B. Wurzell. 2nd record.

†159/5.4. Iris versicolor ***6**, N. Somerset: Pond, Emborough, ST/613.507. P. R. & I. P. Green, 1992.

†159/8.3. Crocus nudiflorus ***70**, Cumberland: Grass verge of path near Rose Castle, S. of Dalston, NY/372.465. E. E. Marper, 1992, **LANC**. ***73**, Kirkcudbrights.: Mill Island, R. Cree N. of Newton Stewart, NX/409.662. J. McCleary, 1989.

†159/13.1. Crocosmia paniculata ***70**, Cumberland: Muncaster Park, SD/090.958. M. M. Gill, 1992, **LANC**, det. O. M. Stewart.

†159/13.3. Crocosmia pottsii ***98**, Main Argyll: Streamside near Scout Cottage, Lunga, NM/809.084. B. H. Thompson, 1992.

162/14.1. Anacamptis pyramidalis **58**, Cheshire: Roadside embankment, Ringway, SJ/807.836. J. McHarry, 1992. Only extant locality.

162/18.3 × 5. Dactylorhiza incarnata × D. purpurella (D. × latirella) ***80**, Roxburghs.: With parents in calcareous flush, Murder Moss, NT/503.286. R. W. M. Corner, 1991, det. I. Denholm (from photographs).

Book Reviews

Random-access guide to selected British Hawkweeds. J. Bevan, based on a program by C. J. Legg; illustrated by K. J. Adams. Pp. 24 + disk. National Museum of Wales & Field Studies Council, Cardiff & Preston Montfort. 1992. Price £15 (ISBN 0–7200–0367–9).

The development of computer-assisted keys to critical groups of British plants has accelerated in recent years; see also the review in *Watsonia* **19**: 199–200 (1993) of the *FLORA* program. Despite the modest reference in its title to 'selected' British Hawkweeds, this program actually covers 251 taxa of British species of *Hieracium* (excluding *Pilosella*), three more than are recognised in Kent's *List of vascular plants of the British Isles* (see review in this issue). Colin Legg's program, a version of which also exists for the genus *Carex*, is fast becoming a general-purpose tool which can handle data from different genera using standardised procedures.

Having obtained the review copy only a few days before helping to run a practical class for first-year biology undergraduates, we were able to give it a baptism of fire by testing its effectiveness among a number of first-time users. The results were reassuringly good; both the software and the data scoring have evidently been thoroughly tested. Terminology is explained in a well-illustrated leaflet which accompanies the program; both macroscopic and microscopic characters are used. Glandular hairs, which are so effective for differentiating the species of *Doronicum* sect. *Macrophylla* in south-west Asia, are equally valuable here in providing useful characters from both phyllaries and peduncles. Geographical data are coded into twelve units, six of which cover Scotland; 16 habitat types and three altitudinal zones are also covered.

Perhaps the most sophisticated feature of the program, and one which greatly contributes to its effectiveness, is the system of the character weighting. Each of the 324 character states is rated according to how well it differentiates between species, allowing the program to place more weight on 'good' characters when computing a coefficient of similarity. Results are presented either in descending order of number of simple matches or of weighted matches, the choice being left to the user. Having obtained a list of provisional results, one can also display the characters which are most effective to differentiate the top 20 species in the list.

Once one has entered data from an unknown specimen, there are several ways of interpreting the results. These include: identifying and describing the species most similar to the unknown one; tabulating characters for the top-ranking species; comparing pairs of species; and matching the character states of the unknown species with those of the species chosen by the program as the one it most closely resembles.

The booklet concludes with lists of subjective and unhelpful characters, and a short bibliography. The key does assume that the user can recognise a member of the genus *Hieracium*, and provides no means of excluding other Compositae other than *Pilosella*. The section on getting started ends with the very sensible advice that it is essential to check identifications against specimens named by experts in well-curated herbaria. No herbarium with a computer which runs MS-DOS should be without this program. A version also exists for BBC computers.

