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The cover illustration of *Meconopsis cambrica* L. Viguier (Welsh Poppy) was drawn by Rosemary Wise.

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Classification by molecules: What's in it for field botanists?

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ABSTRACT

Following a brief summary of the author's views on the philosophy and practice of plant classification, with particular reference to molecular systematics, the impact of the use of DNA sequence data on the classification of a range of taxa in the British flora is assessed. The degree to which their classification has been affected is discussed under four headings: *No change here, then* (little or no impact); *Welcome back old friends* (changes that represent reversions to classifications that were in use some time ago but had fallen out of favour); *A cautious welcome to new friends* (changes that seem novel at first sight but which on study are readily explicable by previously available data); *Unwelcome newcomers* (changes that seem unavoidable but which are not supported by exomorphic characters). It is concluded that, far from being remote and of interest only to professional molecular biologists, molecular systematics is highly relevant to the study and enjoyment of plants by all botanists, from molecular biologists to plant hunters, who still have much to contribute.

KEYWORDS: Taxonomy, Classification, Molecular systematics, DNA sequencing, APG-III, Paraphyletic groups, British Flora

INTRODUCTION

WHY CLASSIFY

Plants (and animals) have been classified by man from the earliest times. It is a natural and sensible way to commence the study of organisms, because it enables the huge and bewildering range of their form to be comprehended in a logical way, rather than being simply marvelled at, and it provides a framework into which all known organisms can be fitted and their relationships assessed. Uncertainty is introduced when the type of classification to be adopted has to be decided. Since there are many types of classification possible, controversy is inevitable; it has existed from the first attempts at classification until the present day, and doubtless will always be with us. But arguments about the ideal type of classification are pointless unless the *purpose* of the classification is taken into consideration, because no single system of classification is ideal for all situations.

TYPES OF CLASSIFICATION

By and large there are two main categories of classification – artificial and natural, although most systems carry elements of both. Artificial classifications are generally based on one or few characters, and are usually devised for specific purposes. Good examples are the use of wood anatomy by timber technologists, growth-habit and flower-colour by landscape gardeners, and the number of stamens and pistils by Linnaeus. Although such classifications might be ideal for particular situations, they are usually totally inadequate when applied widely. This is because they do not indicate the *relationships* of plants, whether that relationship is defined phenetically (by appearance) or phyletically (in evolutionary terms). For example, some of the plants in Linnaeus's class Diandria (with two stamens) are *Anthoxanthum* (a grass), *Veronica* (speedwell) and *Cypripedium* (an orchid). Close relatives of all three of these belong to quite different classes. In other words, the placement of a taxon in an artificial group does not predict any further characters of that taxon.

In contrast, natural systems group together plants with overall similarity, using a wide range of characters, and provide a high level of predictivity. The statement that a taxon belongs to, say, the Poaceae, Lamiaceae or Fabaceae immediately informs us about many features of that taxon. If we discover a new species of grass, for example, we are able to predict accurately a large number of its characters before we examine the plant in detail. Classifications defining natural groups such as these are known as general purpose classifications, because they are the most useful ones in most situations, and they are considered the best sort to aim for. For a long time predictivity has been considered the ideal yardstick of a good classification (e.g. Stace 1989), and this is still true today (Stuessy 2009). Although other

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criteria have been advocated as the best indication of a good natural classification, those views are in a minority and I personally am totally convinced that the best (most useful) classification is the most predictive one.

HOW TO CLASSIFY

The construction of a highly predictive general purpose classification has traditionally been attempted by two different routes: phenetic and phyletic. Both methods may vary from highly subjective to ones constrained by strict mathematical conventions. In the former (phenetic) method the aim is to use a large number of characters and classify together those taxa sharing the greatest number of common features. In the latter (phyletic) approach phylogenetic trends are analysed and the classification is based on the closeness of taxa in their evolutionary pathways. Classifications obtained by the rigorous application of each of these two approaches should be extremely similar, if not identical, because the degree of similarity between taxa is determined genetically by their closeness of evolutionary descent. (Consider, for example, your own family and your next-door neighbour's family). If there are significant differences between the two classifications then for some reason or other one method has (or both methods have) failed us. Early on (e.g. Nineteenth Century) both methods relied on highly subjective assessments, when such 'failures' were commonplace, but increasingly more sophisticated techniques have been applied and subjectivity has been concomitantly reduced; it will never, however, be eradicated. The introduction of many of these newer techniques was heralded by claims that we now had a robust methodology that gave us a classification that closely reflected the true (i.e. phylogenetic) relationships of the taxa. The data being used, however, were always secondary manifestations of the genetic code (e.g. morphology, chemistry, cytology), and inevitably sometimes gave misleading or (when two different sets of data were used) conflicting results. The ability to use the genetic code (sequence of bases in DNA) directly, therefore, was a massive advance when it became available in the 1990s, for at last, in theory at least, we had direct access to the genetic basis of evolution.

MOLECULAR CLASSIFICATIONS

Since we know in detail the mechanism of evolution (mutation) of DNA (the miscoding of the four bases during replication) we can be certain that a phylogeny based on it will truly reflect the course of evolution, and a classification derived from it will be the closest we can ever get to an accurate representation of the relationships (and therefore similarity) of taxa. Because of this we can be confident that molecular classifications based on DNA base sequences will not be bettered in the future, but will endure for centuries to come and become universally adopted. The latest version, known as APG-III, was published in September 2009 (APG 2009).

This is not the place to discuss the methodology of molecular systematics, but it must be admitted that considerable controversy still surrounds some aspects. These particularly involve the methods used to derive the evolutionary pathways of DNA from its base sequences, and the parts (inevitably a tiny fraction of the whole) of DNA that are sequenced. Real concerns exist because sometimes different classifications are obtained from the use of different techniques, or from the analysis of different DNA regions. In a recent analysis (Carlson *et al.* 2009) of Dipsacaceae, for example, *Scabiosa sensu lato* was defined as a monophyletic taxon using evidence from cpDNA data, but polyphyletic using nuclear ITS evidence unless the genus *Sixalix* (including *S. atropurpurea*) is separated. *Coeloglossum* has been found embedded within *Dactylorhiza* following most analyses (e.g. Bateman *et al.* 1997; Pridgeon *et al.* 1997), but it was separated from it by the analysis of Devos *et al.* 2006. Such experiences are, however, rather rare and cannot shake our belief in the philosophy of molecular classification, especially as we largely understand the causes of these so-called incongruences.

There is, however, one major aspect of classification for which DNA base sequences do not provide all the answers. Hybrids, and polyploids derived from them, should in theory carry the DNA sequences of both parents, but this is often not true with regard to the two most commonly utilised region of DNA: chloroplast DNA and nuclear rDNA (the small region of chromosomal DNA that codes the ribosomal RNA, which forms the structure of the cytoplasmic ribosomes, in which the proteins are coded). Chloroplasts are virtually always inherited from the female parent in angiosperms, although the reverse is true in gymnosperms (e.g. Ennos *et al.* 1999), and

rDNA, via a process known as concerted evolution, most often also represents only the female-derived sequence (e. g. Franzke & Mummenhoff 1999; Lihová *et al.* 2004). Hence the phylogenies of hybridogenous plants based on these regions are often in reality phylogenies of the female parents of the taxa being studied, rather than of the taxa themselves, and moreover results from the two regions of DNA are not suitable as checks on each other as they exhibit the same parental directional bias. There are, however, examples of rDNA sequences in a hybrid representing those of the male rather than female parent, and sometimes some populations of the hybrid or polyploid exhibit the male and others the female parent, or the hybrid derivative exhibits a chimaera of both parent types (Franzke & Mummenhoff 1999; Lihová *et al.* 2004 and other examples cited therein). A recent study of *Nymphaea* (Volkova *et al.* 2010) found that the r-DNA of the allopolyploid *N. candida* is constantly that of one of its parents, *N. alba*, although some populations of *N. candida* are derived from *N. alba* as the female parent and others from it as the male parent. Sometimes the hybrid/polyploid may appear in two different places in the resultant cladogram according to its male or female inclination, thus providing valuable clues as to its origin (P. Catálan, pers. comm. 2010). Using this reasoning it seems that the hexaploid *Vulpia myuros* is likely to have evolved from hybrids between the diploid *V. bromoides*/*V. muralis* group and the tetraploid *V. ciliata*/*Psilurus* group. Similarly the tetraploid *V. fasciculata* might have arisen from hybridisation between the diploid *V. membranacea*/*V. fontqueriana* group and the diploids in *Vulpia* section *Loretia* (Torrecilla *et al.* 2004; Stace 2005).

It is not known to what *extent* this is a problem in molecular classification at the lower levels of the hierarchy, but the classification of polyploids at the species level using molecular data clearly needs to be approached with great caution. Ideally polyploids should be omitted from the initial analyses, to be added later when the relationships of the diploids have been clarified. Probably, however, these problems are of negligible significance at the higher levels of the hierarchy.

A further consequence of the use of only a very small proportion of the DNA in deducing the phylogeny is that in some closely related taxa there might actually be no differences present in those regions. Hence the absence of any differences does not necessarily mean that the total sequences are identical. For example, apparently no differences in DNA sequences have been detected between *Platanthera chlorantha* and *P. bifolia* (Bateman & Sexton 2008) or between *Gentianella amarella* and *G. anglica* (Winfield & Parker 2000). Experienced taxonomists, especially field botanists, are well aware that in each of these two examples two separate taxa are involved, and therefore that molecular differences must exist.

CLASSIFICATIONS FOR FLORAS

Although there is consensus regarding the best classification to be adopted for general purposes, a decision on which system should be followed in Floras, or in other floristic works arranged in list form, is another matter. If the most closely related plants are required to appear close together then obviously the current taxonomic classification should be utilised. But some authors have chosen other arrangements, of which alphabetical is commonest, as for example in *Vascular Plants of the Pacific Northwest* (Hitchcock *et al.* 1955–1969) and *Flora of Canada* (Scoggan 1978–1979). I find it difficult to see any real advantage in an alphabetical arrangement, because a full index or cross-referencing in the appropriate place in the text is still necessary due to the existence of synonyms, and future name-changes often necessitate radical reordering. The user will not know whether watercress is under *Nasturtium* or *Rorippa*, so both need to be listed. And surely it is better if, say, the grasses are all together in a generic list. In Britain, *Scarce Plants in Britain* (Stewart *et al.* 1994) is alphabetically arranged; there is, fortunately, a complete index, but *Anacamptis morio* and *Neotinea ustulata* do not appear in it and as time goes on more and more standard names will be found lacking. The text of the *RHS Gardeners' Encyclopedia of Plants and Flowers* (Brickell 1989) is alphabetical, but the coloured illustrations are arranged according to plant habit, flowering time and flower colour, etc., for ease of identification. A dual approach was also used in *The Pocket Guide to Wild Flowers* (McClintock & Fitter 1956), the text here being in systematic order. These are special solutions for particular objectives, but for any technical Flora I consider a systematic order mandatory.

In the past it has often been difficult to decide which of several currently available systems of classification should be adopted in a

Flora. Sometimes, e.g. *Flora Europaea* (Tutin *et al.* 1964–1980), *Flora of Turkey* (Davis 1965–1985) and *Flora Nordica* (Jonsell 2000–), rather old and outdated systems were deemed the most suitable, and in other cases, e.g. *Flora of the British Isles* (Clapham *et al.* 1952), an essentially new sequence was concocted. Most authors consider that a Flora is not the ideal place to adopt a new or very recently devised classification, for fear of its being short-lived or soon greatly modified. A well-known and well-tested system is far better. For that reason it could be argued that APG is too new and unfamiliar to be suitable for use in an identification manual, and certainly most new Floras being produced, at least in Europe, still do not adopt it. However, as pointed out above, APG is certain to endure for the foreseeable future; in this respect it is unique, and the more it is promoted the sooner it will become familiar and its universal logic and usefulness demonstrated. If it is accepted that a Flora should be arranged systematically then the adoption of the APG system is inevitable. Diggs & Lipscomb (2002) and Stace (2009) have argued for the adoption by Flora-writers of a pragmatic compromise between the extremes of a strict cladist interpretation and the use of only phenotypically observable characters.

A further weighty consideration operating when adapting a phylogenetic classification for use in a floristic work is how to express the latter as a linear sequence. A phylogeny is obtained from DNA sequence data in the form of a branching pathway, usually each branch-point giving rise to only two (or very few) sub-branches, not as a main axis with side-branches. In converting this form to a linear sequence either of the two sub-branches at each branch-point may with equal justification be placed before the other. Usually the smaller or shorter sub-branch is placed first, or (allowing for much subjectivity) the one with more obviously highly evolved taxa is placed second; often these two informal criteria coincide. In the LAPG-III system (LAPG 2009) the monocots precede all but a few of the most 'primitive' dicots, reversing the common situation. However, the opposite is equally faithful to the DNA data, and for that reason I as well as others (e.g. Heywood *et al.* 2007, Hawthorne & Hughes 2008) prefer to place the monocots (ending with the grasses) after the dicots, retaining the more familiar sequence.

When adopting the APG system there are further legitimate possibilities of deviating from the classifications published by APG (2009) and LAPG (2009). Two will be briefly mentioned. Firstly there is the vexed question of whether paraphyletic groups should be recognised as taxa. Paraphyletic groups are those whose members are all derived from a common ancestor, but unlike monophyletic groups they do not include ***all*** of the derivatives of that ancestor. Arguments for and against still rage, and will for the foreseeable future. Although it is probably true that the majority view is against the recognition of paraphyletic taxa, they are accepted by many. I subscribe to this latter view because, as stated previously, I consider that the over-riding criterion of a good classification is a high degree of predictivity. There can be no doubt that a paraphyletic Araceae (with Lemnaceae excluded), for example, is a more highly predictive taxon than a monophyletic Araceae (with Lemnaceae included). The duckweeds differ from the rest of the Araceae in morphology, chromosome number, ecology, physiology and reproductive behaviour, and I believe that there is no over-riding reason why they should not be separated at the family level.

Secondly, I do not believe that data from DNA sequences should be used to deduce the ***absolute*** level (rank) at which taxa should be recognised, only their ***relative*** levels. For example, in APG-III the Sparganiaceae and Typhaceae are amalgamated (under the latter), but since only the two genera *Sparganium* and *Typha* are involved the recognition of both families is equally in accordance with the data. Similarly, whether or not *Orchis* should be drawn wide enough to include its sister group *Aceras* is largely a matter of preference (Bateman 2006; Bateman *et al.* 1997; Pridgeon *et al.* 1997). All our centuries of experience in taxonomic research has shown that at a particular taxonomic rank any character is capable of showing wide variation in the degree of divergence of its character-states in different taxonomic groups. For example ovary position (superior, inferior, etc.) is frequently constant at the family level (e.g. Ranunculaceae), sometimes at the tribal or generic level (e.g. Rosaceae), and rarely not above the sectional or species level (e.g. *Saxifraga*). The fact that such a minuscule part of the total DNA sequences of related taxa can be compared emphasises the inadvisability of using sequence data as an ***absolute*** measure of relationship.

RELEVANCE OF MOLECULAR CLASSIFICATIONS TO THE FIELD BOTANIST

GENERAL CONSIDERATIONS

There is undoubtedly a considerable resistance to the adoption of new classifications, part of a natural tendency to conservatism in *Homo sapiens*. Most people prefer the familiar to the novel, and this particularly applies to classifications because they summarise the patterns of variation and it is difficult to adopt and learn a different system. Sometimes it is claimed in mitigation that the new system is more difficult to absorb or remember, or is less successful at interpreting the plant relationships. These are, however, hollow excuses; in reality the reluctance to change is due not to 'difficulty' or inadequacy, but simply to unfamiliarity (or even laziness!). If the new system is a good (highly predictive) one, better than the replaced one, perseverance with it will soon reveal its advantages. There is also the point that the new generation of botanists that is constantly being recruited on a rolling basis does not have knowledge or experience of the older systems, and therefore it lacks the reticence of the older generations. The latter cannot afford to get left behind.

Two important yet contrary points concerning the molecular APG classification are relevant here. Firstly, there can be no doubt it that will prove more highly predictive than any previous system, and that it will endure for the foreseeable future. Secondly, it has to be admitted that some of the close relationships indicated are counter-intuitive and would not have been predicted by other means. There is naturally a reluctance to accept cryptic characters over visible ones, and hence to group plants of very different appearance (e.g. *Callitriche*, *Plantago*, *Linaria*) together, or to separate very similar ones (e.g. *Cormus*, *Sorbus*).

The main purpose of this paper is to address the above conundrum. It seeks to demonstrate that the perceived negative features of the APG system are in fact mostly spurious, and are in any case far outnumbered by overtly positive aspects. In fact the apparent anomalies can be used didactically to demonstrate the value of the APG classification, and it is important that field botanists along with all other taxonomists be exposed to the new system as soon as possible. Older systems, albeit as diverse as those of Linnaeus, Bentham & Hooker, Engler, Hutchinson or Cronquist, remain instructive, interesting and eminently worthy of study, but they are essentially extinct fossilised forerunners of the new molecular classification. It is simply not the case that the classification adopted by botanists is unimportant; use of the APG system will prove beneficial to all users, even to the extent of increasing the enjoyment of discovering plants in the field. The following four sections are intended to address these points, using the whole range of situations with which the APG system confronts the (often unsuspecting) botanist.

1. NO CHANGE HERE, THEN

It must be emphasised that ***most*** aspects of the main classifications to which British botanists have been exposed in the past half-century (e.g. Clapham *et al.* 1952; Tutin *et al.* 1964–1980; Cronquist 1981) are equally evident in the APG system at family, genus and species levels. This is testament to the powers of deduction that taxonomists have made from detailed studies over three centuries of many aspects of the variation of plants. Also demonstrated is the fact that the lower the level of taxonomic rank (especially below the genus level) the fewer changes to the classification are made by the APG system.

Large well-known families such as Asteraceae, Brassicaceae, Caryophyllaceae, Cyperaceae, Lamiaceae, Orchidaceae and Poaceae are identically or almost identically defined using molecular and phenetic data. Given the distinctive features of these families, making them instantly recognisable, it would be most surprising if this were not so, and it would justifiably shake our confidence in molecular data. Even some less easily defined families, in which one might have feared disruption using molecular data, remain unaltered. To illustrate the morphological diversity of just three families, in *New Flora of the British Isles* (Stace 2010) Ranunculaceae (note the range in perianth organisation and fruit type) appear 11 times in the family keys, Saxifragaceae (wide range in flower structure, especially ovary position) appear 12 times, and Rosaceae (huge variation in all aspects of flower and fruit morphology) 17 times. Yet, apart from the exclusion of *Parnassia* from the Saxifragaceae, all three remain with the same familiar circumscriptions.

More surprisingly, there are some pairs of families whose distinction in the past has often been debated, yet their traditional delimitations

TABLE 1. FRAGMENTATION OF THE LILIACEAE *SENSU LATO*

ALISMATALES
- Tofieldiaceae (*Tofieldia*)
- (with 12 other families)

DIOSCOREALES
- Nartheciaceae (*Narthecium*)
- (with Dioscoreaceae)

LILIALES
- Melanthiaceae (*Paris*)
- Alstroemeriaceae (*Alstroemeria*)
- Colchicaceae (*Colchicum*)
- Liliaceae *sensu stricto* (5 genera; *Gagea*, incl. *Lloydia*, native)

ASPARAGALES
- Xanthorrhoeaceae (5 genera; *Simethis* native)
- Alliaceae (13 genera; *Allium*, *Leucojum* & *Narcissus* native)
- Asparagaceae (14 genera, 9 native, incl. Agavaceae)
- (with Orchidaceae & Iridaceae)

are vindicated by molecular methods. A good example is Lamiaceae/Verbenaceae. Another is Apiaceae/Araliaceae. In the latter the traditional distinction is maintained apart from the position of *Hydrocotyle*, which should be transferred from the former to the latter family (Plunkett 2001). An alternative, surely preferable, solution is to separate the Hydrocotylaceae as a third family. Another would be to amalgamate the two families. All three choices are equally in accordance with the molecular data.

2. WELCOME BACK OLD FRIENDS

One of the most interesting aspects of the new molecular classification comes from an analysis of the apparently new relationships that it proposes, especially as upon inspection many of these turn out to be not so novel after all. I wish to cite several examples. The first two concern the two families that have been by far the most radically transformed by molecular data, Liliaceae and Scrophulariaceae.

Liliaceae

Our representatives of the Liliaceae *sensu* Cronquist (1981) have not only been divided into a minimum of nine families (some of which could be further split), but these families are dispersed across four different orders in which they are often linked with other families that were not formerly in the Liliaceae (Table 1). Some of the new arrangements were probably not predictable, e.g. *Tofieldia* and *Narthecium* fall into different families in different orders, but in fact the rudiments of this new classification were foreseen in the pioneering work of Rolf Dahlgren (e.g. Dahlgren 1980, 1983), who studied a wide range of characters and classified from first principles without regard to previous classifications, which therefore did not influence him. This new system of lilioid classification has been built up over the past 30 years or so in several publications (e.g. Dahlgren & Clifford 1982, Dahlgren *et al.* 1985), preparing us for the radical changes now seen in the APG classification. In our flora the Liliaceae *sensu stricto* contain only three native species, now all in the genus *Gagea*. These are difficult to distinguish morphologically as a group from the five bulb-bearing genera of Asparagaceae subfamily Scilloideae, but blue flowers are ubiquitous in the latter apart from *Ornithogalum*, and absent in the former.

Scrophulariaceae

The traditional Scrophulariaceae are now represented in our flora by five families, Scrophulariaceae *sensu stricto* containing only three native genera (Table 2). In addition the semi-parasitic genera (*Rhinanthus* etc.) are removed to the Orobanchaceae, and Buddlejaceae are included in the new Scrophulariaceae. Moreover, in the APG system three other very diverse families are subsumed into one of the five Scrophulariaceous families: Plantaginaceae, Hippuridaceae and Callitrichaceae are grouped with eleven of our genera including *Veronica* and *Linaria* in a family variously known as Veronicaeae or Plantaginaceae. An alternative treatment would

TABLE 2. REDISTRIBUTION OF THE SCROPHULARIACEAE *SENSU LATO* (LAMIALES)

CALCEOLARIACEAE
Calceolaria

*VERONICACEAE
Digitalis, *Erinus*, *Veronica* (incl. *Hebe*), *Sibthorpia*, plus Antirrhineae

*PLANTAGINACEAE
Plantago & *Littorella*

*HIPPURIDACEAE
Hippuris

*CALLITRICHACEAE
Callitriche

SCROPHULARIACEAE *sensu stricto*
Verbascum, *Scrophularia*, *Phygelius*, *Sutera* ('Bacopa'), *Limosella*, plus Buddlejaceae (*Buddleja*)

PHRYMACEAE
Mimulus

PAULOWNIACEAE
Paulownia

OROBANCHACEAE
Traditional Orobanchaceae, plus semi-parasitic Scrophulariaceae

* or these four amalgamated

continue to recognise the three very distinctive families, leaving a paraphyletic Veronicaceae. It is instructive to recognise, however, that several aspects of these radical realignments had been foreshadowed by earlier work. For example, the closeness of *Buddleja* to Scrophulariaceae *sensu stricto* in terms of their secondary metabolites was documented by Jensen (1992) and others, and the floral and embryological similarities of *Lathraea* and *Orobanche* and the semi-parasitic Scrophulariaceae have often been noted (e.g. Kuijt 1969). Several Coleoptera and Lepidoptera are known to use only *Plantago* and *Linaria* as their foodplants (Drummond 1957; Allen 1960, 1961), presumably due to chemical similarities, which led Airy Shaw (1958) to comment that he had long considered their respective families to be more closely related than current classifications indicated. How right he was!

Pteridophytes

The traditional division of the pteridophytes into four phyla (psilophytes, lycophytes, calamophytes, filicophytes) has been transformed by the discovery that the lycophytes, not the psilophytes, were the first group to be differentiated from the rest, which are together known informally as monilophytes (Smith *et al.* 2006). The Nineteenth Century morphologists had discovered that in the true ferns there are two major types of sporangia: those with thick walls (eusporangiate ferns) and those with thin walls (leptosporangiate ferns); this character is correlated with others (e.g. subterranean mycorrhizal versus surface green gametophytes respectively) and was used to define the major division of the true ferns right up to the middle of the Twentieth Century (e.g. Smith 1938). If this character is extended to the rest of the monilophytes, the psilophytes are seen to be eusporangiate and the calamophytes (horsetails) are leptosporangiate. In fact molecular data have demonstrated that the first division of the monilophytes was into eusporangiates (psilophytes and eusporangiate true ferns) and leptosporangiates (calamophytes and leptosporangiate true ferns) (Fig. 1). Hence the horsetails are more closely related to the vast majority of the true ferns than are the eusporangiate ferns (in our flora just the Ophioglossaceae). This gives us an unfamiliar sequence in pteridophyte classification, but one which agrees with the strong emphasis on the eusporangiate/leptosporangiate distinction formerly held by pteridologists but somewhat relegated in more recent times.