J. R. Edmondson

The Orchid book: a guide to the identification of cultivated orchid species. Edited by J. Cullen. Pp. xxxvi + 529; illustrated. Cambridge University Press, Cambridge. 1992. Price £24.95 (ISBN 0–521–41856–9).

Basically an identification guide to the genera and species of orchid in general cultivation, this book is based on the Orchidaceae account published in *The European Garden Flora* **2**, but with updated text. It is essentially a work of reference with about 900 species briefly described. The selection of which species to include has been governed by the criterion that on the whole they should be representative of general European collections of cultivated orchids, and occasionally of others held elsewhere in the world. Consequently only a small proportion of those which have at one time or another been in cultivation has been covered.

An introductory section outlines the basic structure of the orchid flower, the growth habit of the plant, and makes brief reference to cultivation techniques. Next is a set of keys which firstly divide the family into five apparently separate morphological groups and subsequently into their respective genera. The main section follows and comprises descriptive text of the selected genera and species. It is arranged in the format of a Flora with a brief summary given for each genus including information on geographical range, cultivation conditions and important literature references. Diagnostic characters for each genus are usually briefly stated and may be followed by sub-keys which break them down into their component species. These are then summarised under a series of standard headings which cover descriptions of floral structures, habit, climatic hardiness, native distribution range, synonyms, and also include a list of literature sources where illustrations may be found. For some species, where floral description is difficult, there are small accompanying sketches, but other illustrations in the book are limited to just 16 colour photographs.

Published so as to be available for the World Orchid Congress held in Glasgow in 1993, it is primarily aimed at the orchid grower and will be of only limited interest to the British botanist. To the latter its main value lies in the insight it gives into the more exotic species occurring world-wide, and in the most useful reference list to orchid illustrations. Its treatment of native British and European orchids is very basic and brief; for example in *Dactylorhiza*, *D. majalis* is listed without reference to any of the distinctive components of the aggregate, whilst *D. sambucina* is dismissed in less than 50 words. Whilst the keys are no doubt capable of separating the selected species covered within the book, they are very brief and generalised and likely to be of only limited use to practical botanists. Nevertheless, it is a well-produced book in which great attention has been given to detail both in the text and floral sketches. It should become an essential source of reference for both amateur and specialist grower.

M. J. Y. Foley

Stewart and Corry's Flora of the North-east of Ireland, 3rd edition. Edited by P. Hackney. Pp. 419, with 17 figures, nine black and white plates and 14 colour plates. Institute of Irish Studies, The Queen's University, Belfast. 1992. Price £17.50 (ISBN 0–85389–446–9).

The first edition of this *Flora* (1888) was mainly the work of Samuel Alexander Stewart. Thomas Corry was tragically drowned while botanising on Lough Gill some years previously but since he had jointly initiated work on the flora of the three North-east counties of Down, Antrim and Londonderry, his name was added as joint author and the *Flora* published with financial help from the Corry family. Stewart told the story of the tragic drowning in his introduction to the *Flora*, and paid handsome tribute to the young man who was Babington's assistant at Cambridge and who seemed certain to make a significant contribution to both British and Irish botany. In the second edition of the *Flora* (1938) Robert Lloyd Praeger paid tribute to Stewart's critical and painstaking approach to the work, noting that he had waged "ruthless war on imposters and claimants without sufficient credentials" and provided a really reliable list of the local flora, "so accurate indeed that the ensuing fifty years . . . has revealed very little that must now be withdrawn – a remarkable tribute to the compiler".

This third edition is firmly rooted in tradition. Prominence is given to the old records and the aim has been to update, verify and assess the status of each species. 280 pages in 2-column format have been given over to the catalogue, allowing for a generous inclusion of localities, annotations and comments. Bryophytes have been omitted from this edition. The now standard practice of recruiting specialists to write the accounts of critical groups or including only those records critically examined by specialists, duly acknowledged, has been applied.

Part of Praeger's 'Botanist's Guide' to the area from the second edition of the *Flora* has been retained. It is supplemented by further chapters by Paul Hackney on the topography of the area and its outstanding botanical features, as well as comparisons of the flora with that of the rest of Ireland and with South-west Scotland (the Mull of Kintyre is only 20 km away from the Antrim coast). There are chapters on the climate by Nicholas Betts and on the history of the vegetation by J. R. Pilcher, each containing much that is of interest to the general reader.

The northerly position and relatively mild climate of the area are reflected in the flora. Atlantic species such as *Trichomanes speciosum* and *Hymenophyllum tunbrigense* manage to survive while *Geranium pratense*, *Gymnocarpium dryopteris*, *Carex magellanica* and *Carex pauciflora* are confined to this north-east corner of Ireland. Among the surprising absentees from this large and complex area is *Gentianella amarella*, common on the southern Irish dunes and extending to the far north of Scotland.

The appendix of doubtful records, casuals and species without good credentials has been dispensed with. All records are included in one list but with appropriate comments. Widely cultivated species such as forestry and hedging species are included. Stewart might not have approved of these departures. The almost smiling face of this tough little man, whose only fault according to Praeger was his "overweening modesty", greets the reader on p. 8. He would, I feel sure, have quickly overcome his earlier reservations and heartily approved of this splendid production which is remarkably low-priced for the quality of paper, printing and binding and sets a high standard for Irish regional Floras to follow.

D. Synnott

Verbreitungsatlas der Farn- und Blütenpflanzen Kärntens. H. Hartl, G. Kniely, G. H. Leute, H. Niklfeld & M. Perko. Pp. 451, 16 colour plates and c. 2450 maps. Verlag des Naturwissenschaftlicher Verein für Kärnten, Klagenfurt. 1992. Price 360 Austrian Schillings (ISBN 3–85328–000–5).

The history of botany in this most beautiful part of Austria goes back to, at least, the 1700s and the time of Franz Xaver Freiherr v. Wulfen, commemorated by Jacquin in *Wulfenia carinthiaca*. Since then, there has been continuous activity in the study of the plants of Carinthia's high mountains, its forests, lakes and valleys. With an area of about 10 000 sq km and a flowering plant and fern total of almost 2500 species it has, for its size, a very rich and varied flora. And a glance through the colour photographs of this finely produced book shows how the combination of a scenic environment and interesting or beautiful plants blend to make Carinthia a place of special attraction for the field botanist. But this is not a coffee-table book to be browsed over and laid down. It is a scholarly work stemming from the distillation of much scientific knowledge gleaned over more than two centuries; its presentation has also been meticulously planned. The period from inception, gestation to appearance covered almost 25 years and the impressive list of European botanists who were involved testifies to its impeccable credentials.

The main aim of the book is to present by computerised dot-maps, together with complementary symbols and notes, the present-day Carinthian distributions and status (i.e. endangered, synanthropic, alien, doubtful status, etc.) of all its fern and flowering plant species. The province is divided into c. 88 grid squares. The text covers c. 40 pages of introduction, botanical history, geography; there are twelve pages of colour plates, twelve to a page, 307 pages of dot maps, arranged alphabetically by genus (which makes for easy reference) and about 70 pages of very useful supplementary information covering particular species, hybrids, literature and local names.

It is unlikely to be a best-seller among British botanists, but for those who do buy it or can otherwise consult it, it will act as an incentive to get the reader out to Klagenfurt, the Wörther See and the Kârawanken.

Any book devoted to an artificial area is likely to have a built-in likelihood of being insular in concept and of limited readership appeal. The criticism could be made here, but nevertheless it is a significant contribution to botanical knowledge in a floristically important part of S.E. Europe.

The Klagenfurt Natural History Society deserve congratulations for supporting the project and seeing it through to such a satisfactory conclusion; at 360 Austrian Schillings (c. £23) it is not, by present standards, expensive.