Primitive angiosperms

The revelation that angiosperms are not simply separable into dicotyledons and monocotyledons represents a major departure from

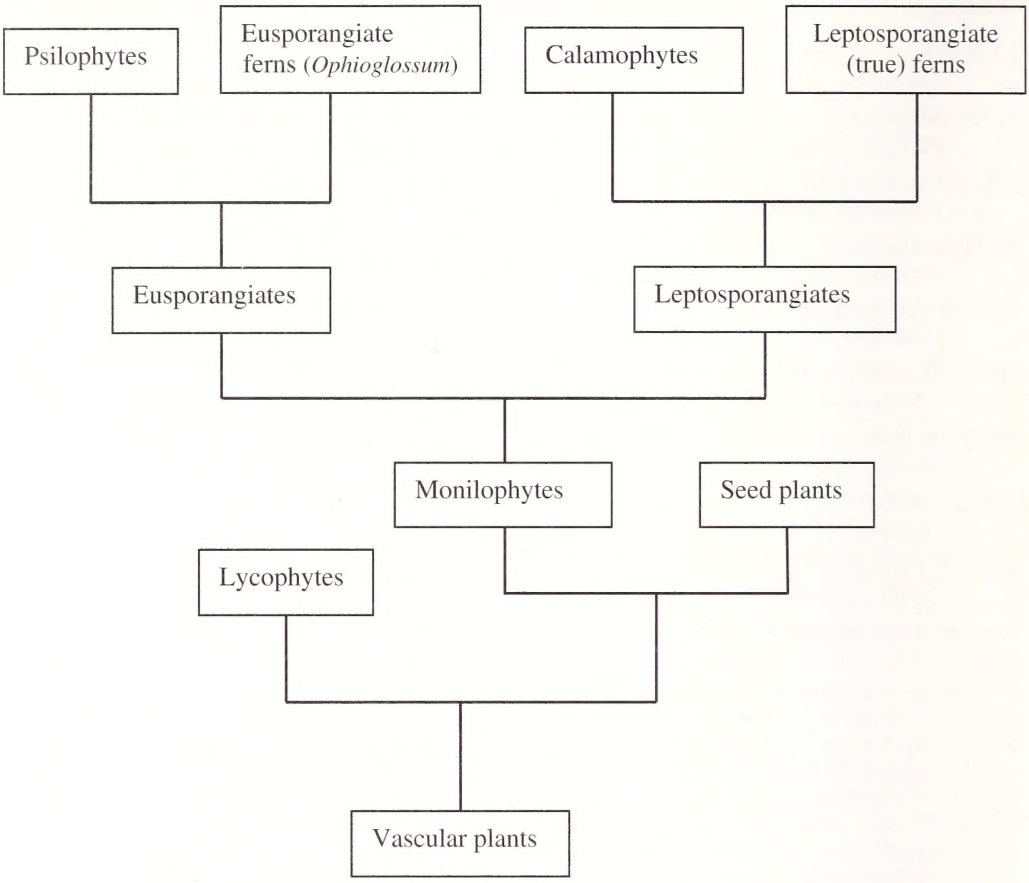

FIGURE 1. Cladogram of relationships of the major groups of pteridophytes, simplified and adapted from Smith *et al.* (2006). Based on DNA sequences from several separate studies.

most previous classifications. Before the division of the angiosperms into dicots and monocots a number of primitive families split off (Fig. 2). There are five such families in our flora, the Nymphaeaceae being the only native one; they can be usefully known as pre-dicots. But this is actually not a totally novel concept. Many early workers commented on the monocot-like features of the Nymphaeaceae and allies (e.g. vascular cambium, pollen-grain and root-hair character-states); this is well discussed and referenced by Dahlgren (1983). The pre-dicots are largely those families placed by Cronquist (1981) at the start of the dicotyledons, before the Ranunculaceae. The Ceratophyllaceae were at first placed by the APG system in the pre-dicots, but are now thought to be the most primitive (i.e. earliest divergent) true dicotyledon family.

Sapindaceae

The amalgamation of the extremely different Hippocastanaceae (*Aesculus*) and Aceraceae (*Acer*) with the tropical family Sapindaceae, whose only representative in our flora is the introduced tree *Koelreuteria*, which has alternate pinnate leaves and strongly inflated capsules, seems at first like the joining of disparate entities. However, a wide look at the former Sapindaceae *sensu stricto* shows a considerable range of structure, including, for example, the presence in the Malaysian *Atalaya* of fruits extremely like those of *Acer* (Heywood *et al.* 2007). Flowers with five petals and eight stamens are characteristic for all three former families. Moreover, many old works (e.g. Hooker 1884, Bonnier 1917, Fiori 1923–1929) recognised the Sapindaceae *sensu lato*, so that the APG classification is not brand new but a re-adoption of a much older idea.

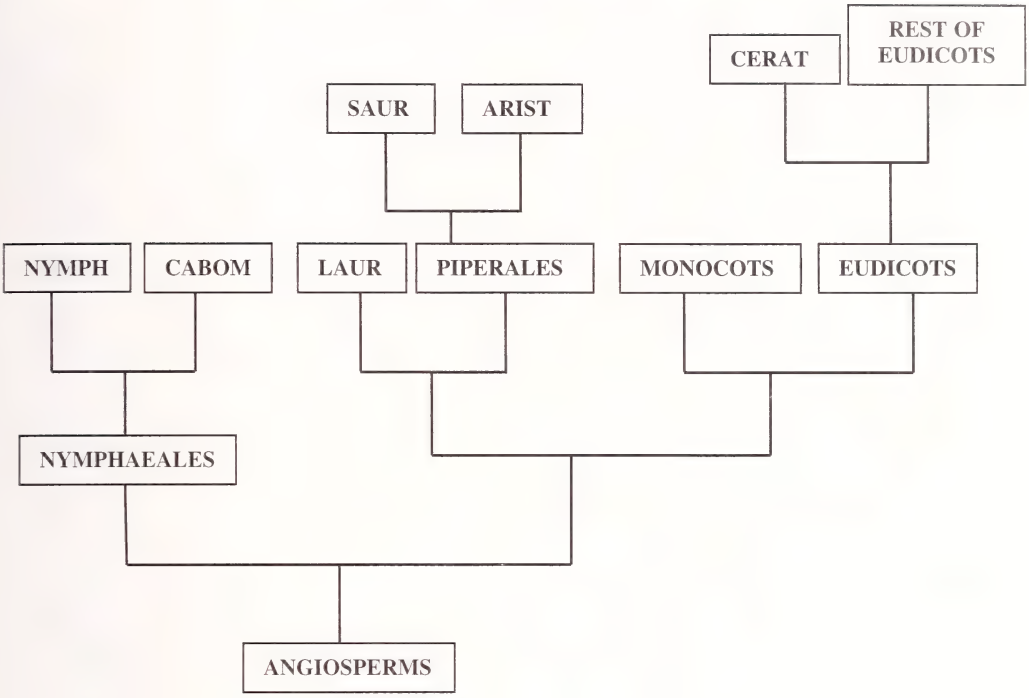

FIGURE 2. Cladogram of relationships of the major groups of angiosperms as represented in our flora, simplified and adapted from APG (2009). Based on DNA sequences from many separate studies.
Abbreviated family names: NYMPH = Nymphaeaceae; CABOM = Cabombaceae; LAUR = Lauraceae; SAUR = Saururaceae; ARIST = Aristolochiaceae; CERAT = Ceratophyllaceae.

Helictotrichon

The genera *Avenula* and the Australian *Amphibromus* have to be split from *Helictotrichon*, but this is actually only a reversion to former opinions. *Amphibromus* (including our *A. neesii*) was traditionally a separate genus, but was amalgamated with *Helictotrichon* by Clayton & Renvoize (1986) in *Genera Graminum*, a work that in general lumps rather than splits wherever possible. *Avenula* (containing our two native species) has a chequered history, being recognised or not and with a range of conflicting diagnoses, but was established in the current sense by Holub (1962, as *Avenochloa*; 1980). It is primarily separated by aspects of root and leaf epidermis anatomy. Despite these cryptic characters, which led to many taxonomists not recognising the split, molecular data clearly vindicate Holub's conclusions. Hence we no longer have any *Helictotrichon* in our flora.

Three resurrected genera

Here are three more examples of 'new' classifications resulting from molecular systematics actually being cases of reversion to older thinking.

Molecular data indicate that the genus *Apium* should be divided into *Apium sensu stricto* (only *A. graveolens* in our flora) and *Helosciadium* (Spalik *et al.* 2009). Although the British floras of the Nineteenth Century treated *Apium sensu lato*, at the start of the Twentieth Century the two segregates were recognised, e.g. by Riddelsdell (1906, 1917), and this continued right up to Hutchinson (1948); it was Clapham *et al.* (1952) who re-amalgamated them.

Watercress was placed in the genus *Nasturtium* by Aiton (1812) and remained there until it was amalgamated with *Rorippa* by Hayek (1905), and this was almost universally adopted. However, DNA sequences show that *Nasturtium* is closer to *Cardamine* than to *Rorippa sensu stricto* (Fig. 3), and the re-segregation of *Nasturtium* and *Rorippa* is now accepted (Franzke *et al.* 1998).

Similarly, *Ranunculus* is polyphyletic if *Ficaria* is retained within it (Paun *et al.* 2005). Lesser Celandine was first placed in the genus

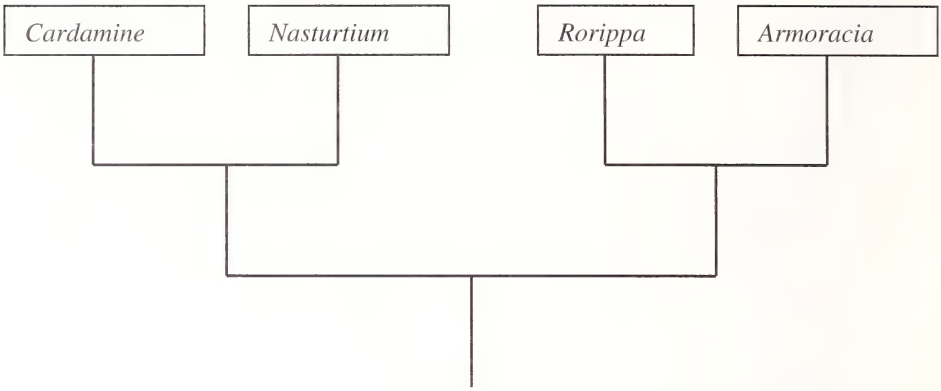

FIGURE 3. Cladogram of relationships of *Rorippa* and *Nasturtium*, simplified and adapted from Franzke *et al.* (1998). Based on DNA sequences from cp-DNA and r-DNA ITS regions.

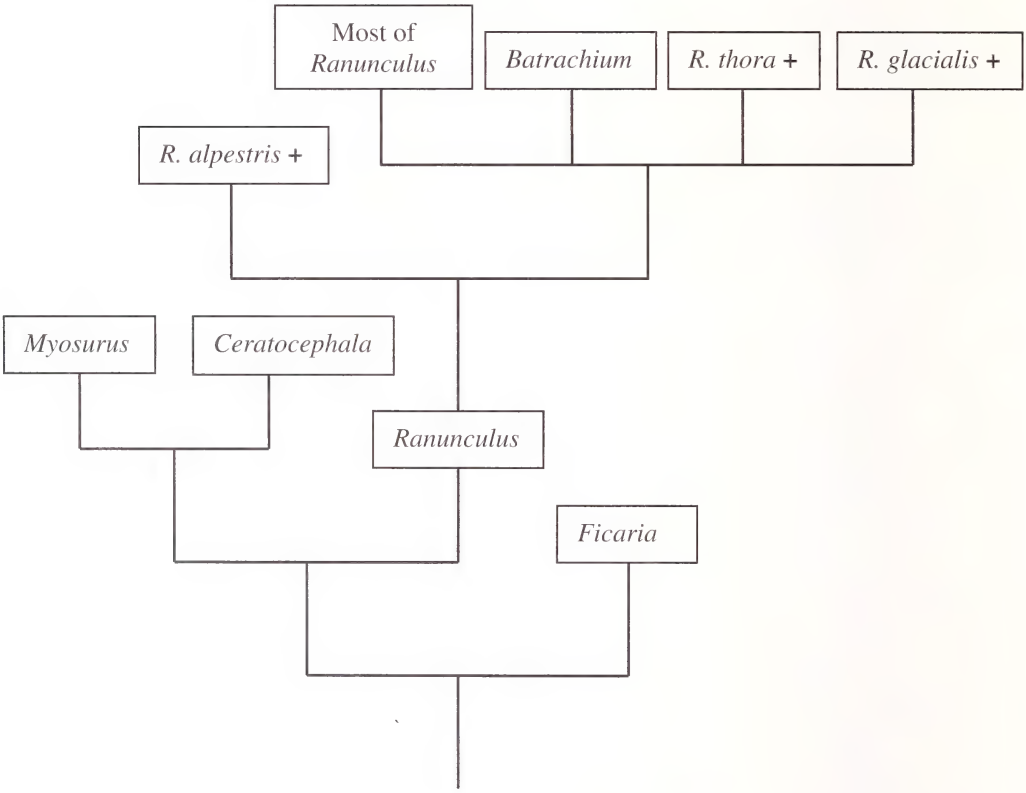

FIGURE 4. Cladogram of relationships of *Ranunculus* and its closest relatives, simplified and adapted from Paun *et al.* (2009). Based on DNA sequences from cp-DNA and r-DNA ITS regions.

Ficaria by Hudson (1762), although this was followed by very few authors except Hutchinson (1948). Again, the recognition of two genera is a reversion to a much earlier opinion. According to the molecular evidence *Ficaria* can be retained in *Ranunculus* only if *Myosurus* and *Ceratocephala* are as well. It is of interest, on the other hand, that the Water-crowfoots, which have often been segregated into the genus *Batrachium*, are shown by molecular data to be true members of *Ranunculus* (Fig.4).

3. A CAUTIOUS WELCOME TO NEW FRIENDS

As previously implied, it is often difficult at first to become persuaded that novel relationships suggested by a new classification are genuine. However, those that at first sight seem implausible, yet on closer scrutiny indicate hidden truths, are perhaps the most instructive of all. The following examples are intended to illustrate this point.

Legumes and Milkworts

It must be admitted that the rather extraordinary flowers of these two families do bear an overall resemblance; how many of us I wonder in our very early days thought that *Polygala* might be some diminutive legume? In almost all classifications, however, the two have been placed far apart in different orders. Despite this they are keyed out adjacently in the family keys in both Clapham *et al.* (1952) and Stace (1997, 2010). So it is perhaps not so surprising that in the new APG classification the Polygalaceae and Fabaceae are classified along with just two other very small Southern Hemisphere families in the order Fabales. Superficial resemblances often do indicate some underlying close genetic relationships.

Malva/Lavatera

When two quite variable genera are delimited by a single character (fusion of epicalyx), and there seem to be a number of parallelisms between them, it is likely that a new look might result in a quite different classification. Molecular data do not support the epicalyx character as an indicator of the major lines of evolution in this group (Escobar García *et al.* 2009). The cladograms (Fig. 5) contructed from these data can be interpreted as a classification in several diverse ways. It is still possible to recognise *Malva* and *Lavatera* as separate genera, as did Linnaeus, but several species would need to be moved from one to the other and additional genera would be needed. For example, *Malva moschata* would become a *Lavatera*, and *Lavatera cretica* and *L. arborea* would be transferred to *Malva*. In general appearance the flowers of *Malva moschata* resemble those of *Lavatera* species such as *L. trimestris* at least as closely as those of most *Malva* species, and the similarity of *Lavatera cretica* to *Malva sylvestris* is well known, leading to frequent misidentifications by the inexperienced. In this family there is another pair of similar species, often misidentified by beginners in Mediterranean field work, viz. *Althaea hirsuta* and *Malva cretica*. It is most instructive, therefore, to find that in molecular terms these two species fall into the same subclade, not in the main *Malva* or *Althaea* subclades (Fig. 5). Once again the molecular evidence more strongly supports superficial resemblances than the traditional taxonomic framework. In practical terms it seems better to recognise an enlarged *Malva* (to include *Lavatera* and *Althaea hirsuta*) than to indulge in the considerable swapping of species that would be needed to retain *Malva* and *Lavatera*, especially as additional genera would be needed as well.

Peucedanum

Considering how narrowly most umbellifer genera are drawn, the three species (two native) of *Peucedanum* in our flora are remarkably diverse, and have completely unrelated English names. The differences can be seen in Table 3. Several of the characters that distinguish the species are more usually constant at the generic level. For this reason the three species had to be keyed out in separate places in the generic key in both Clapham *et al.* (1952) and Stace (1997, 2010). It is perhaps not surprising, then, to find that the genus is not monophyletic; in fact our three species fall in separate clades and are now placed in separate genera. The conundrum is explained by the fact that the fruits of the three species (and of the non-British ones too) are very similar, and traditionally fruit morphology and anatomy are given great emphasis in umbellifer classification. Once again, general appearance is a better signal of evolutionary relationship than the perceived most important diagnostic characters.

Festuca/Schedonorus

The large diverse genus *Festuca* has been divided up many times in different ways, but the most frequent group to be split off is the

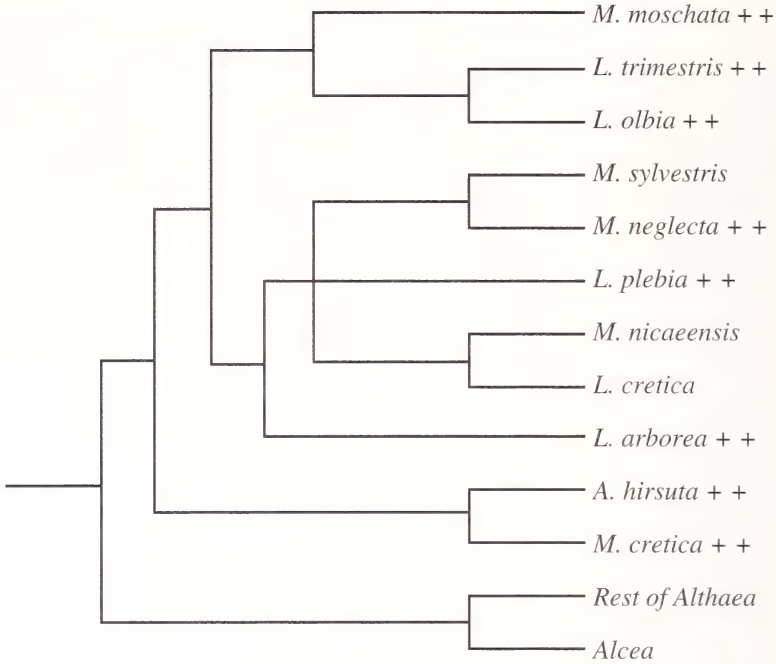

FIGURE 5. Cladogram of relationships of *Malva*, *Lavatera* and allied genera, simplified and adapted from Escobar García *et al.* (2009). Based on DNA sequences from five cp-DNA and r-DNA ITS regions.

TABLE 3. CHARACTERS OF THE BRITISH SPECIES OF *PEUCEDANUM* (APIACEAE)

P. palustre	***P. officinale***	***P. ostruthium***
Stems hollow	Stems solid	Stems hollow
Leaves fully decompose	Leaf-bases remain as dense sheath of fibres	Leaves fully decompose
Bracts >3	Bracts 0-few	Bracts 0-few
Sepals very small, not persistent	Sepals conspicuous, persistent	Sepals very small, not persistent
Petals white	Petals yellow	Petals white
Milk-Parsley	*Hog's Fennel*	*Masterwort*
THYSELIUM	*PEUCEDANUM*	*IMPERATORIA*
Fruits strongly dorsally compressed, somewhat longer than wide, glabrous, with low dorsal and winged lateral ridges	Ditto	Ditto

'broad-leaved fescues' (*F. pratensis*, *F. arundinacea* and *F. gigantea*). These species are distinct from the rest in morphology (e.g. long pointed leaf-auricles), cytology (pattern of chromosome banding) and hybridisation behaviour. While they do not hybridise with other species of *Festuca*, they cross very readily with *Lolium perenne* and *L. multiflorum* in all six combinations (Stace 1975). Despite this there has been great resistance to the redrawing of generic boundaries, and the broad-leaved fescues are retained in *Festuca* in virtually all floras. However, molecular data clearly show them to be separated from the rest

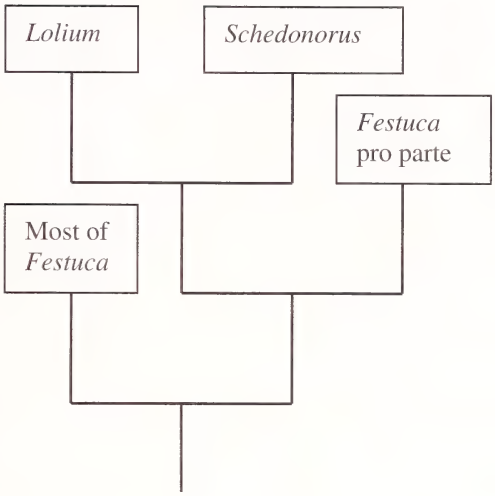

FIGURE 6. Greatly simplified cladogram of relationships of some major groups of *Festuca sensu lato*, adapted from Catalán *et al.* (2006). Based on DNA sequences from r-DNA ITS region.

of *Festuca*, in fact sister to *Lolium* (Fig. 6), and confirm the need to segregate them into the genus *Schedonorus* (or else transfer them to *Lolium*, or to amalgamate all three) (Gaut *et al.* 2000, Catalán *et al.* 2006). In this case the molecular evidence has simply been the final nail in the coffin. The hybrids with *Lolium* go under × *Schedolium*.

Thlaspi and relatives

Several generic relationships in the Brassicaceae are indicated for the first time by DNA sequence analysis. In a family where fruit morphology alone has always been considered of paramount importance, this is with hindsight not surprising (cf. *Malva/Lavatera* above). *Thlaspi* and relatives provide one example. The five species in our flora should be segregated into four genera: *Thlaspi* (*T. arvense* and *T. alliaceum*), *Pachyphragma* (*T. macrophyllum*), *Noccaea* (*T. caerulescens*) and *Microthlaspi* (*T. perfoliatum*). The first two of these four are notable for containing species that smell of garlic when fresh. Two other British crucifers possess the same feature: *Alliaria*, which has a totally different fruit (siliqua rather than silicula) and has always been placed far from *Thlaspi*, usually close to *Sisymbrium*; and *Peltaria*, an eastern European alien recently found naturalised on Skye, also usually placed far from *Thlaspi*. The fruits of *Peltaria* are different again, being pendent, indehiscent, flattened 'fried eggs', usually with only one seed. Extraordinarily, these four garlic-smelling genera are found to be close together on molecular data, forming, together with *Teesdalia*, the tribe Thlaspideae (Al-Shehbaz *et al.* 2006). The two non-garlic-smelling genera formerly in *Thlaspi* are placed in a related tribe, Noccaeeae. Clearly, the presence of the garlic-smelling compounds is a much better indicator of relationships than is fruit morphology.

Taxa with reduced morphology

Many taxa exhibit a reduced structure compared with their relatives due to the adoption of a particular life-style, e.g. parasitism, an annual autogamous habit, or occurrence in water. In many cases in the past we have been quick to segregate such taxa because of their very distinctive features, but, where the molecular data show that these taxa are nested within (rather than being sister to) their 'unreduced' relatives, consideration of amalgamation is warranted. Examples are Cuscutaceae with Convolvulaceae; Viscaceae with Santalaceae; Lemnaceae with Araceae; Pyrolaceae, Monotropaceae and Empetraceae with Ericaceae; *Coronopus* with *Lepidium*; and

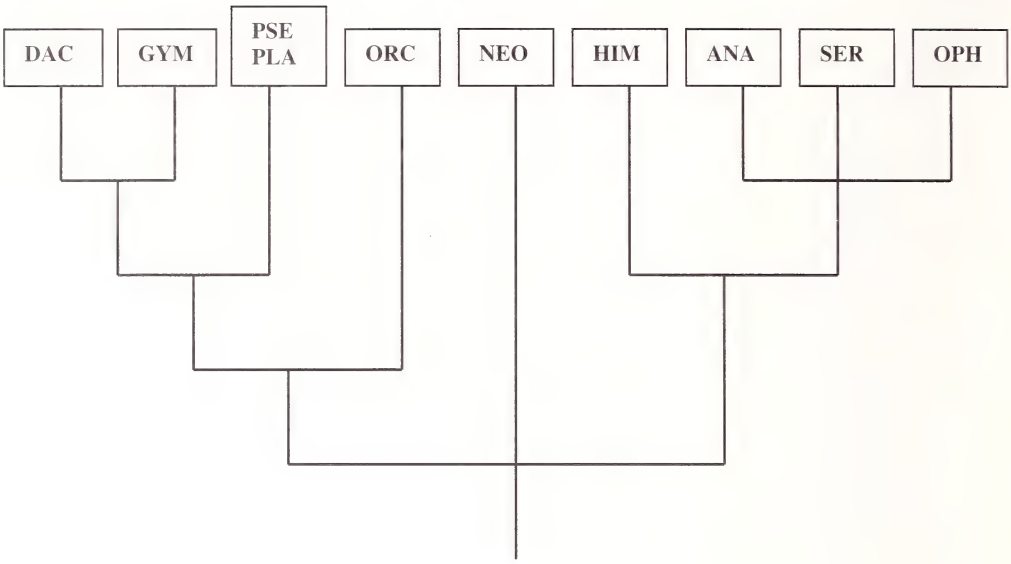

Figure 7. Cladogram of relationships of British genera of orchids of subtribe Orchidinae, simplified and adapted from Bateman (2006). Based on DNA sequences from cp-DNA and r-DNA ITS regions.
Abbreviated generic names: DAC = *Dactylorhiza*; GYM = *Gymnadenia*; PSE = *Pseudorchis*; PLA = *Platanthera*; ORC = *Orchis sensu stricto*; NEO = *Neotinea*; HIM = *Himantoglossum*; ANA = *Anacamptis*; SER = *Serapias*; OPH = *Ophrys*.

Callitrichaceae with Plantaginaceae/Veronicaceae. It is instructive to search for other examples, and these relatively novel alignments should help us to pinpoint wider evolutionary trends more clearly.

4. UNWELCOME NEWCOMERS

It would be disingenuous to imply that all changes signalled by molecular research are either obviously, or after study can clearly be seen to be, changes for the good. Because of the nature of the data we must assume that this ***is*** the case, but it is often hard to accept it, and when there are no exomorphic characters to support the new classification real practical problems arise. The number of examples, although rising, is mercifully still small. It is not, however, a new problem. There have always been 'strange bedfellows', where the association of two taxa is at first difficult to understand. *Circaea* and *Epilobium*, *Ruta* and *Citrus*, *Primula* and *Anagallis*, *Galium* and *Coprosma*, and *Malus*, *Rosa*, *Aphanes* and *Rubus* are a few of many examples. It is just that we have come to grips with these over a long period, whereas the new examples, e.g. *Veronica* and *Plantago*, or *Veratrum* and *Paris*, still seem very strange.

Orchis

By far the best-known example, and perhaps the first to emerge, is the dismemberment of the genus *Orchis*. A monophyletic *Orchis* is maintained only by removing some species to the genus *Anacamptis* and others to *Neotinea* (Bateman *et al.* 1997; Pridgeon *et al.* 1997) (Fig. 7). *Orchis ustulata* actually fits well into *Neotinea*, and the newly enlarged latter genus is easily recognised and keyed as an entity (small flowers), but this is not true of the extended *Anacamptis* (including *Orchis laxiflora* and *O. morio*). The latter two species are starkly different in appearance from *A. pyramidalis*, and it is difficult to see how the new *Anacamptis* and *Orchis* can now be readily recognised, still less keyed. The best practical answer to the latter is to key out the species to the two genera together. The very useful character concerning the stance of the two lateral sepals cuts across the new generic boundary. Hybridisation patterns to some extent support the new generic separation, but not entirely so, because apparently well substantiated hybrids have been found between *O. mascula* and *Anacamptis morio* (Godfery 1933).

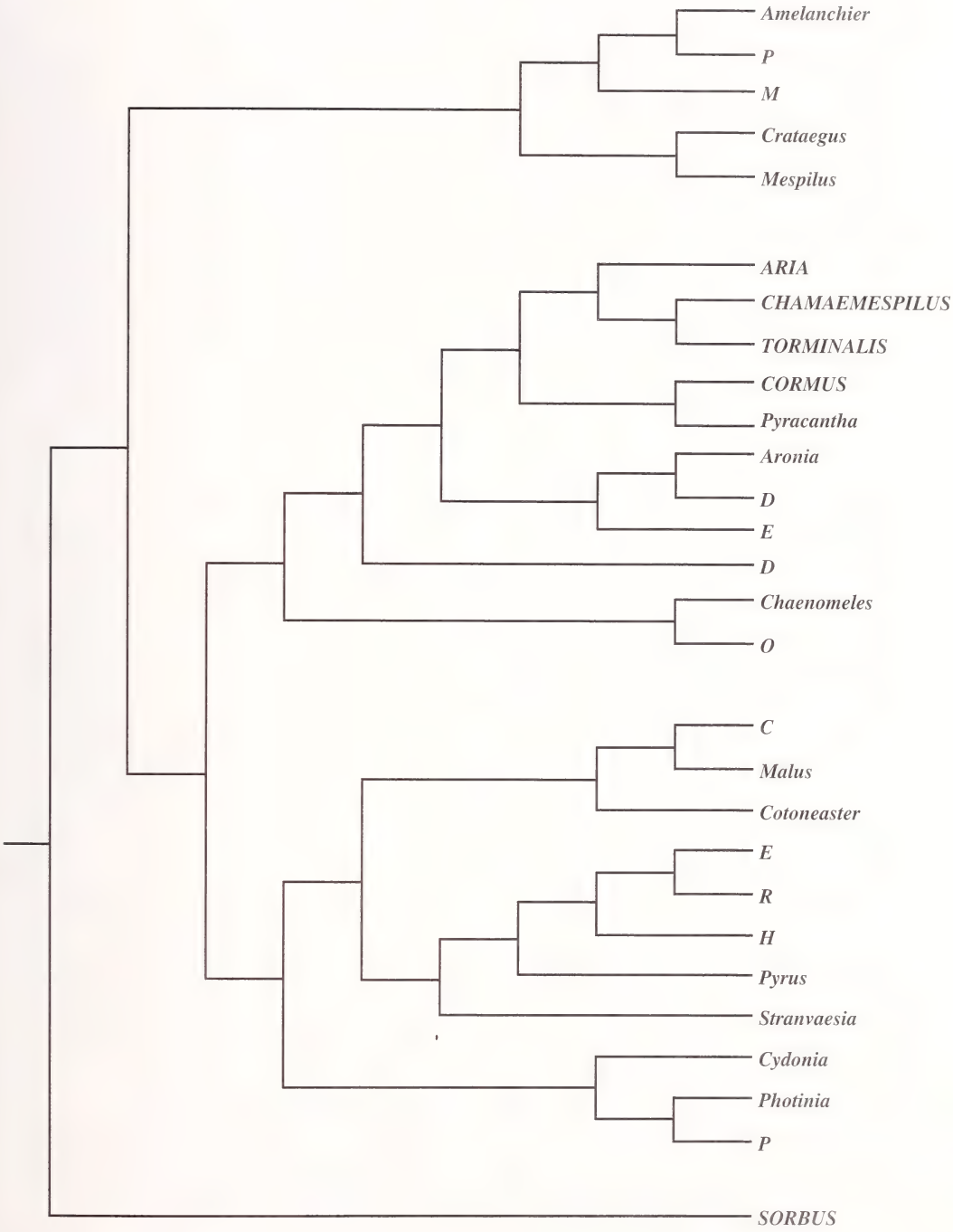

FIGURE 8. Cladogram of relationships of the genera of the former Rosaceae subfamily Maloideae, simplified and adapted from Potter *et al.* (2007). Genera in the British flora are named; others are indicated by their initial letter only. *Sorbus* segregates are in capital letters. Based on DNA sequences from six nuclear and four chloroplast loci.

Senecio

The huge genus *Senecio* has been divided in many different ways in the past, but the separation of a relatively small group of species centred on *S. jacobaea* (also including *S. cineraria*, *S. aquaticus*, *S. erucifolius* and *S. paludosus* in our flora) following molecular studies (Pelser *et al.* 2007) is unprecedented. This group, now known as the genus *Jacobaea*, is supported by hybridisation behaviour, because there exist several hybrids within it but none is known between the genera *Jacobaea* and *Senecio*. There appear, however, to be no distinguishing exomorphic characters; as the above authors euphemistically state "clear morphological synapomorphies for *Jacobaea* have not been identified to date". The species of the two genera, as with *Anacamptis/Orchis*, are best keyed out together.

Anagallis/Lysimachia

These two genera of Primulaceae have not yet been examined sufficiently widely in terms of DNA sequences to enable a thorough reclassification, but there is enough evidence to make us certain that the generic limits will require revision (Anderberg *et al.* 2007). One particular surprise to emerge is that *Lysimachia nemorum* appears to fall within *Anagallis*, not *Lysimachia*, despite its yellow corolla, valvate capsule, and glabrous filaments borne suprabasally on the corolla; all four character-states are otherwise absent from *Anagallis*. So why is *L. nemorum* called Yellow or Wood Pimpernel in English? Can we spot other characters to link it with *Anagallis*? Conversely, and as a matter of interest, this same research shows that *Centunculus* should be re-separated from *Anagallis*.

Sorbus

Molecular evidence indicates that *Sorbus* is polyphyletic, and should be divided into up to five genera: *Sorbus sensu stricto* (*S. aucuparia*), *Cormus* (*S. domestica*), *Torminalis* (*S. torminalis*); *Aria* (most of our other species); and the Alpine *Chamaemespilus* (Potter *et al.* 2007). The most surprising (and perhaps even suspicious) aspect of this is that *Sorbus sensu stricto* and *Cormus* are not only separated, but placed very far apart in the old subfamily Maloideae; the other three segregates are placed close to *Cormus* (Fig. 8). These restricted genera are readily distinguished, but there is a major problem in practice because of the extent of hybridisation. Hybrids not only occur between most of these generic segregates, but also involve other genera such as *Aronia*, *Cotoneaster*, *Amelanchier*, *Crataegus*, *Mespilus*, *Malus* and *Pyrus*. Most of these hybrids are sterile and occur only in cultivation, but many of those between the segregates of *Sorbus* are apomictic, have reproduced to form taxa with distinctive distributions, and are now recognised at the rank of species. In our flora there are three such groups of agamospecies, derived from *Aria* × *Torminalis*, *Aria* × *Sorbus* and *Aria* × *Sorbus* × *Torminalis* (Rich *et al.* 2010). If the five segregate genera are recognised then the latter three groups would also need to be accorded separate generic status. In addition there are a number of hybrids that are not considered as species because they are non-apomictic and sterile, e.g. *S. aria* × *S. aucuparia* = *S.* × *thuringiaca* and *S.aria* × *S.torminalis* = *S.* × *tomentella* (*S.* × *vagensis*). In our flora these cover two segregate generic combinations, which would nomenclaturally require separate nothogeneric recognition. Hence in our flora alone in place of *Sorbus* there would need to be seven genera plus two nothogenera. Of the 37 native species now recognised in our flora only one would remain in *Sorbus*, and 13 would fall into the three new genera of hybrid origin. This system is workable but vastly more complex than the present one. According to the data of Potter *et al.* (2007) *Sorbus* could be retained in its present wide sense only if almost all of the Maloideae were also amalgamated with it!

CONCLUSIONS

The APG system of classification of angiosperms is here to stay. It is not just another scheme in a long line of attempts to find the answer to flowering plant family relationships, but is ***the*** answer itself, or something pretty close to it. Undoubtedly adjustments will be made over the years, but they will concern minor detail and not represent radical realignments.

The view is expressed here that perceived difficulties or dissatisfaction with the new system are due principally to unfamiliarity and a residual conservatism among taxonomists. If the APG system had been in common use for the past 50 years, and now the Cronquist classification, say, were being proposed, I have no doubt that the same reluctance to change would be apparent. It is frankly that we have

been indoctrinated by the traditional classifications, e.g. that fruit morphology is the most important character in the crucifers, and that abandonment of these prejudices will take time.

Partly because of the intrinsic detail of the new system, and partly because any new system will provoke its potential users into thinking carefully about it, often from different angles from previously, the APG molecular classification has much to teach us. New associations as well as new dissociations of taxa are very informative. For instance, the *Thlaspi* example above should prompt us to take the smell of garlic more seriously as an important character. It should lead field botanists, if they don't already, to sniff a fresh crucifer as one of the primary facts to gather about it. How many of us know immediately which of our five former species of *Thlaspi* are garlic-scented? Not all of us I guess. The case of *Peucedanum* already mentioned should reinforce our understanding of the important generic characters, so that we get our priorities right when trying to determine, say, a sterile umbellifer. Not a few field botanists will rejoice in the discovery that sometimes really obvious features like scent, colour and leaf-shape have turned out to be more revealing of relationships than much more cryptic characters. And plant breeders will be pleased to see that the significance of the ability of taxa to hybridise in indicating relationships (in recent years questioned by some, e.g. Seberg & Petersen 1998) is reinforced.

The use of the molecular classification is far from a final answer to all problems. For example, the true relationships of the Boraginaceae (i.e. which order the family belongs to) are still uncertain (or they were when I last investigated). Diggs & Lipscomb (2002) and Stace (2009), as summarised above, have advocated the adoption of a pragmatic compromise. Molecular data alone are not the answer to everything, and the following caveats should in my opinion, be heeded.

- Extremely distinctive taxa that markedly change the circumscription of the group to which they are closest should be considered candidates for separate recognition, leaving a more tightly defined albeit paraphyletic taxon. I see no merit in the dogma that all taxa must be monophyletic.
- Relatively weak molecular evidence should not be relied upon to change old classifications; changes should be made only once the data are unequivocal. *Coeloglossum* is best retained as a separate genus until its amalgamation with *Dactylorhiza* becomes certain (compare Pridgeon *et al.* 1997 and Devos *et al.* 2006).
- Degrees of similarities/differences in DNA sequences should not be used as an absolute criterion of relationships, only as a relative one. As for all other taxonomic data, differences of a degree that indicate family distinction in one area of angiosperms might be better expressed at the generic level in another area.
- There will always be scope for argument and disagreement. Decisions should always be reached by considering a great range of evidence in addition to the molecular data. Botanists who know the plants concerned intimately, particularly in the living state in the field, are usually better placed to judge the evidence objectively. There is a feeling among some botanists that the scientists who investigate molecular systematics are divorced from whole plants – they know them simply as DNA sequences. This was recently expressed in a heartfelt but cynical way by Robert Thorne (Thorne 2010) in his obituary of one of his peers (Armen Takhtajan), both doyens of angiosperm classification in the second half of the Twentieth Century:

  > "This was before the age of molecular taxonomy when we thought it important to have close contact with the plants we were cataloguing for their phyletic relationships."

  Some of us still do!

All botanists, from molecular biologists to plant hunters, have much to learn from and much to contribute to the field of molecular systematics. The new molecular classification will lead us to look at our plant finds in a different way, and thereby add to our enjoyment and understanding.

ACKNOWLEDGMENTS

I am grateful to Tim Rich and Christopher Davis for help with the literature on *Sorbus* and *Malva* respectively.

REFERENCES

AIRY SHAW, H. K. (1958). "Unrelated" food plants? *Entom. Mon. Mag.* **94**: 232.

AITON, W. T. (1812). *Hortus Kewensis*, ed. 2, **4**: 109. Longman *et al.*, London.

ALLEN, A. A. (1960). Food plants of *Gymnetrini* (Col., Curculionidae) etc. as an indication of botanical affinities. *Entom. Mon. Mag.* **96**: 48.

ALLEN, A. A. (1961). The food plants of *Phalonia degreyana* McLach. (Lep., Phaloniidae) as further evidence of affinities. *Entom. Mon. Mag.* **96**: 214.

AL-SHEHBAZ, I. A., BEILSTEIN, M. A. & KELLOGG E. A. (2006). Systematics and phylogeny of the Brassicaceae: an overview. *Pl. Syst. Evol.* **259**: 89–120.

ANDERBERG, A. A., MANNS, U. & KÄLLERSJÖ, M. (2007). Phylogeny and floral evolution of the Lysimachieae (Ericales, Myrsinaceae): evidence from *ndhF* sequence data. *Willdenowia* **37**: 407–421.

APG (2009). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Bot. J. Linn. Soc.* **161**: 105–121.

BATEMAN, R. M. (2006). How many orchid species are currently native in the British Isles?, in BAILEY, J. P. & ELLIS, R. G., eds. *Current Taxonomic Research on the British and European Flora*, pp. 89–110. Botanical Society of the British Isles, London.

BATEMAN, R. M., PRIDGEON, A. M. & CHASE, M. W. (1997). Phylogenetics of subtribe Orchidinae (Orchidoideae, Orchidaceae) based on nuclear ITS sequences, 2. Infrageneric relationships and reclassification to achieve monophyly of *Orchis sensu stricto*. *Lindleyana* **12**: 113–141.

BATEMAN, R. M. & SEXTON, R. (2008). Is spur length of *Platanthera* species in the British Isles adaptively optimized or an evolutionary red herring? *Watsonia* **27**: 1–21.

BONNIER, G. (1917). *Name This Flower*. J. M. Dent & Sons, London & Toronto.

BRICKELL, C. (1989). *RHS Gardeners' Encyclopedia of Plants and Flowers*. Dorling Kindersley, London.

CARLSON, S. E., MAYER, V. & DONOGHUE, M. J. (2009). Phylogenetic relationships, taxonomy, and morphological evolution in Dipsacaceae (Dipsacales) inferred by DNA sequence data. *Taxon* **58**: 1075–1091.

CATALÁN, P., TORRECILLA, P., LÓPEZ-RODRÍGUEZ, J. Á. & MÜLLER, J. (2006). Molecular evolutionary rates shed new light on the relationships of *Festuca*, *Lolium*, *Vulpia* and related grasses (Loliinae, Pooideae, Poaceae), in BAILEY, J. P. & ELLIS, R. G., eds. *Current Taxonomic Research on the British and European Flora*, pp. 45–70. Botanical Society of the British Isles, London.

CLAYTON, W. D. & RENVOIZE, S. A. (1986). *Genera Graminum. Grasses of the World*. HMSO, London.

CRONQUIST, A. (1981). *An Integrated System of Classification of Flowering Plants*. Columbia University Press. New York.

DAHLGREN, R. M. T. (1980). A revised system of classification of the angiosperms. *Bot. J. Linn. Soc.* **80**: 91–124.

DAHLGREN, R. M. T. (1983). General aspects of angiosperm evolution and macrosystematics. *Nordic J. Bot.* **3**: 119–149.

DAHLGREN, R. M. T. & CLIFFORD, H. T. (1982). *The Monocotyledons; a Comparative Study*. Academic Press, London.

DAHLGREN, R. M. T., CLIFFORD, H. T. & YEO, P. F. (1985). *The Families of the Monocotyledons: Structure, Evolution and Taxonomy*. Springer, Berlin & New York.

DAVIS, P. H. (1965–1985). *Flora of Turkey*. Edinburgh University Press, Edinburgh.

DEVOS, N., RASPÉ, O., JACQUEMART, J.-L. & TYTECA, D. (2006). On the monophyly of *Dactylorhiza* Necker ex Nevski (Orchidaceae); is *Coeloglossum* (L.) Hartman a *Dactylorhiza*? *Bot.J. Linn. Soc.* **152**: 261–269.

DIGGS, G. M. & LIPSCOMB, B. L. (2002). What is the writer of a Flora to do? Evolutionary taxonomy or phylogenetic systematics. *Sida* **20**: 647–674.

DRUMMOND, D. C. (1957). Food plants of *Chrysolina violacea* (Müll.), *C. haemoptera* (L.), *C. crassicornis* (Hell.) and *C. polita* (L.) (Col., Chrysomelidae). *Entom. Mon. Mag.* **92**: 368.

ENNOS, R. A., SINCLAIR, W. T., HU, X.-S. & LANGDON, A. (1999). Using organelle markers to elucidate the history, ecology and evolution of plant populations, in HOLLINGSWORTH, P. M., BATEMAN, R. M. & GORNALL, R. J., eds. *Molecular Systematics and Plant Evolution*, pp. 1–19. Taylor & Francis, London & New York.

ESCOBAR GARCÍA, P., SCHÖNSWETTER, P., FUERTES AGUILAR, J., NIETO FELINER, G. & SCHNEEWEISS, G. M. (2009). Five molecular markers reveal extensive homoplasy and reticulate evolution in the *Malva* alliance (Malvaceae). *Mol. Phylogenet. Evol.* **50**: 226–239.

FIORI, A. (1923–1929). *Nuova Flora Analitica D'Italia*. M. Ricci, Firenze.

FRANZKE, A. & MUMMENHOFF, K. (1999). Recent hybrid speciation in *Cardamine* (Brassicaceae) – conversion of nuclear ribosomal ITS sequences in statu nascendi. *Theor. Appl. Genet.* **98**: 831–834.

FRANZKE, A., POLLMANN, K., BLEEKER, W., KOHRT, R. & HURKA, H. (1998). Molecular systematics of *Cardamine* and allied genera (Brassicaceae) and non-coding chloroplast DNA. *Folia Geobot.* **33**: 225–240.

GAUT, B. S., TREDWAY, L. P., KUBIK, C., GAUT, R. L. & MEYER, W. (2000). Phylogenetic relationships and genetic diversity among members of the *Festuca-Lolium* complex (Poaceae) based on ITS sequence data. *Pl. Syst. Evol.* **224**: 33–53.

GODFERY, M. J. (1933). *Monograph and Iconograph of Native British Orchidaceae*. Cambridge University Press, Cambridge.

HAWTHORNE, W. D. & HUGHES, C. E. (2008). Optimising linear taxon sequences derived from phylogenetic trees – a reply to Haston *et al*. *Taxon* **57**: 698–704.

HAYEK, A. von (1905). *Schedae ad Floram Stiriacum Exsiccatum* **3/4**: 170. Hensel, Vienna.

HEYWOOD, V. H., BRUMMITT, R. K., CULHAM, A. & SEBERG, O. (2007). *Flowering Plant Families of the World*. Royal Botanic Gardens, Kew.

HITCHCOCK, C. L., CRONQUIST, A., OWNBEY, M. & THOMPSON, J. W. (1955–1969). *Vascular Plants of the Pacific Northwest*. University of Washington Press, Seattle & London.

HOLUB, J. (1962). Ein Beitrag zur Abgrenzung der Gattungen in der Tribus *Aveneae*: die Gattung *Avenochloa* Holub. *Acta Horti Bot. Pragensis* **1962**: 75–86.

HOOKER, J. D. (1884). *The Student's Flora of the British Islands*, ed. 3. MacMillan, London.

HUDSON, W. (1762). *Flora Anglica*, p. 214. J. Nourse, London.

HUTCHINSON, J. (1948). *British Flowering Plants*. P. R. Gawthorn, London.

JENSEN, S. R. (1992). Systematic implications of the distribution of iridoids and other chemical compounds in the Loganiaceae and other families of the Asteridae. *Ann. Missouri Bot. Gard.* **79**: 284–302.

JONSELL, B., ed. (2000–). *Flora Nordica*. The Bergius Foundation, Stockholm.

KUIJT, J. (1969). *The Biology of Parasitic Flowering Plants*. University of California Press, Berkeley.

LAPG (2009). The Linear Angiosperm Phylogeny Group (LAPG) III: a linear sequence of the families in APG III. *Bot. J. Linn. Soc.* **161**: 128–131.

MCCLINTOCK, D. & FITTER, R. S. R. (1956). *The Pocket Guide to Wild Flowers*. Collins, London.

PAUN, O., LEHNEBACH, C., JOHANSSON, J. T., LOCKHART, P. & HÖRANDL, E. (2005). Phylogenetic relationships and biogeography of *Ranunculus* and allied genera (Ranunculaceae) in the Mediterranean region and in the European Alpine System. *Taxon* **54**: 911–930.

PELSER, P. B., NORDENSTAM, B., KADEREIT, J. W. & WATSON, L. E. (2007). An ITS phylogeny of tribe Senecioneae (Asteraceae) and a new delimitation of *Senecio* L. *Taxon* **56**: 1077–1104.

PLUNKETT, G. M. (2001). Relationships of the order Apiales to subclass Asteridae: a re-evaluation of morphological characters based on insights from molecular data. *Edinb. J. Bot.* **58**: 183–200.

POTTER, D., ERIKSSON, T., EVANS, R. C., OH, S., SMEDMARK, J. E. E., MORGAN, D. R., KERR, M., ROBERTSON, K. R., ARSENAULT, M., DICKINSON, T. A. & CAMPBELL, C. S. (2007). Phylogeny and classification of the Rosaceae. *Pl. Syst. Evol.* **266**: 5–43.

PRIDGEON, A. M., BATEMAN, R. M., COX, A. V., HAPEMAN, J. R. & CHASE, M. W. (1997). Phylogenetics of subtribe Orchidinae (Orchidoideae, Orchidaceae) based on nuclear ITS sequences, 1. Intergeneric relationships and polyphyly of *Orchis sensu lato*. *Lindleyana* **12**: 89–109.

RICH, T. C. G., HOUSTON, L., ROBERTSON, A. & PROCTOR, M. C. F. (2010). *Whitebeams, Rowans and Service Trees of Britain and Ireland. A monograph of British and Irish* Sorbus *L.* Botanical Society of the British Isles, London.

RIDDELSDELL, H. J. (1906). British forms of *Helosciadium nodiflorum* Koch. *J. Bot.* **44**: 1–6.

RIDDELSDELL, H. J. (1917). *Helosciadium* in Britain. *Rep. Bot. Soc. Exch. Club Brit. Isles* **4**: 409–412.

SCOGGAN, H. J. (1978–1979). *The Flora of Canada*. National Museum of Natural Sciences, Ottawa.

SEBERG, O. & PETERSEN, G. (1998). A critical review of concepts and methods used in classical genome analysis. *Bot. Rev.* **64**: 371–417.

SMITH, G. M. (1938). *Cryptogamic Botany, II. Bryophytes and Pteridophytes*. McGraw-Hill, New York & London.

SMITH, A. R., PRYER, K. M., SCHUETTPELZ, E., KORALL, P, SCHNEIDER, H. & WOLF, P. G. (2006). A classification for extant ferns. *Taxon* **55**: 705–731.

SPALIK, K., DOWNIE, S. R. & WATSON, M. F. (2009). Generic delimitations within the *Sium* alliance (Apiaceae tribe Oenantheae) inferred from cpDNA *rps16-5'trnK*$^{(UUU)}$ and nrDNA ITS sequences. *Taxon* **58**: 735–748.

STACE, C. A., ed. (1975). *Hybridization and the Flora of the British Isles*. Academic Press, London.

STACE, C. A. (1989). *Plant Taxonomy and Biosystematics*, ed. 2. Edward Arnold, London.

STACE, C. A. (1997). *New Flora of the British Isles*, ed. 2. Cambridge University Press, Cambridge.

STACE, C. A. (2005). Plant taxonomy and biosystematics – does DNA provide all the answers? *Taxon* **54**: 999–1007.

STACE, C. A. (2009). Chaos out of order in our new Floras? *Gorteria* **33**: 140–148.

STACE, C. A. (2010). *New Flora of the British Isles*, ed. 3. Cambridge University Press, Cambridge.

STEWART, A., PEARMAN, D. A. & PRESTON, C. D. (1994). *Scarce Plants in Britain*. JNCC, Peterborough.

STUESSY, T. F. (2009). *Plant Taxonomy. The Systematic Evaluation of Comparative Data*, ed. 2. Columbia University Press, New York.

THORNE, R. F. (2010). In Memoriam. Armen Leonovich Takhtajan (1910–2009). *Taxon* **59**: 317.

TORRECILLA, P., LÓPEZ-RODRIGUEZ, J.-A. & CATALÁN, P. (2004). Phylogenetic relationships of *Vulpia* and related genera (*Poeae*, Poaceae) based on analysis of ITS and *trnL-F* sequences. *Ann. Missouri Bot. Gard.* **91**: 124–158.

TUTIN, T. G. *et al.* (1964–1980). *Flora Europaea*. Cambridge University Press, Cambridge.

VOLKOVA, P.A., TRÁVNÍČEK, P. & BROCHMANN, C. (2010). Evolutionary dynamics across discontinuous freshwater systems: Rapid expansions and repeated allopolyploid origins in the Palearctic white water-lilies (*Nymphaea*). *Taxon* **59**: 483–494.

WINFIELD, M. & PARKER, J. (2000). *Molecular Analysis of* Gentianella *in Britain*. English Nature Report 155.

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The first British record of *Nardus stricta* L. (Poaceae)

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ABSTRACT

It is generally accepted that the first notice of *Nardus stricta* L. in Britain is due to Thomas Johnson who recorded it on Hampstead Heath in 1632. Here, I question this orthodoxy and suggest that the plant Johnson saw, and collected, on the Heath was not *N. stricta*. If so the first British record remains Johnson's but refers to his finding it on Chislehurst Common in 1633, as recounted in his revision of Gerard's *Herball* published that year. The identity of the plant from Hampstead Heath is unclear; three possibilities are considered.

KEYWORDS: Mat-grass, Thomas Johnson, Hampstead Heath.