I. C. Hedge

An illustrated guide to Fungi on wood in New Zealand. I. A. Hood. Pp. 424. Auckland University Press, Auckland. 1992. (Distributed outside New Zealand by Oxford U.P.) Price £19.50 (ISBN 1–86940–063–1).

I write this review from the standpoint of a 'consumer'. The book will be of particular interest to an experienced amateur mycologist like myself who is about to visit New Zealand on a natural history tour, because it is aimed at "amateur naturalists in general". In this respect, it achieves its purpose admirably.

The acknowledgment in the Foreword that there is a need for a much better appreciation of the indispensable role played by fungi in the ecology of the New Zealand forests is pertinent, as this matches a currently developing change of focus in the study of fungi in Europe. There is an excellent Introduction to the book, comprising sections on historical background, biology and ecology, amongst others. Very clear, concise accounts of the processes of reproduction and dispersal, growth and nutrition, hosts and distribution are given with minimal resort to technical language. This is most encouraging for the non-specialist reader.

The accounts incorporate appropriate references to particular species illustrated in the text. The pen-and-ink drawn figures are delightful. Producers of other field guides might learn from these. Coloured drawings are not always an advantage and may indeed be counterproductive for the beginner. The figures are laid out spaciously with details of the fungi clearly identified; eight pages of colour plates, each with six small (occasionally too small) images, are included. The text is equally well presented and illuminating. The keys are adequately explained, and are easily followed. In conclusion, this book can be highly recommended for the amateur naturalist.

R. Cook

The botanizers. Amateur scientists in nineteenth-century America. E. B. Keeney. Pp. xii + 206, with eleven black and white illustrations. University of North Carolina Press, Chapel Hill & London. 1992. Price $29.95 (ISBN 0–8078–2046–6).

No, this is not a history of the B.S.B.I.'s counterpart in America (not that there is any quite similar body there): it is a general study of amateur botany in the United States during the period when, in the author's words, it "rapidly became the most popular science in America for recreational and pedagogical purposes". Oddly, despite this, and despite the profusion of historians of science on the other side of the Atlantic and the multiplicity of their doctoral theses (of which this book is itself the outgrowth of one), the subject has never previously come in for the degree of scholarly attention it deserves. This reflects the much greater emphasis long placed over there on professional status and the proportionately weak survival of an amateur scholarly tradition – in striking contrast to Britain and the Netherlands. As a result, as the author points out, American historians "have often overlooked the nearly self-evident fact that amateurs and professionals pursue science for different reasons . . . and the influence of those differences on the science that these professionals and amateurs pursued." People whose prime motive is self-cultivation are ipso facto not of much interest to historians of science, who tend in any case to think that too few of them left writings to make it feasible to study them as a collective entity. That this is a serious misconception Elizabeth Keeney amply demonstrates: quite apart from the records and publications of societies there is "a vast array of commonly untapped sources heavily laden with information on amateur science", ranging from popular journals to advice manuals and works of fiction. These she has energetically quarried, with results that are eminently readable.

Despite the alien context, B.S.B.I. members will find much in these pages that is very familiar, for amateur botany on the two continents seems to have run broadly in parallel. At the same time they will be surprised to find what continue to be normal and everyday field botany practices portrayed as quaint, bygone Victoriana. The author appears to have seen or talked to no present-day plant taxonomists, either amateur or professional, and has consequently failed to realise that the world she describes is by no means the irrecoverably antique one that she supposes.

The volume is attractively produced, with a number of well-chosen, out-of-the-way illustrations (two photographs of the Josselyn Botanical Society on an outing in Maine in 1896 are particularly appealing), numerous source-notes and an exhaustive bibliography.

D. E. ALLEN

List of vascular plants of the British Isles. D. H. Kent. Pp. xvi + 384. Botanical Society of the British Isles, London. 1992. Price £11.50 (ISBN 0–90115–821–6).