INTRODUCTION

Nardus stricta L. (Mat-grass) is a plant of acid soils which in the south of England grows mainly on open commons and heaths. Eutrophication and habitat loss have led to an overall decline which is particularly pronounced in the districts around London where it was once common. It has, for example, totally disappeared from Hampstead Heath, where quite recently it was "still locally plentiful" (Kent 1975: 593). Since the Heath was, according to the authors most often quoted (Clarke 1900; Druce 1932; Kent 1975), the site where *N. stricta* was first recorded in Britain by Thomas Johnson (*c.* 1600–1644), this is a matter of some regret.

Johnson left two lists of plants on Hampstead Heath. The first, *Ericetum Hamstedianum*, comprises the second part of *Iter* (Johnson 1629) which is primarily an account of a "herborising" journey through Kent; it records 61 plants, plus a lichen, that Johnson and his companions found on the Heath on 1 August 1629, and a further ten seen in May. Johnson and his friends visited Kent again in 1632. His account of this trip, *Descriptio itineris* (Johnson 1632) includes a section, *Enumeratio plantarum in ericeto Hampstediano locisque vicinis crescentium*, listing 96 species (and another lichen) "growing on Hampstead Heath and its neighbourhood", of which 33 repeat those in the previous list. Discounting a duplicate record of *Lactuca serriola* L. (Oswald 2000), there remain 133 probably distinct species (of which four are mosses) constituting the first British local flora. An English translation of both books (Gilmour 1972) included scientific names supplied by Francis Rose and Gilmour. In some cases they were unsure of the identity and offered a likely name. A few (see Appendix) appear to be erroneous.

Eleven species are graminiform plants, Johnson's diagnostic name being "Gramen" with a qualifying phrase. Two are *Carex*, two *Juncus*, one *Luzula*, one is *Eriophorum* and five are grasses. One of these appears in both lists with slightly different orthography: "Gram: Sparteum capillaceo folio minimum" (Johnson 1629: B3r) and "Gramen spartium capillaceo folio minimum" (Johnson 1632: 33). Rose and Gilmour interpreted the former as "Probably *Nardus stricta* L." but the latter, curiously, as "*Nardus stricta* L." without qualification. Clarke (1900: 186) and Druce (1932: 374) cited the 1632 name, not that of 1629, as the first British record of Mat-grass. In their *Flora of Middlesex* (1869: 316) Trimen and Dyer too gave Johnson's 1632 record as the first (for the county) but with a query signifying doubt about its identity. Neither Kent (1975) nor other later authors such as Fitter (1945) have expressed any doubt that the plant was *Nardus stricta*. However a careful reading of references elsewhere in Johnson's writing suggests otherwise.

JOHNSON'S ADDITIONS TO GERARD'S *HERBALL*

In his revised and corrected edition of John Gerard's *Herball* (Gerard 1633), Johnson referred to many of the plants he had seen in Kent and Hampstead, often adding information omitted from *Iter* and *Descriptio itineris*. In a new chapter called "Of divers other Grasses"

he described twelve grasses not mentioned in Gerard (1597); one of these is "Gramen spartium capillaceo folio minimum" whose entry (Gerard 1633: 30b) reads in part:

> Vpon Hampsted heath I haue often obserued a small grasse whose longest leaues are seldome aboue two or three inches high, and these leaues are very greene, small, and perfectly round like the *Spartum Austriacum*, or Feather-grasse: I could neuer finde any stalke or eare vpon it: wherefore I haue brought it into the Garden to obserue it better. In the forementioned Iournall, *pag*.33 [*ie* Johnson (1632: 33)] you may finde it vnder the name of *Gramen Spartium capillaceo folio minimum*.

Clarke (1900: 186) mentions this passage. It is hardly a convincing description of *Nardus stricta*, particularly in the lack of flowers or seed which should have been present on 1 August Old Style (12 August New Style), the date of Johnson's visit in 1629. Though "often observed" the plants were never seen with stems, and unfortunately Johnson nowhere mentions what happened to those he took into cultivation.

More compelling evidence, however, that this plant was not *Nardus stricta* is that Johnson found what undoubtedly was Mat-grass in 1633, just in time for him to describe it in the *Herball*. It is, in fact, the final entry (Gerard 1633: 1630):

> In August last whiles this worke was in the Presse, and drawing to an end, I and Mr *William Broad* were at Chissel-hurst with my oft mentioned friend Mr *George Bowles*, and going ouer the heath there I obserued this small *Spartum* whose figure I here giue, and whereof you shall find mention, in the place noted under the title of the figure; but it is not there described, for that I had not seen it, nor could finde the description therof in any Author, but in Dutch, which I neither had, nor vnderstood. Now this little Matweed hath some small creeping stringy roots: on which grow somewhat thicke heads, consisting of three or foure leaues, as it were wrapt together in one skin, biggest below, and so growing smaller vpwards, as in *Schænanth* [*Schoenus*] vntil they grow vp to the height of halfe an inch, then these rushie green leaues (whereof the longest scarce exceeds two inches) breake out of these whitish skins wherein they are wrapped, and lie along vpon the ground, and amongst these growes vp a small grassie stalke, some handfull or better high, bending backe the top, which carries two rowes of small chaffie seeds. It is in the perfection about the beginning of August.

This is an excellent description of *Nardus stricta* and the figure Johnson refers to is an equally good illustration from L'Obel (1591), who called it "Spartum nostras parvum", a name used later by Ray (1724: 393), Smith (1828: **1**, 71) and others. The "place noted under the title" refers the reader back to an earlier chapter, "Of Mat-Weed" in which Johnson mentioned a plant he then knew only at second-hand (Gerard 1633: 41):

> *Lobell* giues a figure of another smaller Rush leaued *Spartum*, with small heads, but hee hath not described it in his Latine Workes, so that I can say nothing certainly of it.

So at the time he wrote this, probably early in 1633, Johnson had not seen *Nardus stricta* but on coming across it on Chislehurst Common he recognised it and ensured that it was included in the *Herball*. He is therefore still responsible for the first British record, but in Kent, not Middlesex. The implication is that the plant he "often observed" on Hampstead Heath, and tried to grow in his garden to elucidate its identity, was not *N. stricta*.

IDENTITY OF GRAMEN SPARTIUM CAPILLACEO FOLIO MINIMUM

What then was it? Johnson's description (Gerard 1633: 30b), the first part of which was quoted above, concludes as follows:

> It may be this is that grasse which *Bauhine* set forth in his *Prodromus*. *pag*.11 vnder the title of *Gramen sparteum Monspeliacum capillaceo folio minimum*. I haue thought good in this place to explaine my meaning by these two names to such as are studious of plants, which may happen to light by chance (for they were not intended for publicke) vpon our Iournall, that they need not doubt of my meaning.

Even at that time this was not very helpful. Those "studious of plants" would recognise the reference to Caspar [Gaspard] Bauhin's *Prodromus theatri botanici* (1620) in which some 600 plants were described, most of them for the first time. Seventy-three were grasses of

which Nos. 29, 30 and 31, none of them illustrated, were varieties of "Gramen sparteum capillaceo folio", signifying a tough (literally "esparto-like") grass with hairlike leaves: 29 is "Basiliense maius" (the greater, from Basle), 30 is "Hollandicum minus" (the lesser, from Holland); and 31 is "Monspeliacum minimum" (the smallest, from Montpelier). Bauhin's Latin diagnosis for this last species indicates white fibrous roots, leaves about an inch long, stems slender, glabrous, three or four inches long, inflorescence short, of very small florets, reddening with age, found in fields near Montpelier in summertime. Johnson, of course, had only roots and leaves to guide him.

These names re-appear in Bauhin's *Pinax theatri botanici*, published in 1623, a concordance of diagnostic names of great value for discerning the intentions of earlier authors. In his copy of a later printing of *Pinax* (Bauhin, 1671), now in the library of the Linnean Society, Linnaeus identified many species by adding his own binomials; for example, beside "Gramen sparteum juncifolium. Spartum nostras parvum, Lob." Linnaeus wrote *Nardus stricta*. Unfortunately he did not annotate species Nos. 29 or 31 from *Prodromus*, though alongside 30 he wrote simply *Nardus*. In this he followed Morison (1699: 217) whose "Gramen sparteum capillaceo folio, minus", omitting "Hollandicum", appears to be *Nardus stricta*.

Savage (1935) made a thorough study both of Linnaeus's annotatations and of Alphonse de Candolle's determinations of specimens in Burser's herbarium, originally formed by Bauhin and the source of many of his diagnostic names. Savage's interleaved copy of *Pinax*, also in the Linnean Society's library, shows that de Candolle determined the herbarium specimens of Nos. 30 and 31 as *Aira juncea* (and neither of them as *Nardus*). Of course *A. juncea* Vill., not being native to Britain, could not be Johnson's plant. Sir James, Smith, into whose hands Linnaeus' copy of *Pinax* passed, apparently did not examine Burser's herbarium. Citing Dillenius (1719: 172), he identified "Gramen sparteum capillaceo folio minimum" with an even smaller plant, *Mibora minima* (L.) Desv. (Smith 1828: **1**, 84). This fits the diagnosis in *Prodromus* very well and is probably the plant Bauhin intended; it is an annual of sandy ground near the coast, common enough around Montpelier but very rare in Britain and surely not to be found on Hampstead Heath, even in the seventeenth century. Later writers, realising that Johnson's "Gramen spartium" could not possibly be *Mibora* and perhaps unaware of de Candolle's determinations, may have equated it by default to *Nardus stricta*.

There are a few other small grasses in the British flora of similar vegetative appearance to Johnson's plant. One, *Aira praecox* L., was and still is present on the Heath but, having flowered in May, withers to invisibility by August so can be excluded. Three others have never been recorded in Middlesex or indeed anywhere in the London area. *Corynephorus canescens* (L.) P. Beauv. is a rare sand-dune plant like *Mibora*; it appeared in *Prodromus* as "Gramen sparteum variegatum" (Bauhin 1620: 11) and was named (as *Aira canescens*) by Linnaeus in his copy of *Pinax*. Like *Mibora*, its habitat excludes it. The other two are less easily dismissed. *Agrostis curtisii* Kerguélen grows on dry sandy heaths in south-west England, including the Bagshot Sands in Surrey less than 40 km from the same formation which caps Hampstead Heath; conceivably it could once have grown there. It flowers from June to late July and if it was as common as Johnson suggests, he should have seen its flower or seed. *Deschampsia setacea* (Huds.) Hack., a plant of peaty pool margins, is virtually restricted in southern England to a few populations in the New Forest and Surrey (Chiapella 2009) where it seems to appear erratically and is "almost impossible to find in years when it fails to flower" (Lousley 1976). But Johnson was a keen observer, and in his time there were extensive bogs and marshes on Hampstead Heath. The presence of, for example, *Drosera rotundifolia, Eriophorum angustifolium, Hydrocotyle vulgaris, Menyanthes trifoliata, Pedicularis sylvatica, Ranunculus sceleratus,* and *Sphagnum* sp. in his list of plants indicates habitats suitable for *D. setacea*.

These habitats also suit a plant that does not require a hypothetical extension of range, and has neither flower nor seed. The fern *Pilularia globulifera* L. has tough, filiform bright green leaves a few centimetres long and less than a millimetre in diameter that look like tufts of hair. First recorded in Britain near Petersfield in Hampshire, probably by John Goodyer who, thinking it a grass, named it "Gramen piperinum" (Merrett 1667: 57), it was once not uncommon on boggy heaths near London. Hudson (1762: 393) found it on Hampstead Heath though it is long extinct there. It is plausible that this was Johnson's plant.

CONCLUSIONS

The plant "Gramen spartium capillaceo folio minimum" that Johnson recorded from Hampstead Heath in 1629 and 1632 was not *Nardus stricta*. Johnson did, however record *N. stricta* on Chislehurst Common in 1633. This is the first British record. The identity of the Hampstead plant is uncertain. *Agrostis curtisii* and *Deschampsia setacea* are possible but have never been recorded in Middlesex. A more likely candidate, based on its close correspondence with Johnson's description, a suitable habitat, and subsequent confirmation of its presence on the Heath, is *Pilularia globulifera*.

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REFERENCES

BAUHIN, C. (1620). *Prodromos theatri botanici*. Traudt, Frankfurt.
BAUHIN, C. (1671). *Pinax theatri botanici*. J. Regis, Basle.
CHIAPELLA, J. O. (2009). Neotypification of *Aira setacea* Hudson (Poaceae). *Watsonia* **27**: 239–242.
CLARKE, W. A. (1900). *First records of British flowering plants*. West, Newman and Co., London.
DILLENIUS, J. J. (1719). *Catalogus plantarum sponte circa Gissam nascentium*. Frankfurt.
DRUCE, G. C. (1932). *The comital flora of the British Isles*. Buncle, Arbroath.
FITTER, R. S. R. (1945). *London's natural history*. Collins, London.
GERARD, J. (1597). *The herball or generall historie of plantes*. Norton, London.
GERARD, J. (1633). *The herball ... very much enlarged and amended by Thomas Johnson*. Islip, Norton and Whitakers, London.
GILMOUR, J. S. L. (1972). *Thomas Johnson: Botanical journeys in Kent & Hampstead*. Hunt Botanical Library, Pittsburgh.
HUDSON, W. (1762). *Flora Anglica*. London.
JOHNSON, T. [1629]. *Iter plantarum investigationis ergo susceptum*. [Cotes. London].
JOHNSON, T. 1632. *Descriptio itineris plantarum investigationis ergo suscepti*. Cotes, London.
KENT, D. H. (1975). *The historical flora of Middlesex*. The Ray Society, London.
L'OBEL, M. (1591). *Icones stirpium*. Plantin and Moret, Antwerp.
LOUSLEY, J. E. (1976). *Flora of Surrey*. David and Charles, Newton Abbot.
MERRETT, C. (1667). *Pinax rerum naturalium Britannicarum*. Pulleyn, London.
MORISON, R. (1699). *Historia plantarum universalis*, Vol. 3. Oxford.
OSWALD, P. H. (2000). Historical records of *Lactuca serriola* L. and *L. virosa* L. in Britain, with special reference to Cambridgeshire (v.c. 29). *Watsonia* **23**: 149–159.
RAY, J. (1724). *Synopsis methodica stirpium Britannicum* (3rd ed.). Innes, London.
SAVAGE, S. (1935). Studies in Linnaean synonymy. 1. C. Bauhin's *Pinax* and Burser's herbarium. *Proc. Lin. Soc.* **148**: 17–26.
SMITH, J. E. (1828). *The English flora* (2nd ed.). Longman, Rees, Orme, Brown and Green, London.
TRIMEN, H. & DYER, W. T. T. (1869). *Flora of Middlesex*. Hardwicke, London.

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APPENDIX

It may be useful to list some erroneous or doubtful identifications of Johnson's diagnostic names in Gilmour (1972), other than *Nardus stricta*. These, with suggested alternatives, are:

"Filix fœmina" [Gilmour: *Athyrium filix-femina* (L.) Roth.] *Pteridium aquilinum* (L.) Kuhn.

"Gramen parvum marinum spica loliacea" [Gilmour: *Agropyron pungens* (Pers.) Roem. & Schult., or the hybrid with *A. junceiforme* (*A.* × *acutum* auct.)] *Parapholis incurva* (L.) C. E. Hubb.

"Quinquefolium peiræum majus, Tab. Tormentilla facie, Ger. Pentaphyllum album, Matth. exiguum alterum, Tragi." [Gilmour: *Potentilla reptans* L.] *Potentilla argentea* L.

"Paronychia altera, Dod. rutaceo folio, Lob. Alsine petræa rubra, & Paronychia, 3. Tab" [Gilmour: Possibly *Teesdalia nudicaulis* (L.) R.Br.] *Saxifraga tridactylites* L.

"Lactuca syl. alter odore magis visoso foliis non dissectis, Lactuca agrestis odore opii, Lob. Ad. Endivia major & I. Trag.Thesion, Ludg." [Gilmour: *Lactuca virosa* L.] *Lactuca serriola* L. (Oswald, 2000).

"Gramen palustre echinatum, Lob. aculeatum, Lugd." [Gilmour: *Carex otrubae* Podp.] *Carex viridula* Michx.

Gilmour also suggests that "Sinapi sylvestre minus bursæ pastoris folio, Lob. Sinapi. 3. Matth. an Irio Apulus alter levifolio Erucæ. Col." may, like the previous entry "Eruca sylvestris, Lob", be *Diplotaxis tenuifolia* (L.) DC., but there is little evidence to support this; perhaps Johnson himself was uncertain and so gave alternative names.

Berwickshire's disappearing scarce plants

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ABSTRACT

As part of a larger project to repeat-record the v.c. of Berwickshire as a whole, a sample of 162 populations of locally rare and scarce species recorded between 1987 and 1995 were re-surveyed between 2007 and 2009. Of these 120 have probably survived and 42 appear to have been lost. This equates to a loss of 16% a decade. The sample excludes certain mobile species as no valid method was available to match losses against recent colonisation. The causes of the losses is analysed and change in the flora is discussed more generally by broad habitat. Comparison is made with other studies and conclusions are drawn regarding future recording.

KEYWORDS: British flora, rare species, extinctions, colonisation, change over time

INTRODUCTION

The flora of v.c. 81 Berwickshire was recorded systematically hectad by hectad on a sample basis between 1987 and 1999, noting 6-figure GRs for most records of the scarcer species, whether native or alien. A Rare Plant Register was published in 2004 (Braithwaite 2004) listing about 1,000 extant populations for around 200 native species. In 2007 a new cycle of recording was commenced following approximately the same hectad by hectad sequence as the 1987–1999 survey. One module of the recording plan is to re-find as many of the populations of rare and scarce (R&S) species as practical and to record fine-scale detail of their populations. This programme provides an opportunity to review the R&S populations believed to have been lost over a period of 15–20 years and any new colonisation observed. By 2009 six hectads had been repeat-recorded in this way and a consistent pattern of severe losses of R&S populations has emerged which is the subject of this paper.

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THE STUDY AREA

V.c. 81 Berwickshire lies near the centre of Britain, taken north to south. Its lowlands are agricultural and its uplands grassland, moorland and forestry. It has a fine coast, though much of it is cliff, a varied river system and diverse wetlands. It thus has elements representative of many of the habitats found in Britain, though there are no truly montane areas while ancient woodland, still open water and urban habitats are under-represented. Indeed the largest town, Eyemouth, has a population of only 3,400. Berwickshire has an area close to that of twelve hectads. The six whole and part hectads re-surveyed have a total area close to five hectads, or about 40% of the v.c., and all major habitats are sampled.

SPECIES SELECTION

The species considered are those listed in the Berwickshire Rare Plant Register 2004 as at least locally scarce, being believed present at ten or fewer localities in the v.c. (or thought likely to decline below this number in the near future). All were believed to be natives or archaeophytes in v.c. 81. A few species are now known to be slightly more widespread than was believed in 2004 and would not now qualify as locally scarce. No changes to the species selection have been made for this or other reasons except that the microspecies of *Hieracium*, *Rubus* and *Taraxacum* are excluded.

The wellbeing of populations of R&S species is not representative of the average of the range of species present at a particular site, as more widespread species are usually more resilient to change. Nevertheless the presence of R&S species tends to be strongly indicative of 'good' examples of a particular habitat, 'good' habitat being partly measurable by its species richness in relation to the range of species characteristic of the habitat. The loss of R&S species may thus be strongly indicative of degradation of habitat.

Berwickshire R&S species include many that are widespread nationally, as judged from the *New Atlas* (Preston *et al.* 2002). They are often scarce locally because they are near the limits of their geographic range. There is thus a degree to which the wellbeing of R&S species is related to climate change. One would expect there to be winners as well as losers, and indeed there are some species that appear to have spread, such as *Polystichum setiferum* (all Latin names follow Stace 1991). So there is a need to balance the review of losses with a review of new colonisation.

METHODS AND THEIR LIMITATIONS

At the beginning of each season lists of the R&S populations for the hectads to be repeat-recorded are extracted from the v.c. 81 MapMate database. These lists are sorted by site and annotated. Many sites fit within a single 'floating' 1 km square (not bounded by fixed gridlines) but the more linear sites may be 2 km or so long. Large blocks of similar habitat are subdivided into two or more sites. A plant population that extends into two such subdivisions is treated as two populations. Priorities are set for the sites to be visited. High priority may be given to sites poorly recorded, if at all, in previous surveys and low priority is given to sites revisited between 2000 and 2006, but in general the best sites are given the highest priority with a selection of others chosen to give as complete a sample of habitats as possible.

Taking these site lists, with so much 6-figure GR data, out into the field has enabled the localities of a high proportion of R&S populations to be visited. Nevertheless many populations have not been refound and much thought has been given to whether they have been lost or merely overlooked.

The review of potential losses to separate real losses from populations overlooked has been unashamedly subjective, though the review has been approached as systematically as possible. A scoring system has been used to limit the impact of subjective judgement: 1 for a refind, 0 for clear evidence of loss and ¾, ½ and ¼ for cases where it was considered more or less likely that a population had been overlooked. There is the further problem that the plants in a population cannot be assumed to be distributed within a site just as they were twenty years previously. Not only may numbers vary from year to year in response to the weather but the habitat gaps they exploit may close in some places and open in others. This is a particular problem for species which exploit mud beside ponds, lochs, burns and rivers such as *Rumex conglomeratus* and *R. maritimus*. Even if a 1 km stretch of habitat has been thoroughly searched at a suitable season without success, I may have been reluctant to score less than ½ recognising some probability that the species will reappear in future. Often it is all too obvious that the habitat has changed and that the failure to refind a population represents a real loss, score 0.

NEW DISCOVERIES AND RECENT COLONISATION

In the sample hectads 267 R&S populations (excluding introductions) were known in 1999, 221 most recently recorded in the period 1987–1999 and 46 most recently in 1979–1986. However a further 210 R&S populations are now known, 67 discovered in the period 2000–2004 and 143 in 2005–2009. Thus the sample hectads have been explored progressively over the thirty-year period for which I have been vice-county recorder with each recording phase being more intensive and better informed than the last. So it is no surprise that in 2009, after allowing for probable losses, the number of recorded R&S populations extant far exceeds those known in 1999. In the majority of cases it is reasonable to assume that the new discoveries have been overlooked in the past, indeed many of the sites have had no previous recording visit. In other cases new colonisation is at least a possibility.

This uneven recording history leads to major problems in comparing new colonisation between the 1987–1995 and 2007–2009 surveys with the probable losses. My approach has been to eliminate those species that appear to be mobile before attempting a quantitative analysis of the probable losses and to discuss colonisation in relation to the species and processes involved but not numerically. So there has been a need to identify mobile R&S species for exclusion.

SPECIES EXCLUDED FROM THE NUMERICAL ANALYSIS

Annual arable weeds have all been excluded as their appearance in a field in a particular year is so dependent on the cropping regime.

The clubmosses, *Lycopodium clavatum* and *Diphasiastrum alpinum*, appear to be very vulnerable to muirburn and grazing on the open moorland of Berwickshire and all their populations there seem to be impermanent.

They have colonised newly-constructed forestry tracks extensively in the last twenty years but here too their populations are expected to be impermanent. In the circumstances all clubmoss records have been excluded.

Some aquatic species appear to be mobile. *Catabrosa aquatica* and *Potamogeton pusillus* have appeared in new ponds where they are unlikely to have been introduced. *Potamogeton alpinus* flourishing in a new upland pond could well have been introduced. Such species have been excluded.

There have been changes too on the coast. Single specimens of several 'new' native species have been found, such as *Beta vulgaris subsp. maritima*, and others have appeared for a single season on beaches where they had not been seen before. Others that were known as just a few specimens have disappeared. It is not possible to balance the gains and losses in a numerically valid manner, so all mobile coastal species have been excluded.

It is the custom in BSBI to treat the inland roadside populations of halophytes as aliens on the grounds that their spread has been enabled by vehicles. Whatever their status, such populations have been excluded as mobile. The same argument is applied to the spread of *Spergularia rubra* and a few other locally-scarce species along forestry tracks. A related issue is that a few R&S annuals, such as *Geranium pusillum*, are found both in natural habitats and in more ruderal ones. The ruderal populations often prove to be impermanent or do not produce mature plants every year, like arable weeds, so all such ruderal populations of annuals have been excluded. Plantings and deliberate sowings, which may be thought of as casuals, have also been excluded.

Sedum villosum is quite well represented in the areas re-surveyed and I have been particularly interested to discover how its populations are faring. As it happens some of the visits were inconclusive and I plan repeat visits in the hope of resolving the matter. But an interesting point emerges. It seems that a proportion of the small colonies lower down a burn system have been lost while those at higher altitude remain. There is a possibility that some of the lower colonies were impermanent: established but temporarily in marginally suitable habitat on the floodplain from seed washed down from above. I have resisted this argument for *Sedum villosum* as there does not happen to be evidence that populations in whole sites, as opposed to small groups of plants within a site, were just casuals. However this could be a significant issue when seeking to record change in our montane flora in other areas.

Of the 127 species considered, 21 have been wholly excluded as mobile. The exclusions have the advantage of helping to focus this paper on change in semi-natural habitats. This is convenient as rural Berwickshire is not the county for a study of the role of brownfield sites and the like in the future of the British flora.

REPEAT SURVEY RESULTS TO DATE

The results of the repeat survey are summarised in Table 1:

TABLE 1. LOSSES OF R&S POPULATIONS RE-SURVEYED, BY HECTAD

Hectad	Interval	Sample Population	Losses Population	Losses %	95% Confidence	Loss decade
NT55	17 yrs	18	3·50	19%	±16%	12%
NT64	20 yrs	47	13·50	29%	±12%	16%
NT65	19 yrs	20	6·75	34%	±19%	20%
NT75	17 yrs	19	5·50	29%	±17%	18%
NT77	14 yrs	30	6·00	20%	±13%	15%
NT84	16 yrs	28	6·75	24%	±13%	16%
Total	17 yrs	162	42·00	26%	± 6%	16%

As the outcome for each population is essentially on a presence or absence basis, rather than a report on individual plant numbers within populations, quite a large sample size is required to narrow down the confidence limits of the losses observed. Within these limitations the rate of loss is the same for each hectad.

The same data has been analysed by a simplified set of broad habitats in Table 2:

TABLE 2. LOSSES OF R&S POPULATIONS RE-SURVEYED, BY BROAD HABITAT

Broad Habitat	Sample Population	Losses Population	Losses %	95% Confidence	Loss decade
Aquatic	18	6·00	33%	±17%	21%
Coastal	18	1·75	10%	±13%	6%
Grassland	30	9·75	32%	±15%	20%
Inland Rock	5	1·00	20%	±39%	12%
Moorland	17	6·50	38%	±23%	25%
Wetland	47	14·00	30%	±11%	19%
Woodland	27	3·00	11%	±10%	7%
Total	162	42·00	26%	± 6%	16%

Notes: The grassland sample includes 18 populations of annuals and only 12 of perennials; grassland is mainly neutral grassland; moorland includes bog; the wetland sample includes 26 populations of moorland flush species and only 21 of taller vegetation.

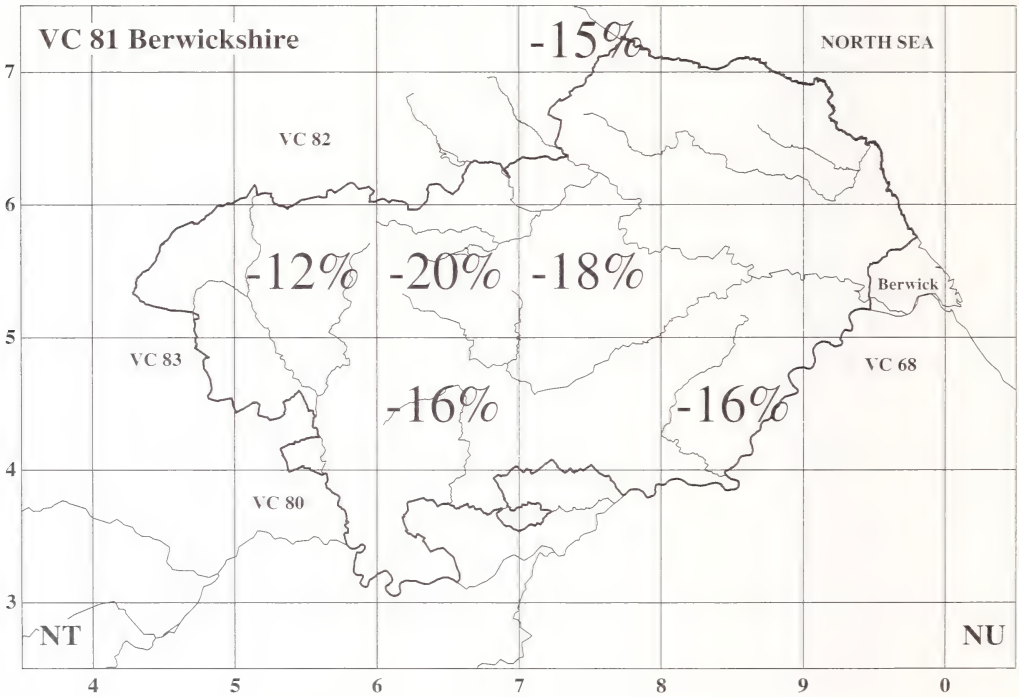

FIGURE 1. Rare and scarce populations: average probable loss per decade per hectad.

Two broad habitats have losses significantly lower than the average, coastal and woodland. There has apparently been an increase in diversity in the coastal habitats once colonisation is allowed for, as discussed below, while there really does appear to have been rather little change in the few woodlands surveyed.

The average probable loss per decade at hectad (10 km) scale is mapped in Figure 1, as is the change at monad (1 km) scale in Figure 2.

Monads with only species-poor habitats have often had but a single R&S species which may or may not have survived, if so they are mapped as 'all survive' or 'all lost'. Monads with the most species-rich habitats have often had several R&S species of which one or more may have been lost, if so they are mapped as 'some lost'. This accounts for the concentration of 'some lost' dots in a few species-rich areas, such as the one at the coast in NT77. This aside, R&S species are relatively evenly

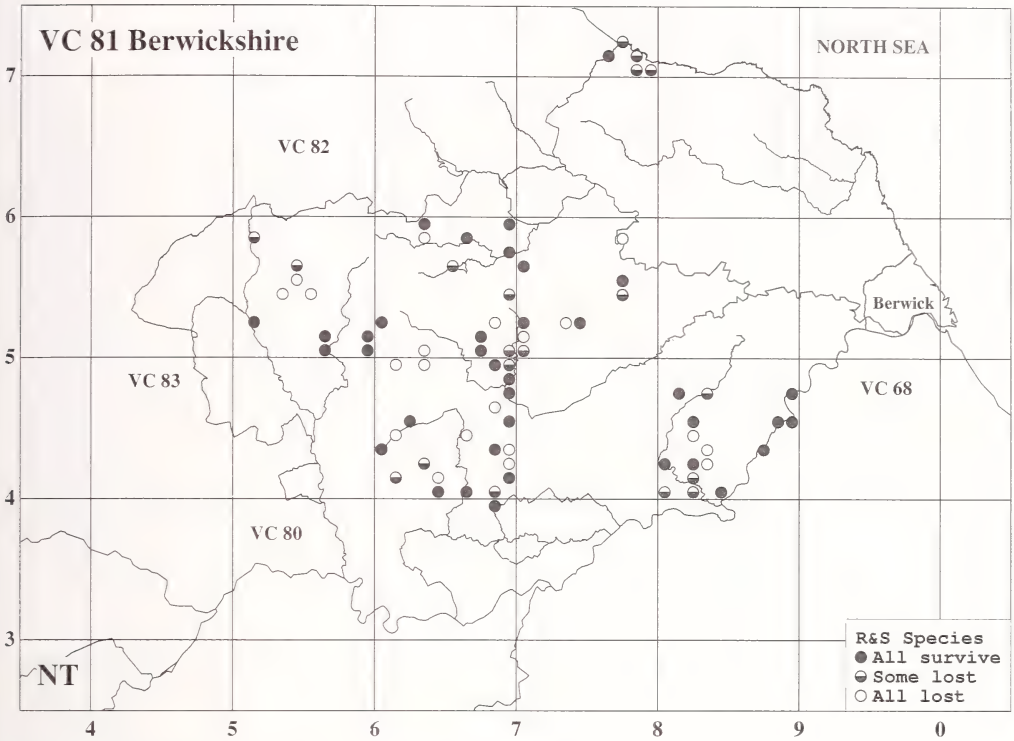

FIGURE 2. Rare and scarce populations: probable losses 1987–1995 to 2007–2009.

distributed across the v.c. and losses are fairly randomly distributed, though some local concentrations are evident.

COMPARISON WITH OTHER STUDIES

The estimate of a 16% loss per decade for R&S populations in Berwickshire may usefully be compared with other studies.

Bradshaw (2009) reports on the decline of the scarcer *Alchemilla spp.* in Northern England over a period of almost fifty years. Of 756 populations recorded at field-scale around 1952 only 210 could be refound in 2000. This equates to a loss of 23% per decade. A similar study reported in the same paper showed *Trollius europaeus* losing 20% of its populations per decade between 1967 and 2004.

Change in the British Flora 1987–2004 (Braithwaite *et al.* 2006) reported on the *BSBI Local Change* project, the repeat-recording of a sample of tetrads across Britain. It was found that the repeat survey had been more intensive than the first survey so that analysis of apparent gains and losses would not give measures of absolute change. Instead change was analysed relative to an average for representative native species. While only relatively widespread species yielded enough records for analysis they include many that are scarce at the fringes of their geographical range, including some Berwickshire R&S species. As a broad generalisation, the species that had declined most had declined by something of the order of 10% in the 16 year period between surveys, significantly less than the average of 26% in a 17 year period for the Berwickshire R&S species. However, if one studies the data one can infer that the rate of change at the fringes of a species range might be around three times the average as losses are high at the fringes and low in the core area of the range where the species is relatively frequent. This brings the rate of loss at the fringes to the same order of magnitude as the Berwickshire results even without adding something for the likely difference between relative and absolute change and ignoring the difference in scale, 1 km for Berwickshire, 2 km for *BSBI Local Change* (note that a higher rate of loss is to be expected at finer scale, as a tetrad may contain up to four 1 km-scale populations and all must be lost to register change at tetrad scale). So, while the comparison is imprecise, there is no evidence of inconsistency.

TABLE 3. HISTORICAL LOSSES OF R&S POPULATIONS

Basis period	Resurvey period	Sample Population	Losses Population	Losses %	Loss Decade	Comment
1740–1853	1987–2008	401	273	68%	7%	Many of best populations, focus on coastal strip
1854–1902	1987–2008	363	262	72%	10%	304 supplementary to 1740–1853, 59 refinds
1903–1944	1987–2008	143	73	51%	9%	Mostly revisits to best populations
1945–1969	1987–2008	337	176	52%	16%	Representative sample
1970–1986	1987–2008	280	72	25%	15%	Bias to best populations

Repeat-recording projects of all tetrads in several English v.cc. have recently been completed and their results are currently awaited with interest. The analysis of change is likely to be subject to the same problem of more intensive recording in the second survey so absolute measures of change are not expected, at least for the majority of species. More detailed statistics may be possible for some R&S species, but these are by definition the species with rather few populations so there is little opportunity for species by species measures of change. Even for R&S species, the problem of how to allow equitably for recent colonisation of the more mobile species will arise, and this appears to be intractable.

HISTORICAL LOSSES IN BERWICKSHIRE

In the Berwickshire Rare Plant Register 2004 I analysed the historical data for those species with a good historical record along rather similar lines to this paper. The average rate of loss for nineteenth century records had been 9% per decade from 1850 to 2000 and for twentieth century records 14% per decade from 1960 to 2000. Analysis by broad habitat showed that coastal species had declined less than those of other habitats.

Since 2004 Berwickshire's historical plant records have been fully computerised and the analysis has been repeated in greater detail, Table 3. Species of arable and ruderal habitats were not excluded. There is less difficulty in demonstrating the local extinction of arable and ruderal species over a long time-period as so often all sites in a particular hectad have been lost, not just the population at a particular site. This does, however, ignore the issue of casual occurences of arable weeds following introduction with crop seed.

All analysis is taken to the same resurvey date as there was no adequate repeat coverage until recently, so the scope for interpretation is limited. Nevertheless the analysis may be taken as evidence that the rate of losses before the Second World War was slower than more recently.

THE CAUSES OF LOSSES 1987–1995 TO 2007–2009

The cause of many of the losses between 1987–1995 and 2007–2009 can be deduced with reasonable certainty, though a residue remains where no cause is obvious. This is set below.

TABLE 4. CAUSES OF LOSSES

Probable cause of loss	Population
Agricultural/forestry operations	3·00
Alien invasion (*Centranthus*)	1·50
Bramble invasion (*Rubus*)	1·00
Development (housing/caravans)	3·00
Flush degraded (eutrophication/ climate change)	8·75
Grazing, too little	4·75
Habitat fragmentation/drainage	4·00
Muirburn	1·50
New pond (wetland converted)	2·50
Quarried	2·50
Unknown	9·50
Total probably lost	42·00
Probably surviving	120·00
Total sample	162·00

The drivers of change are similar to those identified in other recent studies. The overriding impression has been of an increase in tall rushes and coarse grasses with species-poor vegetation at the expense of shorter more species-rich vegetation.

DISCUSSION OF CHANGE BY BROAD HABITAT

None of the arable R&S species recorded in 1987–1999 have been refound where previously recorded but all have been discovered elsewhere in the survey area. Set-aside strips proved a productive habitat for such species up till 2007 and there was the feeling that arable weed diversity was increasing, but the grant system supporting them has been lost and the reverse was true in 2009 when most new discoveries of scarce arable weeds were made in ruderal situations. *Matricaria recutita*, a near locally-scarce species, has continued to spread.

Of the ruderal R&S species there are three who might be winners from climate change on the basis of the favoured habitats in which they occur. These are *Geranium pusillum*, *Hordeum murinum* and *Veronica polita*. While new discoveries of these species have been made, there have been losses too and no overall trend is evident. All finds of *Geranium lucidum* and *Malva moschata* were considered escapes from cultivation and, while *Mycelis muralis* has increased in natural woodland as well as ruderal habitats, it is a species that is probably a fairly recent accidental introduction (first record 1872).

Colonisation of forestry tracks by *Lycopodium clavatum*, *Diphasiastrum alpinum*, *Spergularia rubra*, *Montia fontana subsp. minor* and *Vicia sativa subsp. segetalis* has been one of the highlights of the re-survey. Many of these tracks have been constructed within the last twenty years.

While there have been losses of aquatic species, *Apium inundatum* and *Ranunculus circinatus* in particular, the overall position seems more positive. The information base has proved inadequate when it comes to considering whether discoveries of additional populations of *Catabrosa aquatica* and *Sparganium emersum* are new colonisation or not. Some change in these two species follows an established cycle of ditch clearance.

Only a few kilometres of coast fall in the survey area though they contain some of the richest coastal habitats in the v.c. The changes have been remarkable. *Aster tripolium*, *Atriplex littoralis* and *Beta vulgaris subsp. maritima* are new to the v.c. (though the *Atriplex* had been recorded recently as a roadside adventive). The populations of *Cakile maritima* and *Glaucium flavum* have increased greatly in numbers and *Atriplex laciniata* has become more frequent. However *Parapholis strigosa*, only recorded in 1984, has disappeared and both *Glaux maritima* and *Puccinellia maritima* may have lost colonies. It is perhaps premature to think of these changes as permanent, it seems more likely that they represent a response to unusually favourable conditions on a coast with small populations on beaches which are vulnerable to damage from winter storms.

In 1987 *Atriplex prostrata*, *Puccinellia distans* and *Spergularia marina* would have qualified as R&S species in Berwickshire. These species are now almost ubiquitous at the margin of main roads and widespread on minor roads. There they have been joined by *Armeria maritima*, *Atriplex littoralis*, *Cochlearia danica*, *Juncus ambiguus* and *Sagina maritima* in what has undoubtedly been the most spectacular change in the flora of the v.c. in the period.

A disproportionate number of Berwickshire's R&S grassland species are annuals. They are found on rocky knowes where their broad habitat could equally well be described as inland rock. Their populations vary from season to season. The losses recorded relate to small-scale quarrying and scrub encroachment. The only increasing species has been *Allium vineale*, which is spreading down the river Tweed in the manner of an alien.

The one loss from inland rock is unusual. There was a surprising colony of *Cryptogramma crispa* on a drystane dyke by an old drove road. This section was demolished by forestry vehicles.

The moorland species with the most losses is *Genista anglica*. It seems to recover poorly from muirburn. *Antennaria dioica* is a moorland-edge species that also suffers. Nowadays, with honourable exceptions, keepers conduct muirburn on the grouse moors with military precision and no bank, burnside or rough corner is allowed to escape. *Empetrum nigrum* has become rather scarce and even *Vaccinium myrtilis* is often extraordinarily sparse. No R&S species are colonising moorland though juniper, *Juniperus communis subsp. communis*, may now be planted at the fringes.

The Lammermuirs have very little wetland but one of the delights of botanising there is to happen upon a small flush area with *Sedum villosum*, if it be relatively acid, or *Carex dioica*, *Eleocharis quinqueflora*, *Selaginella selaginoides* and *Parnassia palustris* if it be more base-rich. I am particularly interested in chronicling the fate of such communities. It is proving difficult. Twice I have been reduced to

revisiting a remote flush area where I have failed to refind the expected rarities. Twice I have been rewarded by refinding the species-rich flush just over a rise little more than a hundred metres from a more run-of-the-mill flushed area. Nevertheless it is clear that there have been losses with tall rushes invading small flushes. Then there have been subtle changes at the burnside itself where *Sedum villosum* was formerly found among moss carpets where *Epilobium brunnescens* is now frequent, though I am not suggesting it is as simple as the one displacing the other.

I am concerned about the riverside and pond species that depend on cattle plodging to keep patches of habitat open. There has been much fencing-off of the riverside to promote angling and water quality. Like muirburn the practice has been taken too far and there has been a marked decline in the populations of *Lythrum portula, Rumex conglomeratus* and *Veronica anagallis-aquatica agg*. These species are probably still present in the seed bank even where they appear to have been lost, so any change in management could reverse their fortunes.

Berwickshire lost most of its remaining woodlands over the centuries of Border warfare, so it is pleasing to report few recent species losses. The last known colony of *Goodyera repens* has finally gone: it had hung on for some years under the few remaining mature pines after the main plantation had been felled and has succumbed to brambles. Two R&S species that appear to be responding positively to climate change are *Carex pendula* and *Polystichum setiferum*. Their colonies in dean woodland by the coast have expanded up the slopes away from the burn and *Polystichum setiferum* appears to have colonised plantations well inland. *Viburnum opulus* had been reduced to less than ten bushes in the v.c. as a native but is now increasingly planted, sometimes in ancient woodland.

SUMMARY

While the discussion of change by broad habitat highlights colonisation as well as the losses summarised in the tables, the overall balance is discouraging. A limited number of species have shown spectacular gains in man-made habitats, particularly roadsides and forestry tracks, but not in more natural habitats. The unobtrusive spread of *Carex pendula* and *Polystichum setiferum* in natural habitats is scant compensation for the loss of so many populations of R&S species, especially those of grassland and wetland.

Nevertheless there is a fundamental asymmetry between decline and spread. Decline is by the gradual whittling-away over many years of populations that fragment and finally succumb. Many species may decline to a similar pattern. Colonisation may be rather rapid. Spread of 1·4 km/year is about the norm for rapidly spreading species (Braithwaite 2010), so a v.c. may be extensively colonised in a twenty-year period between two surveys. Rather few species may be spreading at a particular time so their impact may be underrated. It is easy to forget the now-familiar species that have colonised a v.c. over the last century or so. For Berwickshire these include the following riverside species: *Acorus calamus, Butomus umbellatus, Dipsacus fullonum, Glyceria maxima, Lysimachia vulgaris* and *Scrophularia umbrosa*. If the habitats were surviving climate change need not necessarily lead to a species-poor flora in the long-term.

But at present climate change is but one driver of change and the habitats are not surviving. Most have already been grievously fragmented. Eutrophication is ubiquitous and has been leading to a reduction in diversity. The demands of mankind through agriculture, forestry, sporting interests, the transport infrastructure and the built environment are remorseless. Yes, Berwickshire's scarce plants are disappearing.

CONCLUSION

Evidence is presented that the current rate of the loss of Berwickshire's rare and scarce plant populations is about 16% per decade. However the sample analysed excludes mobile species, especially annual arable weeds and species of ruderal habitats. New colonisation has also been excluded and, while it concerns only a minority of species, discussion indicates that it largely negates the results for aquatic and coastal habitats.

The comparisons have been made at 1 km scale on a presence or absence basis rather than on the basis of changes in the size of individual populations. This basis demands quite large sample sizes before statistically valid results can be expected and for this reason the analysis by broad habitat is very provisional. More detailed results should be possible in the future as all populations of rare or scarce plants are now being plotted out at 10 m scale (100 m for a few large populations) supplemented in some cases by counts of individual plants. No solution is in prospect to the problem of how to measure absolute change for mobile species.

ACKNOWLEDGMENTS

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REFERENCES

BRADSHAW, M. E. (2009), The decline of Lady's-mantles (*Alchemilla vulgaris L. agg.*) and other hay meadow species in Northern England since the 1950s, *Watsonia* **27**: 315–321.

BRAITHWAITE, M. E. (2004), *Berwickshire Vice-county Rare Plant Register,* privately published.

BRAITHWAITE, M. E. (2010), How well has BSBI chronicled the spread of neophytes? *Watsonia* **28**: 21–31.

BRAITHWAITE, M. E., ELLIS, R. W. & PRESTON, C. D. (2006). *Change in the British Flora 1987–2004*, Botanical Society of the British Isles, London.

PRESTON, C. D., PEARMAN, D. A. & DINES, T. D. (2002). *New Atlas of the British and Irish flora*, Oxford University Press, Oxford.

STACE, C. A. (1991). *New Flora of the British Isles*, Cambridge University Press, Cambridge.

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APPENDIX: TABLE OF RARE AND SCARCE SPECIES POPULATIONS IN THE SURVEY SAMPLE

Broad Habitat	*Taxon*	Lost	Surviving	Total	Not analysed	Not Visited	Total
Wetland	*Anagallis tenella*		1·00	1			1
Moorland	*Antennaria dioica*	1·00		1			1
Grassland	*Anthriscus caucalis*	1·00		1			1
Aquatic	*Apium inundatum*	0·75	1·.25	2			2
Coast	*Astragalus danicus*	1·00		1			1
Coast	*Atriplex laciniata*		1·00	1			1
Grassland	*Ballota nigra*		1·00	1			1
Wetland	*Blysmus compressus*		1·00	1			1
Coast	*Blysmus rufus*		1·00	1			1
Grassland	*Botrychium lunaria*	1·00	2·00	3			3
Coast	*Cakile maritima*		1·00	1			1
Coast	*Carex arenaria*		1·00	1			1
Wetland	*Carex dioica*	0·75	3·25	4		1	5
Coast	*Carex distans*		1·00	1			1
Coast	*Carex extensa*		1·00	1			1
Woodland	*Carex laevigata*		1·00	1			1
Grassland/ Ruderal	*Carex muricata* subsp. *lamprocarpa*		1·00	1	1		2
Woodland	*Carex pallescens*	0·75	1·25	2			2
Woodland	*Carex pendula*		1·00	1			1
Woodland	*Carex remota*		1·00	1		1	2
Wetland	*Carex vesicaria*	1·75	0·25	2			2
Coast/ Grassland	*Centaurium erythraea*	0·50	2·50	3			3
Grassland	*Cerastium semidecandrum*	1·00	1·00	2			2
Wetland	*Cicuta virosa*		1·00	1			1
Wetland	*Cirsium heterophyllum*	2·00	3·00	5			5
Grassland	*Clinopodium vulgare*		1·00	1			1
Woodland	*Corallorhiza trifida*		1·00	1			1
Rock	*Cryptogramma crispa*	1·00		1			1
Wetland	*Dactylorhiza incarnata*	1·00	2·00	3			3
Grassland	*Dianthus deltoides*		1·00	1			1
Moorland	*Drosera rotundifolia*	2·00	4·00	6			6
Wetland	*Eleocharis quinqueflora*	1·50	3·50	5			5
Woodland	*Epilobium roseum*					1	1
Wetland	*Eriophorum latifolium*		1·00	1			1
Grassland/ Ruderal	*Erodium cicutarium*		2·00	2	2		4
Coast	*Erophila majuscula*	0·75	0·25	1			1
Wetland	*Euphrasia scottica*		1·00	1			1
Grassland	*Filago minima*	0·75	1·25	2			2
Wetland	*Galium boreale*		1·00	1			1
Grassland	*Galium mollugo*		1·00	1	1		2
Moorland	*Genista anglica*	1·50	2·50	4			4
Coast	*Glaucium flavum*		1·00	1			1
Coast	*Glaux maritima*		1·00	1	1		2
Woodland	*Goodyera repens*	1·00		1			1
Grassland	*Gymnadenia conopsea*		1·00	1			1
Wetland	*Hippuris vulgaris*	0·50	0·50	1			1
Coast	*Honckenya peploides*		2·00	2			2
Woodland	*Hypericum maculatum*		1·00	1			1

APPENDIX CONT...

Broad Habitat	*Taxon*	Lost	Surviving	Total	Not analysed	Not Visited	Total
Coast	*Juncus gerardii*		1·00	1			1
Rock	*Lactuca virosa*		2·00	2			2
Aquatic	*Lemna trisulca*	0·75	1·25	2			2
Coast	*Leymus arenarius*		1·00	1		1	2
Woodland	*Linnaea borealis*		1·00	1			1
Woodland	*Listera ovata*		1·00	1		1	2
Aquatic	*Littorella uniflora*		1·00	1			1
Woodland	*Melica uniflora*	0·25	1·75	2			2
Woodland	*Mentha arvensis*		2·00	2			2
Woodland	*Milium effusum*		1·00	1			1
Wetland	*Molinia caerulea* subsp. *arundinacea*	0·25	0·75	1			1
Grassland	*Montia fontana* subsp. *minor*	0·25	0·75	1			1
Grassland	*Montia fontana* subsp. *variabilis*	0·50	0·50	1	1		2
Woodland	*Mycelis muralis*		2·00	2			2
Grassland	*Myosotis ramosissima*	1·50	0·50	2		1	3
Aquatic	*Nuphar lutea*		1·00	1			1
Grassland	*Ophioglossum vulgatum*		1·00	1			1
Woodland	*Platanthera bifolia*		1·00	1			1
Grassland	*Poa angustifolia*					1	1
Woodland	*Polypodium interjectum*					1	1
Woodland	*Polystichum setiferum*		1·00	1			1
Aquatic	*Potamogeton lucens*		1·00	1			1
Aquatic	*Potamogeton × salicifolius*		1·00	1		1	2
Coast	*Puccinellia maritima*		1·00	1		1	2
Woodland	*Pyrola minor*		4·00	4			4
Woodland	*Ranunculus auricomus*	0·75	1·25	2			2
Aquatic	*Ranunculus circinatus*	1·00		1			1
Aquatic	*Ranunculus lingua*		1·00	1			1
Aquatic	*Ranunculus peltatus*	0·75	0·25	1			1
Rock	*Rosa pimpinellifolia*		2·00	2			2
Woodland	*Rubus saxatilis*		1·00	1			1
Wetland	*Rumex conglomeratus*	0·50	0·50	1			1
Wetland	*Rumex maritimus*	0·75	0·25	1			1
Wetland	*Sagina nodosa*		2·00	2			2
Wetland	*Salix phylicifolia*		2·00	2			2
Wetland	*Schoenoplectus lacustris*		2·00	2			2
Wetland	*Schoenoplectus tabernaemontani*		1·00	1			1
Grassland	*Scleranthus annuus*	0·75	1·25	2			2
Wetland	*Scutellaria galericulata*	0·50	0·50	1			1
Wetland	*Sedum villosum*	2·75	1·25	4			4
Wetland	*Selaginella selaginoides*	0·75	3·25	4			4
Grassland	*Sherardia arvensis*	0·75	0·25	1			1
Grassland	*Silaum silaus*	1·00		1			1
Aquatic	*Sparganium emersum*	1·50	1·50	3			3
Coast	*Spergularia media*		1·00	1			1
Wetland	*Stellaria palustris*	1·00		1			1
Coast	*Triglochin maritimum*		1·00	1			1
Wetland	*Trollius europaeus*		1·00	1			1

APPENDIX CONT...