This is a numbered list of more than 4 200 taxa of vascular plants "known at the present time to be native to or introduced and established in" the British Isles. For each taxon there is a tripartite number for family, genus and species; subspecies are indicated by letters and hybrids by the numbers of their parents. Many synonyms are given but the list is not comprehensive. The inclusion of basionyms is a welcome innovation; it also provides some startling facts. Did you know, for example, that *Symphoricarpos albus* was originally thought to be a *Vaccinium*? or that *Lysimachia terrestris* was first described as a mistletoe?

The arrival of Kent's *List* was keenly anticipated and has fully lived up to expectations. Admittedly, much of what is new, such as the classification and nomenclature, had already appeared in Stace's *New Flora* (reviewed in *Watsonia* **19**: 161–163 (1992)), as had the use of tripartite numbers rather than Dandy's bipartite system, but it is only in Kent's *List* that the full impact of these changes becomes apparent. Rigorous application of the rules of priority and "the attempt . . . to take into account taxonomic studies in Europe as a whole when determining the status of British and Irish representatives" has resulted in wholesale name changes. Such changes, found in both Kent and Stace, are rarely welcome but the majority must be accepted if we are ever to reach a stable nomenclature. Others are still a matter of opinion – do you prefer to split *Scirpus* into seven genera as in Kent and Stace, or to leave them united as in Dandy?

There is no doubt that Kent's *List* is an essential companion that must be on the bookshelf of all botanists, amateur or professional, who have an interest in the British and Irish flora. I do, however, have a few quibbles. Why, for instance, are extinct aliens excluded? They are present in many herbaria and will no doubt be included in many Floras and Checklists; if one of the purposes of the *List* is to aid herbarium or Flora arrangement (as Dandy's *List* was stated to be) then I would have preferred to see them in. The omission of some important crop plants such as *Hordeum vulgare* is especially puzzling. Given the choice, I would have included all the aliens numbered in Stace. This would at least have resulted in a standard numbering system for both books rather than the confusing double system we have now. As early as family 21, the numbering in Kent and Stace diverges when Kent omits the Taxodiaceae, the Redwood family. Numbering of genera within families and species within genera is similarily inconsistent and the decision by Kent not to give unique numbers to any hybrids, although given to some of the commoner ones in Stace, adds to the inconsistency. A useful feature found in Dandy but omitted here is the provision of genus numbers in the index.

This is the first B.S.B.I. publication to have been produced by computer and yet it omits much useful information that one imagines could have been included almost at the proverbial 'touch of a button'! Why, for instance, were the genus and species numbers and even the genus names not repeated at the top of each left-hand page when a genus was split over two pages? It would make consulting the *List* so much easier for the user and would not have taken much extra effort. Less important but still annoying (to me at least) are the many instances of a single line of a two- or multi-lined entry found at the top or bottom of a page. Similarly I prefer not to see authors' initials and surname, and genus initial and species name split over two lines or even over two pages. With a little extra effort in adjusting spaces (there is an awful lot of blank space on each page) these visual imperfections could have been avoided. Another small point concerns the printing of hybrid names and formulae – a multiplication sign (×) looks so much better than an x, and could have been substituted easily.

Proof-reading appears to have been well done; spelling and punctuation mistakes are relatively few, although on page 45 the specific epithet *decalvans* is twice misspelt *decalvens* and is once, incorrectly, preceded by a hybrid sign. It also appears that the computer has occasionally slipped a synonym into the wrong species, the most amusing instance is finding *Cotoneaster humifusa* listed as a synonym of *Taraxacum hamatiforme* not only on page 236, but also (by implication) in the index. In a book such as this, which is relied upon to give the correct name, authority and synonym, it is slightly worrying that so obvious an error was not spotted.

Despite the above points, I already find Mr Kent's *List* an invaluable source of information which I am referring to constantly. British and Irish botanists will remain in his debt for many years to come.