Broad Habitat	*Taxon*	Lost	Surviving	Total	Not analysed	Not Visited	Total
Moorland	*Ulex gallii*		1·00	1			1
Moorland	*Vaccinium oxycoccos*	2·00	3·00	5			5
Grassland	*Valerianella locusta*		1·00	1			1
Aquatic	*Veronica catenata*		1·00	1			1
Aquatic	*Veronica catenata / V. × lackschewitzii*	1·00	1·00	2		5	7
Aquatic	*Veronica × lackschewitzii*	0·25	0·75	1		2	3
Woodland	*Viburnum opulus*	0·25	0·75	1	1		2
Grassland	*Vicia lathyroides*	0·75	0·25	1			1
Grassland	*Vicia orobus*		1·00	1			1
Grassland	*Vicia sativa* subsp. *segetalis*					2	2
	Subtotal	42	120	162	7	19	188
	Excluded species						
Ruderal	*Aethusa cynapium*				2		2
Ruderal	*Arenaria serpyllifolia* subsp. *leptoclados*				1		1
Aquatic	*Catabrosa aquatica*				5		5
Ruderal	*Centaurea cyanus*				1		1
Ruderal	*Chelidonium majus*				1		1
Arable	*Chrysanthemum segetum*				1		1
Ruderal	*Convolvulus arvensis*					1	1
Ruderal	*Filago vulgaris*				1		1
Arable	*Fumaria officinalis* subsp. *wirtgenii*				1		1
Arable	*Fumaria purpurea*				1		1
Ruderal	*Geranium lucidum*				1		1
Ruderal	*Hordeum murinum*				1	1	2
Arable	*Hypericum humifusum*				1		1
Moorland	*Lycopodium clavatum*				4		4
Aquatic	*Lythrum portula*				1		1
Arable	*Persicaria lapathifolia*				2		2
Aquatic	*Potamogeton obtusifolius*					1	1
Aquatic	*Potamogeton pusillus*				2		2
Ruderal	*Spergularia rubra*				1		1
Ruderal	*Veronica polita*				5		5
Arable	*Viola tricolor*				2		2
	Total	42	120	162	41	22	225

Conservation status of two British members of *Hieracium* section *Alpestria*: *Hieracium mirandum* and *H. solum* (Asteraceae)

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ABSTRACT

Population surveys of two members of *Hieracium* section *Alpestria* (Fr.) Arv.-Touv. were carried out to assess their conservation status. *Hieracium mirandum* P. D. Sell & C. West, Remote Hawkweed, is currently known from only two out of its six sites in northern England, with a total population of six plants. *Hieracium solum* P. D. Sell & C. West, Solitary Hawkweed, is currently known in two of its three localities in South-west Scotland, with a total population of 21 plants. Both species have an IUCN Threat Status of 'Critically Endangered'.

KEYWORDS: England, IUCN Threat Status, Remote Hawkweed, Scotland, Solitary Hawkweed.

INTRODUCTION

In their revision of *Hieracium* section *Alpestria* (Fr.) Arv.-Touv., Sell & West (1965) described six new species of hawkweed, including *H. mirandum* P. D. Sell & C. West, Remote Hawkweed, from northern England and *H. solum* P. D. Sell & C. West, Solitary Hawkweed, from South-west Scotland. Both species are listed in the Vascular Plant Red Data Book (Wigginton 1999, where they are both erroneously listed for Shetland) but there is very little recent information available about either species. Surveys of both species were therefore carried out to provide an IUCN Threat Category as required under the Global Plant Conservation Strategy (Secretariat for the Conservation of Biodiversity 2002). *Hieracium* section *Alpestria* is also a priority under the UK Biodiversity Action Plan (UK Biodiversity Group 1998); the action plan includes all British Section *Alpestria* species (C. Cheffings, pers. comm. 2008). The survey results are summarised in this paper; full details for each species are given in Rich & McCosh (2008a, b) which are available on request to T. Rich.

Hieracium mirandum is a very rare, little-known plant. At the time it was described it had only been found once at Stean, Yorkshire (Sell & West 1965). By 1968 two further localities were known in Derbyshire and Yorkshire (Sell & West 1968, where the Derbyshire record was erroneously plotted in SE25 rather than SK25). Details of three further localities subsequently came to light in Cumbria (Halliday 1997). As pointed out by Halliday (1997), in northern England, *H. mirandum* is a distinctive species with 3–6, elliptic, nearly untoothed stem leaves, the lower petiolate and the upper semi-clasping. The heads are blackish-green with dark glandular hairs and a few simple and stellate hairs on the involucral bracts, and it has discoloured styles.

Similarly, *H. solum* is also very rare and poorly known. Cunningham & Kenneth (1979) recorded it only from the Cruach Lusach area in Knapdale, South-west Scotland, where it has been collected in three sites. About ten other *Hieracium* species have been recorded in the central Knapdale area, from which *H. solum* is easily distinguished by its up to 6, entire, semi-clasping, ± glabrous stem leaves and large capitula with a blackish involucre with scattered simple eglandular hairs and a few black glandular hairs, and its discoloured styles. In the field, the leaves have a slight glaucous hue, but are not caesious as described by Sell & West (1965).

METHODS

Historical records were compiled from herbaria (**BM**, **CGE**, **E**, **LANC**, **MANCH**, **YRK**) and the literature and were used to direct the field surveys. Surveys for *H. mirandum* were carried out in July 2008. Surveys for *H. solum* were carried out in 2006 and 2008. Population sizes were counted as far as practicable, and notes were made on associated species.

RESULTS

HIERACIUM MIRANDUM

1. MASSON HILL (V.C. 57 DERBYSHIRE)

Hieracium mirandum was collected from Masson Hill above Bonsall (c. SK2858) on 4 August 1946 by J. E. Lousley and by E. C. Wallace (**BM**), but has not been seen there since. Unsuccessful searches of the area were carried out by Mills & Mills (1970) with C. West in 1967, by R. Smith in the late 1980s, and by R. Smith with J. Bevan in 1990, but the hill had become rather unsuitable with much agricultural improvement; further searches were not considered worthwhile.

2. STEAN (V.C. 64 MID-WEST YORKSHIRE)

The holotype of *H. mirandum* was collected on 29 July 1962 by Miss C. M. Rob from the aqueduct near Well House, Stean, SE0774 (**CGE**). It was searched for again in 1963 and 1964 but was not refound (Sell & West 1965). The site was searched again on 28 July 2008 without success. The plant is certainly extinct at this site and the level of shade makes the occurrence of any *Hieracium* here unlikely.

3. GAYLE BECK, GEARSTONES, RIBBLEHEAD (V.C. 64 MID-WEST YORKSHIRE)

Hieracium mirandum was first collected from a small river at Ribblehead on 9 July 1902 by A. Ley (**CGE**). It was refound, presumably at Ley's site, in 'moderate' quantity in *Salix* scrub on the bank of the Gayle Beck at SD7880 on 10 August 1968 by J. N. Mills (**MANCH**) but was reported to be in grave danger from grazing animals with most of the capitula nibbled off (Mills & Mills 1970). It was collected again anonymously on 30 June 1974 (**BM**), and again by J. N. Mills on 2 July 1975 (**CGE**).

The site was visited on 28 July 2008, and one plant was found on the low, south-facing side of a small (1–3 m high) Carboniferous Limestone gorge (photographic voucher **NMW**). The plant had a stem with the characteristic clasping leaves, but its apex had been eaten off and no flowering heads were present. Associated species included *Thymus polytrichus* A. Kern. ex Borbás and *Ctenidium molluscum* (Hedw.) Mitt. *Hieracium vulgatum* Fr. was present nearby.

4. ORTON (V.C. 69 WESTMORLAND)

Hieracium mirandum was collected from a grassy lane above Orton in August 1935 by A. Wilson (**YRK**, photograph seen; Halliday 1997).

The Orton area (NY60) was searched on 29 July 2008 without success. A few grassy lanes remain around Orton, but the area must have changed significantly since Wilson found it.

5. NEWBIGGIN-ON-LUNE (V.C. 69 WESTMORLAND)

Hieracium mirandum was collected in a long-abandoned limestone quarry between Gaisgill and Newbiggin-on-Lune in 1985 by M. Atkinson; the site was destroyed shortly after by dumping of farm refuse (Halliday 1997; the specimen cited probably never reached **LANC**, pers. comm. G. Halliday, 2008).

The roadside quarry at NY684053 was searched on 29 July 2008 without success; *Hieracium subcrassum* (Almq. ex Dahlst.) Johanss. and *H. vulgatum* were present.

6. TARN BECK, SEATHWAITE (V.C. 69 WESTMORLAND)

Hieracium mirandum was found on damp ground beside a streamlet by the Tarn Beck, Seathwaite at SD2396 on 26 July 1969 by J. N. Mills and J. R. J. M. Mills (**MANCH**). It was not refound on several searches during field work for the *Flora of Cumbria* (Halliday 1997).

On 29 July 2008, five plants of *H. mirandum* were refound with *H. sabaudum* L. and *Crepis paludosa* (L.) Moench under *Corylus avellana* L. and *Fraxinus excelsior* L. (**NMW**).

HIERACIUM SOLUM

1. LOCHAN DUGHAILL (V.C. 101 KINTYRE)

Hieracium solum was first found at Lochan Dughaill at NR8080 by A.G. Kenneth on 11 July 1962 (holotype in **CGE**). Seed was collected in August 1963 and cultivated in Cambridge Botanic Garden (**CGE**).

Lochan Dughaill was visited on 12 July 2006. Eleven flowering *H. solum* plants were found in a very small area on granite rock ledges and in crevices in a black organic soil in very open vegetation (**NMW**). Associated species were *Agrostis vinealis* Schreb., *Calluna vulgaris* (L.) Hull, *Deschampsia flexuosa* (L.) Trin., *Erica cinerea* L., *Rumex acetosella* L., *Solidago virgaurea* L. and *Succisa pratensis* Moench.

2. CRUACH LUSACH (V.C. 101 KINTYRE)

Hieracium solum has been collected in two places at Cruach Lusach; NR785832, 1 August 1964, A. G. Kenneth (**E**), and NR780831, 27 June 1968, A. G. Kenneth, A. C. Jermy & P. D Sell (**CGE**).

Cruach Lusach was searched on 13 July 2006. Two groups of plants were found at the latter site, one with four clumps in nearly vertical, adjacent, west-facing granite crevices

associated with *Calluna vulgaris, Deschampsia flexuosa*, *Sedum rosea* (L.) Scop. and *Vaccinium myrtillus* L., and a second group of six plants on ledges with *Calluna vulgaris, Salix herbacea* L. and *Viola riviniana* Rchb. No *H. solum* was found at the former locality, although two other *Hieracium* species occur there.

3. AN STUCHD (V.C. 101 KINTYRE)

Hieracium solum was collected at An Stuchd (c. NR7580) by A. G. Kenneth in 1964 (**CGE**, **E**).

An Stuchd was searched on 15 July 2008 but *H. solum* was not refound. Given that *H. solum* is likely to be in very small quantity in this area, which is difficult to search thoroughly, it may still be present.

FIGURE 1. Distributions of *Hieracium mirandum* (• 2006–2008, ○ pre-2005) and *H. solum* (■ 2006–2008).

DISCUSSION

Hieracium mirandum is currently known from only two out of six sites in northern England, with a total population of six plants (Figure 1). It has declined at Ribblehead since being seen in moderate quantity in 1968, and is in imminent danger of extinction at both sites; its IUCN (2001) Threat Status is 'Critically Endangered'. *Hieracium solum* was refound in two of its three localities in Kintyre, with a total population of 21 plants (Figure 1). The second population at Cruach Lusach and the site at An Stuchd could still be extant, but if so are likely only to be present in very small quantity and consequently difficult to find. The IUCN (2001) Threat Status of *H. solum* is thus also 'Critically Endangered'. Both species are thus very rare with very small populations, which is typical of many species of *Hieracium* section *Alpestria* (Sell & West 1965).

The main threats to *H. mirandum* are over-grazing at Gayle Beck (Mills & Mills 1970), and shading at Seathwaite; conservation management is required at both sites. The only obvious threat to *H. solum* is from moor burning, which came within 2 m of the tiny population at Lochan Dughaill in 2006. In several places on the Cruach Lusach range, recent fires have swept over partly vegetated rocks and ridges where the hawkweed could have occurred, and burning has the potential to eliminate the very small populations. Longer term monitoring programmes for both species should be established, and the immediate conservation priority for both species is to get living material into cultivation and/or seed banks.

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REFERENCES

CUNNINGHAM, M. R. & KENNETH, A. G. (1979). *The flora of Kintyre*. E. P. Publishing, East Ardsley.

HALLIDAY, G. (1997). *A Flora of Cumbria*. Centre for North-west Regional Studies, Lancaster.

IUCN (2001). *IUCN Red list categories and criteria. Version 3.1*. IUCN, Gland.

MILLS, J. N. & MILLS, J. R. J. (1970). Two *Hieracia* Sect. *Alpestria* from the British mainland. *Watsonia* **8**: 48–49.

RICH, T. C. G. & MCCOSH, D. J. (2008a). Hieracium mirandum *Remote Hawkweed survey 2008*. Unpublished report, National Museum of Wales, Cardiff.

RICH, T. C. G. & MCCOSH, D. J. (2008b). Hieracium solum *Solitary Hawkweed survey 2006–2008*. Unpublished report, National Museum of Wales, Cardiff.

SECRETARIAT FOR THE CONSERVATION OF BIODIVERSITY (2002). *Global strategy for plant conservation*. Secretariat for the Conservation of Biodiversity, Montreal.

SELL, P. D. & WEST, C. (1965). A revision of the British species of *Hieracium* Section *Alpestria* (Fries) F. N. Williams. *Watsonia* **6**: 85–105.

SELL, P. D. & WEST, C. (1968). *Hieracium* L., in Perring, F. H. (1968). *Critical Supplement to the Atlas of the British flora*. B.S.B.I. and Thomas Nelson & Sons, London.

UK BIODIVERSITY GROUP (1998). *UK Biodiversity Group. Tranche 2 Action Plans – Volume I: Vertebrates and vascular plants*. Joint Nature Conservation Committee, Peterborough.

WIGGINTON, M. J., ed. (1999). *British Red Data Books. 1. Vascular Plants*. 3rd ed. Joint Nature Conservation Committee, Peterborough.

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Conservation of Britain's biodiversity: status of the Welsh endemic *Hieracium subminutidens*, Llanwrytyd Hawkweed (Asteraceae)

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ABSTRACT

Hieracium subminutidens (Zahn) Pugsley (Asteraceae), Llanwrytyd Hawkweed, is a rare Welsh endemic, known from the River Irfon catchment at Llanwrytyd and Abergwesyn in v.c. 42 Brecon. Historical records indicate it occurred in at least six sites. Field surveys in July 2008 revealed four populations with 101 plants on riverside rocks. It is I.U.C.N. threat category 'Endangered'. Conservation proposals are outlined.

KEYWORDS: Brecon, I.U.C.N. Threat Criteria, Wales

INTRODUCTION

Hieracium subminutidens (Zahn) Pugsley (Asteraceae), Llanwrytyd Hawkweed, is a very rare, endemic plant, known from the River Irfon [R. Yrfon] catchment at Llanwrytyd and Abergwesyn in Powys (v.c. 42 Brecon), Wales. It is one of 79 rare hawkweeds included in the Vascular Plant Red Data Book (Wigginton 1999), but there is no recent information on its population size which can be used to determine its priority for conservation. Data were compiled on its historical records as part of a project between the National Museum of Wales and the Countryside Council for Wales in 2001–2002, showing that it had been recorded in at least six sites. In this paper the historical records are combined with the results of a field survey in 2008; full details are given in Rich (2002) and Shewring & Rich (2008).

The history of *H. subminutidens* was set out by Pugsley (1948). Plants found by A. Ley in 1896 at Llanwrytyd, Brecon were first ascribed to the Swedish species *H. adlerzii* Almq. Williams (1901–1911) disagreed with the application of the name *H. adlerzii* to the plants, but gave no alternative. Zahn (1921) named them *H. caesium* subsp. *adlerzii* var. *subminutidens*, based on material from Llanwrytyd. Zahn's combination was raised to species status by Pugsley (1941), which remains its current rank (Pugsley 1948; Sell & Murrell 2006). It is a member of section *Vulgata* (Pugsley 1948; Sell & Murrell 2006). Sell & West (1968) suggested that *H. subminutidens* is derived from *H. diaphanum* Fr.

Hieracium subminutidens is a reasonably distinct species, but it grows in an area rich in hawkweeds. Key features of *H. subminutidens* (Pugsley 1948) are the 2–3, dark green, oval to elliptic-lanceolate basal leaves with sinuate-dentate margins (these have often withered at the time of flowering), the 5–7 large stem leaves with scattered simple eglandular hairs on both surfaces, the inflorescence with 3–20, medium-sized capitula, the dark green involucral bracts with ±numerous long and short, fine, dark glandular hairs, some simple eglandular hairs and a few stellate hairs, and the discoloured styles. Pugsley (1948) also noted that involucral bracts were porrect in bud (i.e. stand erect and over-top the young flower buds), but we found this to be very variable and not reliable. The following hawkweeds have also been recorded in the Llanwrytyd–Abergwesyn area: *H. argillaceum* Jord., *H. consociatum* Jord. ex Boreau, *H. daedalolepioides* (Zahn) Roffey, *H. diaphanum*, *H. sabaudum* L., *H. scabrisetum* (Zahn) Roffey, *H. subcrocatum* (E. F. Linton) Roffey, *H. trichocaulon* (Dahlst.) Johanss., *H. uiginskyense* Pugsley and *H. umbellatum* L.

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TABLE 1. HERBARIUM AND LITERATURE RECORDS OF *HIERACIUM SUBMINUTIDENS*

DATE	COLLECTOR	SITE	SOURCE AND NOTES
9/8/1889	A. Ley	Abergwesyn, river gravel	**CGE**
17/7/1890	A. Ley	Abergwesyn, bank near	**BM**, **CGE** (some dated 1899)
22/7/1902	A. Ley	Abergwesyn, on the Irfon 2 miles above	**CGE**
28/6/1921	A. Ley	Abergwesyn, by the Irfon near	**BM**
8/7/1958	B. A. Miles	Abergwesyn and Llanwrytyd Wells	**CGE**
16/7/1890	A. Ley	Llanwrytyd, Blaen y Cwm, rocky mountain stream	**BM**, **CGE**
17/7/1890	A. Ley	Llanwrytyd, hedge bank	**CGE**
13/7/1896	A. Ley	Llanwrytyd, Blaen y Cwm	**BM** (type designated by Pugsley 1948), **NMW**
13/7/1897	A. Ley	Llanwrytyd, rocky streamside rocks	**BM**, **CGE**, **NMW**, Set of British *Hieracia* no. 67.
21 & 22 /7/1902	A. Ley	Llanwrytyd, hedge bank	**BIRM**, **CGE**
11/7/1904	A. Ley	Llanwrytyd	**CGE**
23/7/1907	A. Ley	Llanwrytyd, stream side rock, Nant Hebog	**CGE**
23/7/1907	H. J. Riddelsdell	Llanwrytyd, near	**BM**, **CGE**
12/6/1908	A. Ley	Llanwrytyd	**CGE**
4/8/1955	B. A. Miles	Llanwrytyd Wells, banks of River Irfon	**CGE**
8/7/1958	B. A. Miles	Llanwrytyd Wells, rocks below River Irfon bridge	**CGE**
9/7/1959	C. West & C. E. A. Andrews	Llanwrytyd, rocks below road bridge	**BIRM**, **CGE**
Cultivated material			
5/7/1899	A. Ley	Glen Llanwrytyd	**CGE**
7/7/1899	A. Ley	Abergwesyn, river gravel	**CGE**
1/7/1900	A. Ley	Nant Hebog, Llanwrytyd	**BM**, **CGE**, **NMW** (not all this material is noted at cultivated on the sheets)
26/6/1908	E. F. Linton	Llanwrytyd	**BM** (hort. Edmondsham)

Material in **BIRM**, **BM** and **NMW** mainly determined by D. McCosh, material in **CGE** determined by P. D. Sell.

METHODS

Historical records were compiled from herbarium material in **BIRM**, **BM**, **CGE** and **NMW** and the literature.

Field work was carried out in July 2008, using the historical records to direct searches. Plants were counted systematically as far as was practical given the access difficulties along rivers. Where available, ripe seeds were collected for ex-situ conservation in August 2008. Voucher material determined by D. McCosh has been deposited in **NMW**.

RESULTS

HISTORICAL RECORDS

The historical records traced are listed in Table 1. The total historical distribution is as described by Linton (1905), i.e. Abergwesyn, Llanwrytyd and the upper Irfon Valley, where it has been recorded in at least six (possibly seven) different sites, most recently in 1958–1959. The habitats indicated from the records are riverside rocks, river gravels and hedgebanks.

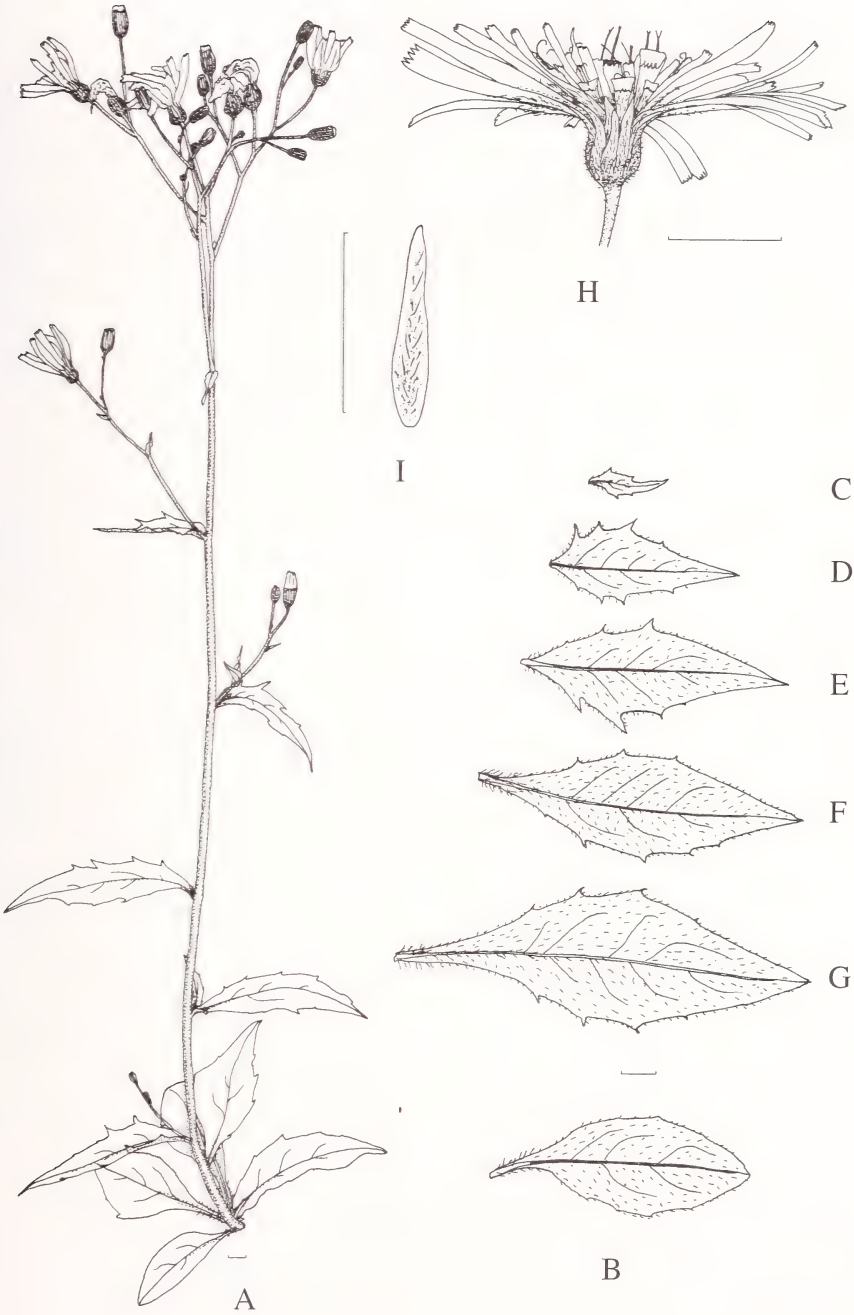

FIGURE 1. *Hieracium subminutidens.* A, plant. B, basal leaf. C–G, stem leaves. H, capitulum. I, involucral bract. Scale bars 1 cm.

FIGURE 2. Distribution of *Hieracium subminutidens* in 2008.

FIELD SURVEY 2008

Llanwrtyd Wells, River Irfon

Hieracium subminutidens was last recorded in Llanwrtyd Wells in 1959 (Table 1). In July 2008, 35 *H. subminutidens* plants were found at SN878467, mostly on the rocks in the river above the bridge with a few plants on the stone retaining walls downstream of the bridge.

The Wash Pool (near Abergwesyn), River Irfon

No specific historical records for the Wash Pool area exist, though there are possible records for the area from 1899 to 1958. In July 2008, 13 *H. subminutidens* plants were found on partially shaded rocks opposite a small island immediately upstream of the Wash Pool (SN859500).

Nant Henog (Nant Hebog)

Hieracium subminutidens was recorded at Nant Henog between 1890 and 1907. In July 2008, 23 plants in three subpopulations were found along the stream at waterfalls and on rock exposures on the banks (c. SN847485). Much of the valley has been planted with conifers and the upland grassland which remains is heavily grazed.

Pwll Bo, River Irfon

As for the Wash Pool, there are no specific records for this exact site but some of Ley's records could refer to the area. In July 2008, 30 *H. subminutidens* plants were found on an area of rock exposure and island approximately 100 m upstream of Pwll Bo lower car park (SN856509).

Abergwesyn valley

No *H. subminutidens* was found at Abergwesyn or two miles above (cf. Table 1), despite an abundance of seemingly suitable habitat and presence of other hawkweeds.

There is a doubtful record for Dyffryn Crawnon, v.c. 42, 21 June 1953, collected by C. E. A. Andrews (**BIRM**), but T. Rich is not convinced it is *H. subminutidens*, and failed to refind it in 2006.

HABITAT AND ASSOCIATED SPECIES

The main habitat was riverside rocks and waterfalls above the normal summer river flow in places ungrazed by animals. The plants were typically rooted in the rock crevices with their associated river sands and gravels, or rarely directly into the mortar of walls. Associated species included riverside trees and shrubs such as *Alnus glutinosa* (L.) Gaertn. and *Salix* spp., and herbaceous plants and ferns such as *Agrostis canina* L., *Anthoxanthum odoratum* L., *Athyrium filix-femina* (L.) Roth, *Deschampsia cespitosa* (L.) P. Beauv., *Dryopteris dilatata* (Hoffm.) A. Gray, *D. filix-mas* (L.) Schott, *Festuca ovina* L., *Galium saxatile* L., *Holcus lanatus* L., *H. mollis* L., *Molinia caerulea* (L.) Moench, *Potentilla erecta* (L.) Rausch, *Rubus* spp., *Sanguisorba officinalis* L., *Solidago virgaurea* L. and *Vaccinium myrtillus* L.

DISCUSSION

Hieracium subminutidens is thus currently known from four sites (Llanwrytyd Wells, Wash Pool, Nant Henog and Pwll Bo), with a total of 101 plants. It appears to have gone from the two River Irfon sites at and above Abergwesyn, though why is not clear as there is much apparently suitable habitat still present. We also did not find any material on hedgebanks, possibly due to mowing of roadsides to maintain sight lines for traffic though other hawkweeds were seen on roadside hedgebanks. The remaining riverside sites are probably similar to where it had been recorded historically, though the lack of detailed historical information makes it difficult to judge whether these populations have also declined. The distribution is mapped in Figure 2.

Under the I.U.C.N. (2001) threat criteria, *H. subminutidens* qualifies as 'Endangered' (total population less than 250 individuals). The main habitat, riverside rocks, indicates that it is potentially under threat from flooding and changes in the river dynamics at all sites. The main population at Llanwrtyd Wells bridge is considered at significant risk from flooding, as it occurs only 20–30 cm above 'normal' summer river levels and is restricted to a single rock outcrop. The small populations at the Wash Pool and Pwll Bo are becoming quite heavily shaded by riverside trees (especially at the former) and it could be eliminated if the shade become too heavy. There are no immediate threats to its survival at Nant Henog though a lack of suitable management limits the ability of the population to spread.

To conserve *H. subminutidens* in situ, some localised management may be needed. As a plant of open acidic rocks and cliffs associated with rivers and streams, generally no management is required provided these stay open from scrub, are not subject to river erosion, and are not grazed (most hawkweeds are sensitive to grazing). Some relaxation of grazing pressure at Nant Henog may allow suitable habitats to be colonised, though some areas show signs of scrubbing up and some targeted clearance work may also prove beneficial. Similarly, selective woodland thinning and clearance along the riversides at the Wash Pool and Pwll Bo would benefit those populations. The Wash Pool, Pwll Bo and Llanwrtyd Bridge localities are within the Afon Irfon SSSI, and *H. subminutidens* should be added to the features for which the site is designated to ensure its conservation is taken into account in the future.

Seeds collected during 2008 have been deposited at the Millennium Seed Bank for ex situ conservation.

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REFERENCES

I.U.C.N. (2001). *IUCN Red list categories and criteria. Version 3.1*. I.U.C.N., Gland.

LINTON, W. R. (1905). *An account of the British Hieracia*. West, Newman & Co., London.

PUGSLEY, H. W. (1941). New species of *Hieracium* in Britain. *Journal of Botany* **79**: 177–183 and 193–197.

PUGSLEY, H. W. (1948). A prodromus of the British *Hieracia*. *Journal of the Linnean Society of London (Botany)* **54**: 1–356.

SELL, P. D. & WEST, C. (1968). *Hieracium* L. In, PERRING, F. H., ed., *Critical Supplement to the Atlas of the British flora*. B.S.B.I., London.

SHEWRING, M. & RICH, T. (2008). Distribution and status of Llanwrtyd Hawkweed, *Hieracium subminutidens* in 2008. Unpublished report, National Museum of Wales.

RICH, T. C. G. (2002). *Collection and determination of apomictic plant taxa in Wales*. CCW contract no. FC 73-05-21. Unpublished contract report to Countryside Council for Wales, February 2002.

WILLIAMS, F. N. (1901–1911). *Prodromus Florae Brittanicae*. C. Stutter, Brentford.

ZAHN, K. H. (1921). Compositae – *Hieracium*. In Engler, A., ed., *Das Pflanzenreich* IV. 280. Heft **76**: 450. Engelmann, Berlin.

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Taxonomy and conservation status of *Hieracium vinifolium* (including *H. kintyricum*), Claret-leaved Hawkweed (Asteraceae)

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ABSTRACT

The taxonomy and conservation statuses of the South-west Scottish endemics *H. vinifolium* and *H. kintyricum* have been assessed from herbarium and field studies. The species generally differ in coloration and size, but have many overlapping characters and cannot be separated in the field; *H. kintyricum* should be included within *H. vinifolium*. *Hieracium vinifolium* was found in five of the six of its historic sites visited, but has probably gone from one site where it could not be refound; one historic site was not visited. 86 plants were recorded in the five sites visited, indicating that overall its IUCN conservation status is 'Endangered'.

KEYWORDS: endemic, Endangered, *Hieracium kintyricum*, IUCN threat criteria, Kintyre, Kintyre hawkweed, Scotland.

INTRODUCTION

In his recent revision of British and Irish *Hieracium* L. (Asteraceae), P. D. Sell described two new endemic species from Kintyre in South-west Scotland, *H. kintyricum* P. D. Sell, Kintyre Hawkweed and *H. vinifolium* P. D. Sell, Claret-leaved Hawkweed (Sell & Murrell, 2006). Both species are members of *Hieracium* section *Vulgata* (Griseb.) Willk. and Lange, and both were first collected as *H. rubiginosum* F. Hanb. by the great Kintyre botanist A. G. Kenneth during his explorations of the vice-county for his Flora (Cunningham & Kenneth 1979). Historically, *H. rubiginosum* was a very variable species (Pugsley 1948; Sell & West 1968), and taxa formerly included in it are now rightly split into at least six taxa. Cunningham & Kenneth (1979) noted that in Kintyre *H. rubiginosum* was a "most variable plant which can be puzzling" and that "it produces extreme variants in the Mull of Kintyre area". It was these 'extreme variants' that were named as *H. vinifolium* and *H. kintyricum*.

Sell & Murrell (2006) listed *H. kintyricum* from only one ravine at Largybaan, but *H. vinifolium* was more widespread on and near the Mull of Kintyre and at Barrahormid in the same vice-county. Both species are listed in the latest JNCC species status assessment as IUCN (2001) threat category 'Vulnerable' (http://www.jncc.gov.uk/page-3408, accessed April 2009) yet neither species had been recorded since the 1960s and there was no population information available. During the course of field work on Kintyre hawkweeds in 2006, 2007 and 2008, we visited the sites *H. kintyricum* and *H. vinifolium* with a view to collect data to enable proper conservation assessments to be carried out, but following difficulties in distinguishing the two species, T. Rich began to question their taxonomy and whether they were part of the variation in one species. In this paper, the taxonomy and conservation status of this pair of species is discussed and reviewed.

METHODS

All available herbarium material of *H. kintyricum* and *H. vinifolium* in **BM**, **CGE**, **MANCH** and **NMW** was examined and a list of sites was compiled. These data were then used to direct field surveys in 2006, 2007 and 2008. Photocopies of material were taken into the field.

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Population sizes were counted as far as practicable in the field (most of the sites are on steep sea cliffs), and notes made on associated species. The only site not visited were the cliffs of Rubha Dùin Bhàin due to strong winds, but the populations in the adjacent Largybaan ravine, an excellent *Hieracium* site (cf. Cunningham & Kenneth 1979), were examined in detail. A Garmin Etrex GPS unit was used to record locations. Voucher specimens have been placed in **BM** and **NMW**.

Soil pH was measured on air-dried soil samples collected from around the roots with a pHep2 Hanna pocket-sized pH meter in a 50:50 mixture with distilled water.

RESULTS

TAXONOMY

Hieracium kintyricum and *H. vinifolium* were described from very little material – only two specimens of *H. kintyricum* and 11 specimens of *H. vinifolium*, though P. D. Sell had seen the latter species in the field in 1968, and had collected a series of specimens from Rubha Dùin Bhàin to show the variation (**CGE**).

When describing his new species, Sell gave a full Latin description and direct English translation, but no further taxonomic notes indicating how they might differ from each other or other species. His descriptions are compared below, with identical characters excluded and indicated by ellipses, and significant differences underlined:

Hieracium kintyricum … *Stem* 30–60 cm, pale yellowish-green, suffused brownish-purple in the lower half, slender to more or less robust … with numerous … simple eglandular hairs … or absent, with few to numerous stellate hairs in the upper part. *Leaves* medium glaucous-green on upper surface, paler beneath, basal few, the lamina 4–10 × 2·0–4·5 cm, broadly ovate, broadly elliptical or elliptical, narrowed above but rounded-obtuse at apex, subentire, remotely denticulate or with a few small teeth, and abruptly contracted or cuneate at the base, the petioles up to 4 cm; cauline 3–5, the lowest and often the first 2, like the basal but sometimes with more numerous teeth and petiolate, the upper with lamina smaller, linear-lanceolate, long acute ... *Inflorescence* with 2–7 capitula, paniculate-corymbose, peduncles rather slender, with … numerous short to medium, pale simple eglandular hairs and a very occasional, short, dark glandular hair. *Involucral bracts* 4–11 × 1·0–1·.5 mm, mostly pale green with little darkening in the centre … obtuse at apex, with … pale simple eglandular hairs, few to fairly numerous … dark glandular hairs obscured by the simple hairs and few stellate hairs towards the base. *Ligules* yellow.

Hieracium vinifolium… *Stem* 20–60 cm, pale green often suffused with purplish-red, usually slender, rarely robust … with numerous … wavy simple eglandular hairs … and with few stellate hairs in the upper part. *Leaves* bluish-grey on upper surface, paler beneath and often tinted reddish-purple beneath, whole leaf sometimes suffused reddish-purple; basal few to numerous, with the lamina 2–10(–14) × 2–5 (–6) cm, elliptical, ovate or lanceolate, rounded-obtuse to subacute at apex, subentire, denticulate to dentate, the upper third sometimes entire, most cuneate, sometimes attenuate or subtruncate at base, the petioles up to 5 cm; cauline 2–8, the lower and median like the basal, shortly petiolate or sessile, the upper with lamina lanceolate, acute … *Inflorescence* with 2–16 capitula, corymbose, sometimes with a long lower branch; peduncles short, sometimes very short and often curved, with … numerous short to medium, pale, dark-based, simple eglandular hairs and numerous short, dark glandular hairs. *Involucral bracts* 3–11 × 0·8–1·0 mm, dark olive green, the inner with paler margins … gradually tapered to an obtuse or subacute apex, with …pale, dark-base simple eglandular hairs, with few … dark glandular hairs and an occasional stellate hair. *Ligules* deep yellow.

These descriptions indicate the species generally differ in coloration and size but have many overlapping characters. There are few discrete characters, such as the inflorescence structure, hair types on the peduncles, involucral bract width and colour and ligule colour. In the key (Sell & Murrell, 2006, page 233), the two species are split at lead 319 as follows:

319. Peduncles with numerous glandular hairs; involucral bracts 0·8–1·0 mm wide … *H. vinifolium*

319. Peduncles with few or no glandular hairs; involucral bracts 1·0–1·7 mm wide … *H. kintyricum* and three other taxa.

In the field, great difficulty was found separating the species. *Hieracium vinifolium* was seen in four of the six recorded localities

FIGURE 1. Variation in *Hieracium vinifolium*. A, B, *H. vinifolium*, Port na h-Olainn. C, *H. kintyricum*-like plants, Largybaan. Scale bars 10 cm.

and seemed distinctive from other *Hieracium* species it was growing with. It varied in size within and between sites, largely depending on exposure on the west-facing cliffs (P. D. Sell's four sheets from Rubha Dùin Bhàin also show this). However, the only group of plants found which resembled *H. kintyricum* at all was found on very sheltered rocks at the upper, east end of the Largybaan ravine, several hundred metres upstream from typical *H. vinifolium* growing on more open exposed rocks. The ligule and involucral bract coloration was virtually identical (photographs in **NMW**). It was suggested in the field that the less intense coloration and more lax growth form and paniculate-corymbose inflorescence of these *H. kintyricum*-like plants was due to habitat, though this should ideally be tested by cultivation experiments. Plants from the Largybaan area are illustrated in Figure 1.

TABLE 1. MEASUREMENTS OF BRACT WIDTHS AND FREQUENCY OF GLANDULAR HAIRS ON THE PEDUNCLES FOR MATERIAL OF *H. VINIFOLIUM* AND *H. KINTYRICUM*

Species	Bract widths (mm)	Frequency of dark glands on peduncles
Hieracium kintyricum		
Largybaan, Kenneth no. 56/69 (Holotype, **CGE**)	1·5	Sparse to frequent
Largybaan, Kenneth no. 52/69 (**CGE**)	(1·3)1·4–1·8(–2·0)	Sparse to frequent, some pale glands present
Largybaan (herb. McCosh)	1·4–1·5	Numerous below head, sparser lower down
Hieracium vinifolium		
Rubha Dùin Bhàin, Sell no. 68/202 (Holotype, **CGE**)	1·2–1·3	Frequent to numerous
Rubha Dùin Bhàin, Sell no. 68/202 (**CGE**)	1·3–1·7	Few to sparse
Largybaan (herb. McCosh)	1·2–1·4	Frequent
Port na h-Olainn (herb. McCosh)	1·3–1·5	Numerous
Port na h-Olainn (V.2007.1.65, **NMW**)	1·5–1·7	Frequent
Port na h-Olainn (V.2007.1.66, **NMW**)	1·3–1·5	Occasional
Beinn a' Theine (V.2008.1.911, **NMW**)	1·2–1·5(–1·7)	Sparse to frequent

Subsequent re-examination of herbarium material failed to indicate any clear differences between the taxa, and the bracts widths and frequency of dark glandular hairs on the peduncles showed more variation than given in the original descriptions or the key (Table 1). We are unable to find any consistent differences between *Hieracium kintyricum* and *H. vinifolium*, and it seemed that the *H. kintyricum*-like plants were simply part of the variation in *H. vinifolium*.

DISTRIBUTION AND ASSOCIATED SPECIES

1. BARRAHORMID (V.C. 98 ARGYLL)

A. G. Kenneth collected *H. vinifolium* at Barrahormid at NR710825 in 1968 (**CGE**, Kenneth no. 368).

The site was visited twice on 15 July 2006 and 17 July 2008 by T. Rich but *H. vinifolium* was not refound. However, on 16 June 2008 B. Burrow found five weak plants with *H. vulgatum* on low rocks in a small roadside quarry at NR712828 several hundred metres to the north of the original grid reference (herb. B. Burrow; pers. comm. 2010); it is possible that this was Kenneth's original site.

2. LIGHTHOUSE BURN, MULL OF KINTYRE (V.C. 101 KINTYRE)

Hieracium vinifolium was collected from the Lighthouse Burn, Mull of Kintyre by A. G. Kenneth in 1965 at NR589082 (**CGE**).

On 15 July 2008, T. Rich and I. Teesdale found two plants and two possible plants (all inaccessible) on the north side of the burn below the waterfall immediately below the path to the foghorn at NR58980819. Associated species were *Agrostis stolonifera* L., *Alchemilla glabra* Neygenf., *Brachypodium sylvaticum* (Huds.) P. Beauv., *Calluna vulgaris* (L.) Hull, *Centaurea nigra* L., *Crepis paludosa* (L.) Moench, *Filipendula ulmaria* (L.) Maxin., *Hypericum androsaemum* L., *Hypericum pulchrum* L., *Hypochaeris radicata* L., *Lotus corniculatus* L., *Plantago maritima* L., *Prunella vulgaris* L. and *Taraxacum* sp.

3. SOUTH POINT, MULL OF KINTYRE (V.C. 101 KINTYRE)

On 26 June 1968, P. D. Sell, A. G. Kenneth and A. C. Jermy collected *H. vinifolium* on cliff ledges by the coast at South Point, NR588076 (**CGE**).

The site was searched extensively above and below the footpath on 14 July 2006 by D. McCosh and T. Rich. Only *H. vulgatum* Fr. was found on a cliff below the footpath at NR58940772. Other cliffs around the area were also searched with no success, and it is likely that this population has gone.

4. PORT NA H-OLAINN (V.C. 101 KINTYRE)

Hieracium vinifolium was collected at Port na h-Olainn at NR593133 by J. N. Mills on 25 June 1969 (**MANCH**).

The cliffs were searched on 20 June 2007 by D. McCosh, T. Rich *et al.*, and two sub-populations were found. The first sub-population of *c.* 20 plants occurred scattered on a steep, west facing, rocky cliff at

NR59461325 (*c.* 150 m altitude) with *Anthoxanthum odoratum* L., *Calluna vulgaris, Erica cinerea* L., *Hedera helix* L. sensu lato, *Hypochaeris radicata, Jasione montana* L., *Rosa canina* L. and *Teucrium scorodonia* L. The soil was a blackish sandy grit, pH 6·4.

The second sub-population occurred c. 150 m to the north at NR59391336 on smaller but more calcareous sandstone with *Agrostis stolonifera, Campanula rotundifolia* L., *Hedera helix, Hypochaeris radicata, Plantago maritima, Potentilla erecta* (L.) Raeusch., *Thymus polytrichus* A. Kern ex Borbás and *Viola riviniana* Rchb. Seven plants occurred on an accessible ledge, and another three plants *c.* 30 m up the cliff.

5. RUBHA DÙIN BHÀIN (V.C. 101 KINTYRE)

Hieracium vinifolium was first collected from the cliffs between Rubha Dùin Bhàin and Uamh Ropa on a B.S.B.I. Excursion on 26 June 1968 led by A. G. Kenneth (**CGE**). The site was not revisited in 2007 due to strong winds.

6. LARGYBAAN (V.C. 101 KINTYRE)

Cunningham & Kenneth (1979) recorded *H. rubiginosum* from Largybaan, a record which presumably refers to *H. vinifolium* (this record could also refer to the Rubha Dùin Bhàin).

On 20 June 2007, D. McCosh, T. Rich *et al.* found *H. vinifolium* scattered along the south-facing cliffs on the north side of the Largybaan stream, with a very occasional plant on rocks on the south side. Populations were noted at NR59511444 (3 plants), NR59631437 (3 plants), NR59631430 (7 plants), NR59781433 (6 plants) and NR59831430 (4 plants). They typically occurred on the edges of rocks with *Calluna vulgaris, Centaurea nigra, Daucus carota* L., *Hypochaeris radicata, Jasione montana, Lonicera periclymenum* L., *Lotus corniculatus, Solidago virgaurea* L., *Teucrium scorodonia* and *Viola riviniana,* and other *Hieracium* species such as *H. anglicum* Fr., *H. flocculosum* Backh. fil. ex Bab. and *H. rubicundiforme* (Zahn) Roffey. The *H. kintyricum*-like plants were found at NR59981422 (6 plants and 8 seedlings, soil pH 6·8) in a more sheltered location on a southern branch of the Largybaan stream.

7. BEINN A' THEINE, MULL OF KINTYRE (V.C. 101 KINTYRE)

A. G. Kenneth collected *H. vinifolium* from a cliff face about 2 miles SE of the lighthouse, Mull of Kintyre at NR603068 in 1965 (**CGE**).

Figure 2. Distribution map of *Hieracium vinifolium* (including *H. kintyricum*). ●2006–2008.

On 17 July 2008, T. Rich and I. Teesdale visited the site and found a good population of plants associated with a small stream/waterfall dropping SW down the cliffs at NR60310695, in a relatively sheltered situation. About 20 plants were counted on the south-facing side, with *Carex flacca* Schreb., *Festuca rubra* L., *Potentilla erecta* and *Thymus polytrichus* and other *Hieracium* species including *H. subrubicundum* Dahlst. on a gentle slope of 15%. Some plants occurred in nearly pure *Calluna vulgaris* on the steep slopes of about 80°.

DISCUSSION

We were unable to distinguish *H. kintyricum* from *H. vinifolium* in the field or herbarium. The descriptions of either species could apply equally well to the other, and there are no clear-cut differences between them, and *H. kintyricum* looks like an environmentally-induced variant of *H. vinifolium*. In light of the additional material seen and re-examination of the original specimens, we suggest that the two taxa should be merged. As both species were described at the same time the names have equal priority under the St Louis Code (Greuter *et al.* 2000), so a decision needs to be made whether to include *H. kintyricum* within *H. vinifolium* or vice versa: *H. vinifolium* is the more widespread of the two and more

representative of the merged species as a whole, and only minor amendments are needed to its description; so the name *H. vinifolium* P. D. Sell is accepted in preference to *H. kintyricum* P. D. Sell which is rejected as a synonym.

Thus *H. vinifolium* was refound in five of the six sites visited, and is very likely still to be present at the Rubha Dùin Bhàin site which was not revisited. It has probably gone from one site where it could not be refound. A total of 86 plants were recorded in the five sites, indicating that overall its conservation status is likely to be 'Endangered' under the IUCN (2001) threat criteria. The distribution is mapped in Figure 2. A small amount of seed has been deposited in the millennium Seed Bank.

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REFERENCES

CUNNINGHAM, M. R. & KENNETH, A. G. (1979). *The flora of Kintyre*. E. P. Publishing, East Ardsley.

GREUTER, W., MCNEILL, J., BARRIE, F. R., BURDET, H.-M., DEMOULIN, V., FILGUEIRAS, T. S., NICOLSON, D. H., SILVA, P. C., SKOG, J. E., TREHANE, P., TURLAND, N. J. & HAWKSWORTH, D. L. (2000). International Code of Botanical Nomenclature (St Louis Code). *Regnum Vegetabile* **138**. Königstein: Koeltz Scientific Books.

IUCN (2001). *IUCN Red list categories and criteria*. Version 3.1. IUCN, Gland.

PUGSLEY, H. W. (1948). A prodromus of the British *Hieracia*. *Botanical Journal of the Linnean Society* **54**: 1–356.

Secretariat for the Conservation of Biodiversity (2002). *Global strategy for plant conservation*. Secretariat for the Conservation of Biodiversity, Montreal.

SELL, P. D. & MURRELL, G. (2006). *The flora of Great Britain and Ireland*. Volume **4**. Cambridge University Press, Cambridge.

SELL, P. D. & WEST, C. (1968). *Hieracium* L., in PERRING, F. H. (1968). *Critical Supplement to the Atlas of the British flora*. B.S.B.I. and Thomas Nelson and Sons, London.

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Notes

CAUCALIS PLATYCARPOS– A VANISHED ARCHAEOPHYTE

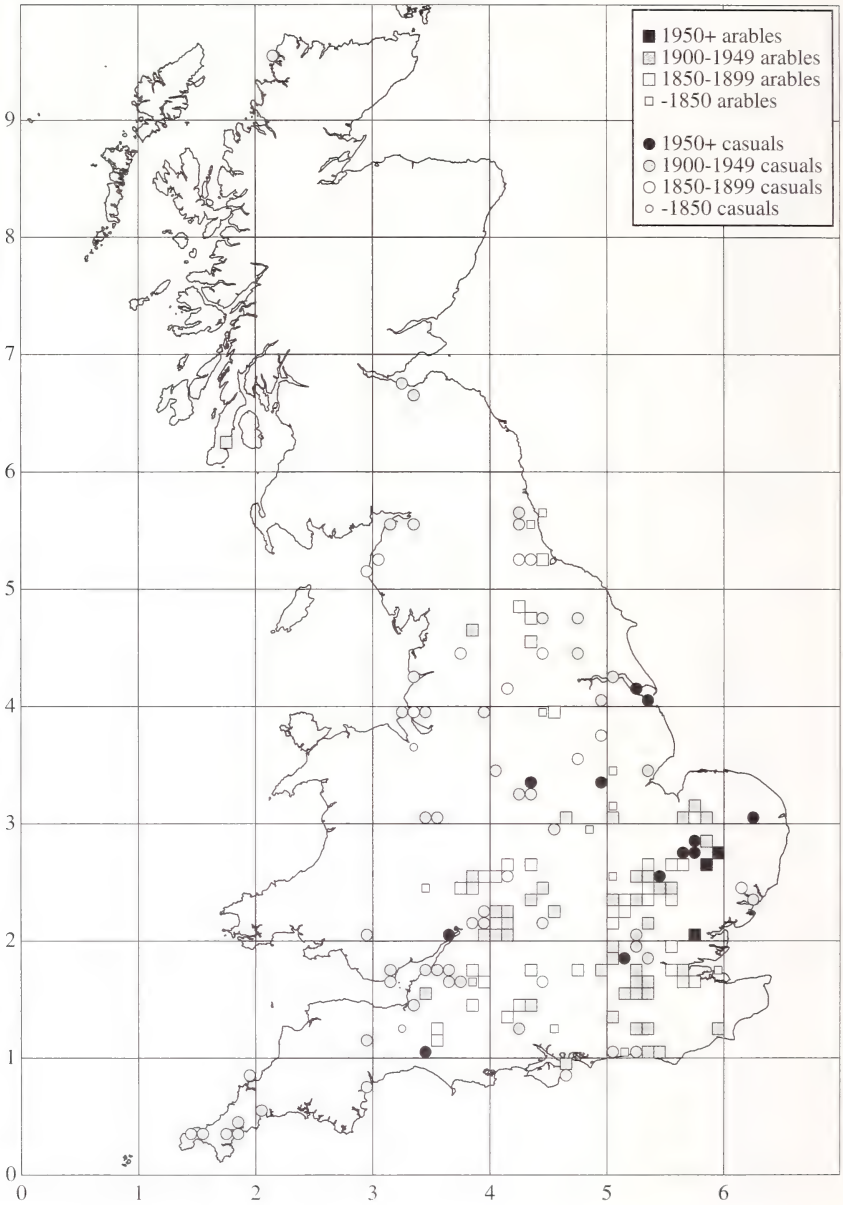
Caucalis platycarpos L., a crop weed and a casual, principally with imported grain, has a long history in Britain. It was almost confined to England, with only a very few records from Wales and Scotland, and with one erroneous record from Ireland (Reynolds 2002). It is an archaeophyte (Preston *et al.* 2004), centred on the Mediterranean, but formerly widely distributed over N.W. Europe and in decline everywhere in that area. It is one of a very distinct group of umbellifers, which have prominent broad-based spines on the ridges, yet are difficult to tell apart and often confused (see Leslie 1977 for a superb little exposition). *Turgenia latifolia*, *Orlaya daucoides* and *O. grandiflora* are others in that group, and Smith (1824) thinks it was probably the last that was recorded in Johnson's 1633 edition of Gerard. But Johnson also recorded '*Caucalis Apii foliis, floribus rubris*, Ger emac., Hedgehogge Parsley, in the cornfields about Bathe' in his Mercurius Botanicus of 1634. There are in fact two illustrations in Johnson's Gerard, one of *Caucalis albis floribus*, Bastard Parsley with white floures, and another of *Caucalis Apii foliis flore rubro*, Bastard Parsley with red floures, and a later indexer and interpreter of Gerard, John Harvey (1997) calls the first *Caucalis platycarpa* and the second *Turgenia* (*Caucalis*) *latifolia*. Confusion indeed!