R. G. Ellis

Atlas écologique des fougères et plantes alliées – illustration et répartition des Ptéridophytes de France. R. Prelli & M. Boudrie. Pp. 277 with 124 black and white plates. Éditions Lechavalier, Paris. 1992. Price F.fr. 260 (ISBN 2–225–82527–0).

If ever a book arrived at a good time for reviewing, this was it. Two days before I left for France was more than enough time to convince me that this was the one book I must take. It now meant that I had something more manageable than *Atlas Florae Europaeae* or the *Atlas of North European Vascular Plants* when setting off to look for pteridophytes in a part of France that was new for me.

The book is not an identification manual as such as it contains no keys, although good descriptions accompanied by beautiful photographs and distribution maps make this an ideal field guide for the pteridologist in France. Prelli's excellent *Guide des Fougères et Plantes Alliées* (reviewed in *Watsonia* **16**: 98–99, 1986, 1st ed.; *Watsonia* **18**: 442, 1991, 2nd ed.) was written instead as an illustrated key for identifications. Most of the commoner species are also found in Britain so English keys will be sufficient for identification in most cases. The authors have not arranged the species in any taxonomic or alphabetical order. Instead they have grouped them by habitat; firstly into lowlands, mountains or Mediterranean and then subdivided either into open, woodland or wetland species or by the type of rock on which they live. The absolute beginner will probably find this approach difficult to follow and a little confusing because several species grow in more than one of the delimited habitats; the authors have placed the species in the habitats in which they are most commonly found. Nevertheless the photographs and the brief descriptions are good and the reader is made aware of the other most similar species. The authors have thoughtfully chosen their photographs to illustrate whole plants or enlargements of parts of them as appropriate for each species. Perseverance should therefore direct the patient observer to the correct result. Reference to the accompanying maps and range descriptions will give additional support to the identifications.

The maps themselves give information about the relative abundance of the plants in each of the French Départements and the coloured map on the back cover shows at a glance which areas are the richest for pteridophytes.

The authors are to be congratulated on producing such a fine book. Anyone heading for France with even a passing interest in pteridophytes would do well to acquire a copy.

B. A. Thomas

British plant communities. Vol. 3: *Grasslands and montane communities*. Edited by J. S. Rodwell. Pp. x + 540, with 36 figures. Cambridge University Press, Cambridge. 1992. Price £95 (ISBN 0–521–39166–0).

This is the third of the five volumes describing plant communities in Britain, and follows the same format as the previous two volumes (reviewed in *Watsonia* **19**: 49, 1992, and **19**: 198, 1993). A general introduction is followed by three main sections describing 13 mesotrophic, 14 calcicolous (calcicolous meaning 'with calcicoles') and 21 calcifugous grassland and montane communities. Finally, there are indices to vegetation synonymy and the occurrence of species in the communities, and an extensive bibliography.

Rodwell's prose is so seductive that it is easy to get side-tracked and learn much in the process. There are mouth-watering accounts of the mesotrophic MG3 *Anthoxanthum* — *Geranium* hay meadows of Teesdale, the calcicolous CG1 *Festuca* — *Carlina* oceanic rock garden grasslands, and in the calcifugous grasslands and montane communities, the U17 *Luzula — Geum* tall-herb community of mountain ledges. A particular strength of the work is the synthesis of an enormous amount of research, relating the vegetation extensively to soil, climate and treatment.

In general, the book is well-presented, though Fig. 20 is poorly integrated into the text; it takes time to find the start of the sub-community descriptions as the synonymy runs into them, and the sub-communities are not numbered in the text. The tables are simpler than the confusing ones of Volume 1, but would still benefit from labelling (e.g. 'Constants', 'associates', etc.). The maps are ordered across rather than down the page (cf. Volumes 1 and 2 respectively). Most of the records on the map for U16c are missing from the map for U16. 'Subspecies' is excluded from the names (thus adopting zoological convention) but 'variety' is included.

The influences of the sampling and analysis should have been dealt with in more detail. For instance, data for the CG1f *Carlina — Scilla* sub-community were abstracted from the Biological Flora for *Draba aizoides* whose quadrats were deliberately centred on that species, resulting in an over-estimation of its frequency in the tables. Over half of the samples analysed for the calcicolous grassland chapter were collected by T. C. E. Wells *et al.* in a small area of Dorset, Hampshire and Wiltshire using 1 × 1 m quadrats and including few bryophytes, resulting in under-estimations of the frequencies of some species and the numbers of species per quadrat, and localized clusters of records on the maps.

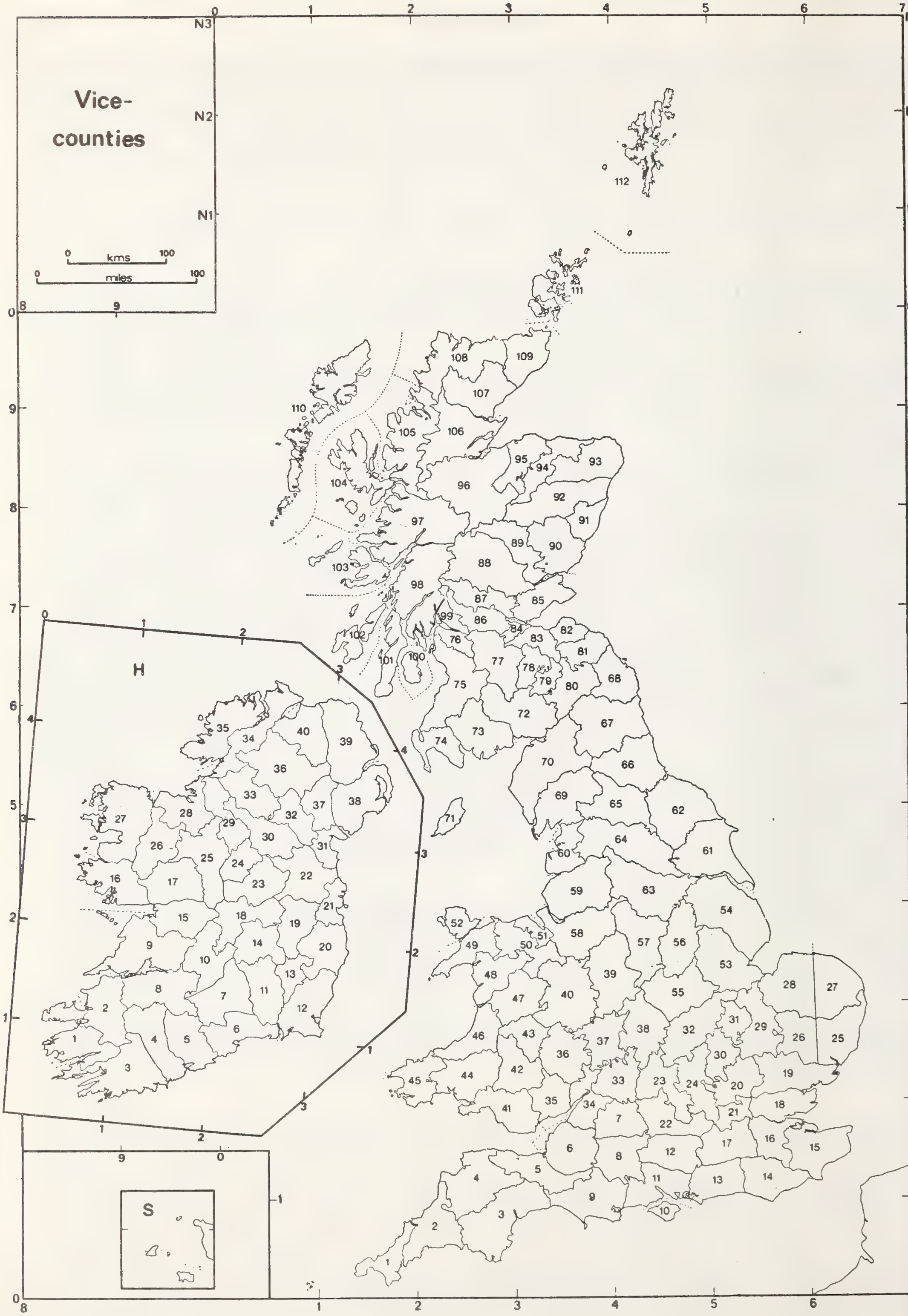
The practical problems of consistently identifying vegetative plants suggests that more judicious lumping might have been adopted (e.g. *Poa pratensis* and *P. humilis* (*P. subcaerulea*) cannot have been consistently separated). Oddly for the calcicolous grasslands, the recorders "always attempted to separate the subspecies of *Cerastium diffusum* . . ." though only one occurs in Britain.

An introduction to the three grasslands would help to place a grassland in its appropriate section, and give the volume more coherence in its own right. There is considerably more variation in mesotrophic grasslands than is described. For example, the grazing meadows on the levels in Kent and Sussex characterized by *Cynosurus cristatus*, *Hordeum secalinum* and *Lolium perenne* are distinctive in the field and clearly related to the MG6 *Cynosurus — Lolium* grasslands; in light of the under-sampling of this community in South East England (cf. the map of samples of the community), perhaps they should be re-examined. Grasslands heavily modified by broad-leaved herbicides are both distinctive and common, and deserve more mention as does *Elymus repens* grassland on neglected land and recent road verges (e.g. M25 embankments). Grasslands dominated by *Festuca arundinacea* similar to the MG12a *Festuca* grassland *Lolium — Holcus* sub-community occur widely inland. Any odd mesotrophic vegetation always keys out unsatisfactorily to MG5 *Centaurea — Cynosurus*, MG6 *Cynosurus — Lolium* or MG7 *Lolium* grasslands at the end of the key. Such criticisms are inevitable for the first airing of such a major work, and indicate possible areas for revision, and it will be interesting to see whether the dissolution of metalliferous and chalk heath vegetation types is adopted elsewhere.

For B.S.B.I. members, this book will be an invaluable reference work as a source of information on vegetation and plant ecology. Accounts of vegetation for County Floras could be summarised from the volumes, though widespread mapping of communities is unlikely to catch on due to the need for bryophyte identification (especially in the north and west) and the high cost of the volumes.

After three years' intensive application of *British plant communities* in the field, I remain firmly convinced of its value and usefulness. It is a convenient, practical tool for describing and assessing vegetation, and provides an excellent framework for understanding the relationships between communities and the environment.

T. C. G. RICH



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INSTRUCTIONS TO CONTRIBUTORS

Scope. Authors are invited to submit Papers and Short Notes concerning the taxonomy, biosystematics and distribution of British and Irish vascular plants, as well as topics of a more general or historical nature.

Manuscripts must be submitted *in duplicate*, typewritten on one side of the paper, with wide margins and double-spaced throughout.

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 separate sheets and attached at the end of the manuscript.

Figures should be drawn in black ink and identified in pencil on the back with their number and the author's name. They should be drawn no more than three times final size, bearing in mind they will normally be reduced to occupy the full width of a page. Scale-bars are essential on plant illustrations and maps. Lettering should be done with transfers or high-quality stencilling, although graph axes and other more extensive labelling are best done in pencil and left to the printer. Photographs can be accepted if they assist in the understanding of the article.

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 of Papers, Short Notes, Book Reviews or Obituaries.

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Plant Records: the appropriate vice-county recorder, who should then send them to C. D. Preston, Biological Records Centre, Institute of Terrestrial Ecology, Monks Wood, Abbots Ripton, Huntingdon, PE17 2LS.

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