However, the first reasonably certain record for Britain was by John Ray from Cambridgeshire in 1660, as '*Caucalis tenuifolia flosculis subrubentibus*, Fine leaved bastard Parsley with reddish or blush-coloured flowers. In the corn about Kingston wood, and elsewhere.' (Ray 1660). For the next 250 years it was recorded fairly consistently. Smith (1824) gave quite a few localities, saying it was frequent in the counties of Oxfordshire and Cambridgeshire. Watson (1847) gave an estimate of 15 counties, and the database from the Biological Records Centre, which I have greatly expanded, has records from 62, though probably only 35 of these counties have records from arable sites, and the numbers of counties with records at any one time would be even lower (Table 1). The individual records for arable plants are fairly consistent up the first half of the 20th century, tailing off very fast after 1950, whereas the records from docks and other non-arable sites show an enormous concentration either side of 1900, presumably from both better recording of aliens and possibly increased grain imports (Table 1). Of course the occurrences in arable sites might just as easily be casual occurrences in cornfields.

There is no general flora published in the early 20th century that might have updated Watson's comments, though Druce (1927) had noted that the extra care taken in cleaning seed-wheat had 'almost extirpated' this weed. In the first edition of Clapham, Tutin & Warburg (1952) it was described as 'a casual or +/- naturalized in arable fields and waste places particularly on chalky soils; rather rare and less frequent than formerly.' Yet by that time it had almost gone – I can only trace a dozen or so records after that date, of which only one or possibly two is from an arable habitat – all the others are from docks and dumps. The first Red Data Book (Perring & Farrell 1977) did, at last, realise the seriousness of the decline, relating that it had been recorded from only 11 10-km squares in the period 1930–1960, with no records since 1962. The 2nd edition (Perring & Farrell 1983) had exactly the same wording, and it was omitted entirely in the 3rd edition (Wiggington 1999). The BSBI Umbellifer

TABLE 1. SUMMARY OF *CAUCALIS PLATYCARPA* RECORDS

	Assumed Arable - number of records	Assumed Arable - number of VCs	Assumed non-arable - number of records	Assumed non-arable - number of VCs
Up to 1850	43	24	1	1
1851–1900	40	19	17	13
1901–1950	37	18	65	35
1951 onwards	2	2	10	8
Total	122		93	



10-km distribution of all British *Caucalis platycarpa* records. Round: casual, Square: arable.

Handbook (Tutin 1980) notes its disappearance from arable habitats. The New Atlas (Preston *et al.* 2002) covered only the taxa fully described by Stace (1997) and as he merely dealt with it as a note, saying it was now an extremely rare casual, formerly more common, it was omitted from our compilation. In fact it had gone, with the last record from a building site in Cambridge in 1971, and the last apparently arable site from Stanton Chair, Suffolk in 1968.

I have no evidence that it was 'formerly a long-persistent weed' , as it is so described in Clement & Foster (1994), rather than a species that was not-infrequently encountered, but here is a species with a long cultural history, which has vanished, completely unmourned.

ACKNOWLEDGEMENTS

I would like to thank Keith Spurgin, Alex Lockton and Chris Preston for help and information towards this note, Mark Spencer, Alison Lean and Tim Rich for extraction of herbarium records and many vice-county recorders for responding to requests. I very much appreciate Martin Sanford's perceptive comments on an earlier draft.

REFERENCES

CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. (1952). *Flora of the British Isles*. Cambridge: Cambridge University Press.

CLEMENT, E. J. & FOSTER, M. C. (1994). *Alien plants of the British Isles*. London: BSBI.

DRUCE, G. C. (1927). *Flora of Oxfordshire*. Oxford: Clarendon Press.

HARVEY, J. H. (1997). (revised version). *A service index of Latin binomials to Gerard's Herbal, as revised by Thomas Johnson, 1633*. Publisher unknown.

LESLIE, A. C. (1977). *Orlaya kochii* Heywood in Cambs. *BSBI News* **15**: 14–15.

PERRING, F. H. & FARRELL, L. (1977). *British Red Data Books: 1. Vascular Plants*. Lincoln: Society for Nature Conservation.

PERRING, F. H. & FARRELL, L. (1983). *British Red Data Books: 1. Vascular Plants*, 2nd ed. Lincoln: Royal Society for Nature Conservation.

PRESTON, C.D., PEARMAN, D.A. & DINES, T.D., eds (2002). *New Atlas of the British and Irish flora*. Oxford: Oxford University Press.

PRESTON, C. D., PEARMAN, D. A. & HALL, A. R. (2004). Archaeophytes in Britain. *Bot. J. Linn. Soc.* **145**: 257–294.

RAY, J. (1660). *Catalogus Plantarum circa Cantabrigiam nascentium.* Cambridge: J. Field & London.

REYNOLDS, S. C. P. (2002). *A catalogue of alien plants in Ireland*. Glasnevin: National Botanic Gardens.

SMITH. J. E. (1824). *The English Flora. Vol 2*. London: Longman, Hurst, Rees, Orme, Brown & Green.

STACE, C.A. (1997). *New flora of the British Isles*, 2nd edition. Cambridge: Cambridge University Press.

TUTIN, T. G. (1980). *Umbellifers of the British Isles*. Botanical Society of the British Isles Handbook No. 2. London: Botanical Society of the British Isles.

WATSON, H. C. (1847). *Cybele Britannica Vol 1*. London: Longman & Co.

WIGGINTON, M. J. (comp. & ed.) (1999). *British Red Data Books. 1. Vascular plants*. Edn. 3. Peterborough: Joint Nature Conservation Committee.

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A CHROMOSOME NUMBER FOR *COCHLEARIA ATLANTICA* POBED.

In July 2002 a rather curious small *Cochlearia* was found growing on shingle at the head of a salt marsh near Laxford Bridge (VC 108, West Sutherland) at NC220467. Its identification best fitted *Cochlearia atlantica* Pobed. as described by Dalby (in Rich 1992). Ripe seeds were collected and planted in pots; the resulting plants were seen to retain their form in cultivation over several years. As there does not appear to be a published chromosome number for this species it was decided to make a chromosome count from these plants.

Growing root tips were collected in the early afternoon, pre-treated in a saturated solution of 8-hydroxquinoline at 4 degrees C for 4 hours then fixed overnight in 3:1 alcohol/glacial acetic acid. After maceration for 1 hr in cold 10% HCL, the roots were stained for 1 hr in lacto-propionic orcein, their tips excised and squashed in 45% acetic acid.

Clear metaphase figures were produced with small dark staining chromosomes. The majority gave a count of 2n=24, a common number for this genus, but a few plants had 2n=12 which is unusual but is known for other members of the genus such as *C. pyrenaica* DC (reported in Rich 1992).

ACKNOWLEDGEMENT

I am grateful to Dr Tim Rich for comments on this result.

REFERENCES

DALBY, D. H. (1992). *Cochlearia officinalis* group, in RICH, T. C. G. Crucifers of Great Britain and Ireland: 264–273. Botanical Society of the British Isles, London.

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CONSERVATION OF BRITAIN'S BIODIVERSITY: STATUS OF *HIERACIUM THALASSINUM* (ASTERACEAE), HAIRY-BRACTED HAWKWEED

Hieracium thalassinum P. D. Sell (Asteraceae), Hairy-bracted Hawkweed, is a member of *Hieracium* section *Subalpina* Pugsley which was described recently in Sell & Murrell (2006). It is a rare endemic known from only two sites in South-west Scotland, the Pass of Melfort in v.c. 98 Argyll and Ballygroggan in v.c. 101 Kintyre. In this note, its conservation status is assessed based on field work in 2006 and 2008.

Hieracium thalassinum is a distinct species, with green to weakly glaucous, rather hairy stems and foliage, a few basal leaves and 1-3 stem leaves which are mostly elliptical and taper into a broad petiole, medium-sized capitula with dense simple eglandular hairs on the involucral bracts and discoloured styles. At first glance it resembles some species in section *Cerinthoidea* Monnier but as it has microglands on the leaf margins is included in section *Subalpina* (Sell & Murrell 2006).

PASS OF MELFORT

Hieracium thalassinum was collected from a rock wall by the River Oude in the Pass of Melfort, near Kilmelford, Argyll (Sell & Murrell 2006) on 9 June 1966 by A. G. Kenneth, and again by A. G. Kenneth, P. D. Sell and C. West on 24 June 1968 at NM848158 (**CGE**).

The site was searched from Fearnach Bay to Blàran on 16 July 2008 by T. Rich without success. The grid reference on the specimen suggests that the plant was found under what is now the Oude Reservoir, but the dam was built in the 1950s and the grid reference is probably slightly inaccurate (P. D. Sell does not now remember the exact location, pers. comm. 2009). The most likely place it occurred was on the west-facing, basalt rock wall by the footpath below the dam (this path was cut to run the pipes for the hydroelectric scheme) between NM846156 and NM845155, which has four other *Hieracium* species, *Arabis hirsuta* (L.) Scop., *Crepis paludosa* (L.) Moench, *Saxifraga aizoides* L., *S. hypnoides* L. and *Vicia sylvatica* L. This rock face is now overgrown with trees in some places but some areas remain open and suitable. Other hawkweeds recorded from the Pass of Melfort include *H. breadalbanense* F. Hanb., *H. cravoniense* (F. Hanb.) Roffey, *H. dicella* P. D. Sell & C. West, *H. oenophyllum* P. D. Sell, *H. pictorum* E. F. Linton, *H. rhomboides* (Senstr.) Johanss. and *H. subhirtum* (F. Hanb.) Pugsley.

Searches of the surrounding area were equally unsuccessful. Above the dam, the banks of the reservoir are largely overgrown and unsuitable. At the north end of the reservoir towards the road bridge (NM853164) there is a series of small, inaccessible cliffs above the stream with a *Hieracium* species, and the river above this to Blàran (NM858172) is slow-flowing without rocks. Below the dam, the River Oude is densely shaded with moss-covered rocks and an occasional patch of *Crepis paludosa*. Immediately upstream of the power station (NM841145), the Oude is fairly slow flowing and largely shaded by dense woodland, and at Melfort Bridge (NM837142) the river is slow flowing between fields with no rocks. *Hieracium thalassinum* might still occur at the Pass of Melfort, but if so in very small quantity.

BALLYGROGGAN

Hieracium thalassinum was first found at Ballygroggan by A. G. Kenneth on 16 June 1965 (**CGE**, **E**). It was collected again the following year by A. G. Kenneth and C. West, and plants were provisionally allocated to *H. petrocharis* (E. F. Linton) W. R. Linton (hence the comment 'looks rather unusual' in Cunningham & Kenneth 1979). P. D. Sell visited the site and collected further plants on 28 June 1968, and one specimen from this second collection was designated as the holotype of *H. thalassinum* (Sell no. 68/369, **CGE**). The limestone at Ballygroggan has been known as a good *Hieracium* site for many years, with *H. anglicum* Fr., *H. britanniciforme* Pugsley, *H. eucallum* P. D. Sell & C. West, *H. rubicundiforme* (Zahn) Roffey and *H. hebridense* Pugsley amongst the species recorded.

The Ballygroggan area was searched briefly on 14 July 2006 by T. Rich and D. McCosh, and in more detail on 16 July 2008 by T. Rich and I. Teesdale. At least 127 plants of *H. thalassinum* occurred on six separate sections of the north-facing cliffs at the top of the slope at the south end of the bay known locally as The Galdrans or Gauldrons. It grew on damp or

dry calcareous rocks, usually toward the top of the rocks which were sheltered from salt spray, at altitudes of c. 20-30 m. Most of the plants were finishing flowering and some had been grazed by goats and were not easy to see, so this is a minimum population estimate for this site, with the possibility of at least another 50 plants being present. It was absent from the larger, west-facing limestone cliffs and basalt dykes to the north. Voucher specimens have been deposited in **BM**, **E** and **NMW**.

The associated species included *Angelica sylvestris* L., *Arrhenatherum elatius* (L.) J. & C. Presl, *Brachypodium sylvaticum* (Huds.) P. Beauv., *Crepis paludosa, Dactylis glomerata* L., *Festuca rubra* L., *Frullania tamarisci* (L.) Dum., *Galium verum* L., *Geum rivale* L., *Hieracium britanniciforme, H. hebridense, Holcus lanatus* L., *Hypochaeris radicata* L., *Isothecium myosuroides* Brid., *Parnassia palustris* L., *Petasites hybridus* (L.) P. Gaertn., B. Mey & Scherb., *Plagiochila porelloides* (Torrey ex Nees) Lindenb., *Plantago lanceolata* L., *P. maritima* L., *Primula vulgaris* Huds., *Prunella vulgaris* L., *Pteridium aquilinum* (L.) Kuhn, *Senecio jacobaea* L., *Solidago virgaurea* L., *Succisa pratensis* Moench, *Thymus polytrichus* Borbás, *Vicia sylvatica* and *Viola riviniana* Rchb. A soil sample taken from around the roots was measured as pH 6.7.

Thus *H. thalassinum* is currently only known from one of its two sites, and is assessed as IUCN (2001) threat category: 'Endangered' on the basis of the small population size. It seems under little direct threat, the only thing likely to affect it in the short term being scrub invasion or over-grazing. Seed from one plant has been deposited at the Millennium Seed Bank.

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We would like to thank Peter Sell for his help, and the Keepers of the Herbaria for access to material at **BM**, **CGE** and **E**.

REFERENCES

CUNNINGHAM, M. R. & KENNETH, A. G. (1979). *The flora of Kintyre*. E. P. Publishing, East Ardsley.
IUCN (2001). *IUCN Red List Categories*. Version 3.1. International Union for Conservation of Nature, Gland.
SELL, P. D. & MURRELL, G. (2006). *The flora of Great Britain and Ireland*. Volume 4. Cambridge University Press, Cambridge.

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LECTOTYPIFICATION OF *HIERACIUM SCULLYI* E. F. LINTON (ASTERACEAE)

Hieracium scullyi, Scully's Hawkweed, was described as a new species in W. R. Linton's (1905) *An account of the British Hieracia* and was cited from 'Rocks by the R. Roughty (discovered by Mr. Reginald Scully)' but no type specimen was indicated. Sell & Murrell (2006) cite the authority as E. F. Linton as new taxa in W. R. Linton (1905) marked 'Linton' were named by his brother E. F. Linton, whilst taxa marked 'mihi', 'nov. var.', 'n. sp.', etc. were named by the author W. R. Linton.

Pugsley (1948) noted that Linton's description of *H. scullyi* was based on specimens collected in 1901 by R. W. Scully, and from amongst the material in herb. E. F. Linton in **BM** a lectotype was chosen by C. West in 1957; however, this selection has never been published. We agree with this selection, and hereby designate the lectotype of *H. scullyi* E. F. Linton as 'Rocks by R. Roughty, Morley's Br., Kerry, R. W. Scully, 5.7.1901' (**BM**).

For details of the current status of *H. scullyi*, see Rich *et al.* (2008).

REFERENCES

LINTON, W. R. (1905). *An account of the British Hieracia.* West, Newman & Co., London.

PUGSLEY, H. W. (1948). A prodromus of the British *Hieracia. Journal of the Linnean Society of London (Botany)* **54**: 1–356.

RICH, T. C. G., HODD, R. L. I. B., MCCOSH, D. J., MHIC DAEID, E. C., MCVEIGH, A., SAWTSCHUK, J. & WYSE JACKSON, M. B. (2008). Conservation of Ireland's biodiversity: a survey and assessment of the current status of three Irish endemic hawkweeds from Kerry, *Hieracium argentatum*, *H. scullyi* and *H. sparsifrons* (Asteraceae). *Biology and Environment: Proceedings of the Royal Irish Academy* **108B**: 143–155.

SELL, P. D. & MURRELL, G. (2006). *Flora of Great Britain and Ireland.* Vol. 4. Cambridge University Press, Cambridge.

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Plant Records

Records for publication must be submitted to the appropriate Vice-county Recorder (see *BSBI Year Book*), and not to the Editors. Following publication of the *New Atlas of the British & Irish Flora* and the *Vice-county Census Catalogue*, new criteria have been drawn up for the inclusion of records in *Plant Records*. (See *BSBI News* no. 95, January 2004 pp.10 & 11). These are outlined below:

- First records of **all** taxa (species, subspecies and hybrids) included in the VCCC, designated as native, archaeophyte, neophyte or casual.
- First record since 1970 of the taxa above, except in the case of *Rubus*, *Hieracium* and *Taraxacum*.
- Records demonstrating the rediscovery of all taxa published as extinct in the VCCC or subsequently.
- Newly reported definite extinctions.
- Deletions from the VCCC (e.g. through the discovery of errors, the redetermination of specimens etc.) **NB** – only those errors affecting VCCC entry.
- New 10-km square records for Rare and Scarce plants, defined as those species in the *New Atlas* mapped in the British Isles in 100 10km squares or fewer. (See *BSBI News* no. 95, January 2004 pp. 36–43).

Records for the subdivisions of vice-counties will not be treated separately; they must therefore be records for the vice-county as a whole. However, records will be accepted for the major islands in v.cc. 100, 102-104, 110 and 113.

In the following list, records are arranged in the order given in the *List of Vascular Plants of the British Isles* and its supplements by D. H. Kent (1992), from which the species' numbers, taxonomy and nomenclature are taken. 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. For all records 'det.' or 'conf.' appear after the herbarium if the determination was based on material already in an institutional herbarium, otherwise before the herbarium.

The following signs are used:
* before the vice-county number: to indicate a new vice-county record.
† before the species number: to indicate that the plant is an archaeophyte.
‡ before the species number: to indicate that the plant is a neophyte.
© before the species number: to indicate that the plant is a casual.
The above 3 signs may also used before the vice-county number to indicate the status of the plant in that vice-county.
® before the vice-county number: to indicate that this is an additional hectad for a Rare or Scarce plant.
Ø at end of entry: established taxon not in Vice-County Census Catalogue. Name of authority provided.
[ ] enclosing a previously published record: to indicate that that record should be deleted or changed.

Records are now published in two separate sections – 1) NATIVES (including archaeophytes) and 2) ALIENS (neophytes and casuals).

The following list contains the first set of records up to and including the year 2009. Further records including the year 2009 will be published in the next issue of *Watsonia*.
Records have been received for the following vice-counties: 5, 10, 13, 17, 31, 36, 37, 39, 55, 57, 58, 60, 62, 67, 79, 80, 87, 89, 91, 93,101, 103, 106, 107, 109, 110, H12, H27, H36 & H37.

Please note that, since Kent Numbers are not yet available for the newly-described species of *Hieracium*, all records for *Hieracium* species are given under the general number 135/28.

ARCHAEOPHYTES AND NATIVES

Equisetum ×willmotii (**E. fluviatile × telmateia**) 4/1.4×9. ***101**, Kintyre: roadside ditch, Cloanaig bay, NR872563, P. Stanley, B. Laney & K. Turner, 2007, det. P. J. Acock. A few stems among *E. telemateia*.

Equisetum ×rothmaleri (**E. arvense × palustre**) 4/1.5×8. ***89**, E. Perth: side of burn, Allt Coire Lagain, Shinagag, Killiecrankie, NN951687, H. McHaffie, 2004, conf. C. N. Page, **RBGE**.

Adiantum capillus-veneris 7/3.1. *‡**H36**, Tyrone: walls in Caledon Estate, H747436, I. McNeill & J. Faulkner, 2000. Probably escaped from nearby greenhouses.

Trichomanes speciosum 10/2.1. **H36**, Tyrone: shady rocks at Strabane Glen, H3598, R. Northridge, 2005. Gametophyte. 1st record since 1891, when sporophyte was recorded 'within 5 miles of Strabane', possibly at same site. ®**H36**, Tyrone: shady rocks at St Patrick's Chair, H597496, R. Northridge, 2008. Gametophyte.

Polypodium ×shivasiae (**P. interjectum × cambricum**) 11/1.2×3. ***5,** S. Somerset: patch in hedge bank, West Leigh, ST114311, M. J. Stribley, 2007, conf. R. Cooke.

Asplenium obovatum subsp **lanceolatum** 15/2.3a. **101**, Kintyre: dolerite dyke on coast, Ardnacross, NR766255, I. & C. Russell, 2007, det. F. McGavigan & H. McHaffie. 141 plants over 2x10m (18 in 1971). 1st record since 1971. Only known site in Scotland.

Dryopteris affinis subsp. **cambrensis** 17/3.3b. ***5**, S. Somerset: single plant in hedge bank, N side of track, Maundown Hill, ST060284, M. J. Stribley, 2007, conf. K. Trewren.

Ceratophyllum demersum 27/1.1. ***79**, Selkirks.: at 340m, Hellmoor Loch, NT385170, R. W. M. Corner, 2009, **herb. R. W. M. C.**

Thalictrum flavum 28/17.3. **67**, S. Northumb.: West Woodburn, NY900868, A. J. Richards, 2008. 1st record since 1967.

†**Chelidonium majus** 30/5.1. *©**101**, Kintyre: road verge, Campbeltown, Fort Argyll, NR734206, I. Teesdale, 2007, det. H. McHaffie.

†**Fumaria officinalis** subsp. **officinalis** 31/5.7a. ***91**, Kincardines: field cropped with potatoes and peas, St Cyrus, NO730628, D. Welch, 2009, det. R. J. Murphy, **herb. R. J. Murphy** & **herb. D. Welch**. Var. *officinalis*. ***93**, N. Aberdeen: edge of arable field, Savoch, NK065426, D. Welch, 2009, det. R. J. Murphy, **herb. R. J. Murphy** & **herb. D. Welch**.

†**Fumaria officinalis** subsp. **wirtgenii** 31/5.7b. ***62**, N. E. Yorks.: large patch on waste ground, Teesside Park, NZ471184, V. Jones & W. A. Thompson, 2009, **herb. V. Jones**.

†**Fumaria densiflora** 31/5.8. ®**10**, Wight: disturbed ground (development site), Newport, SZ495893, P. D. Stanley, 2009.

†**Fumaria vaillantii** 31/5.10. **10**, Wight: arable headland on greensand, Mottistone, SZ415844, P. D. Stanley, 2009, det. T. C. G. Rich. 1st modern record. Also on arable field on greensand, Chale Green, SZ480799, P. D. Stanley, 2009, det. T. C. G. Rich.

Parietaria judaica 36/2.1. ‡**80**, Roxburghs: old walls, Town Yetholm, NT819280, M. E. Braithwaite & BSBI Party, 2009. 1st localised record.

Betula nana 40/1.3. ®**89**, E. Perth: a colony 7m x 2m, at 610m in peat bog, Ben Gulabin, near Spittal of Glenshee, NO106727, P. Bartlett, M. C. Robinson, J. McIntosh, L. Tucker & J. Edgington, 2008.

Atriplex prostrata 43/3.2. ©**H36**, Tyrone: dump at Aughlish, H738631, I. McNeill, 2003. 1st record since 1960s.

Atriplex ×taschereaui (**A. glabriuscula × longipes**) 43/3.3×4. ***H12**, Co. Wexford: single plant on bank of the River Barrow, Killowen, S687205, P. R. Green, 2007, det. P. R. Green & M. R. W. Morris.

Beta vulgaris subsp. **vulgaris** 43/4.1c. *©**H12**, Co. Wexford: single plant on verge of the Gorey By-pass, Moneylawn, T132563, P. R. Green, 2007.

Stellaria nemorum 46/5.1. **93**, N. Aberdeen: alderwood, Glass, NJ463404, D. Welch, 2009, **herb. D. Welch**. 1st record since 1906.

Myosoton aquaticum 46/8.1. ©**H36**, Tyrone: growing on dumped mushroom compost, Fury Valley, H557498, J. Harron & I. McNeill, 2002, det. P. Hackney, **BEL**. ®©**H36**, Tyrone: on mushroom compost, Aughlish, H738631, I. McNeill, 2003.

Herniaria glabra 46/13.1. *‡**55**, Leics.: several plants on granite chippings on post-industrial land, Loughborough, SK522214, A. Lear, 2007.

Persicaria mitis 47/1.15. **39**, Staffs.: one plant in seasonally flooded open grassland, Bass Waterside Wood, Burton upon Trent, SK256240, C. A. Stace & M. E. Smith, 2008. 1st record since 1934.

Polygonum boreale 47/4.5. ®**101**, Kintyre: sandy beach, Point Sands South, NR696477, Kintyre Botany Group, 2007, conf. D. R. McKean & H. McHaffie. 2nd 10km square in VC.

Salix ×rubra (**S. purpurea** × **viminalis**) 61/2.5×9. **89**, E. Perth: river shingle, R. Tay, downstream of Rattray, NO186447, L. Tucker & M. C. Robinson, 2008. Present with both parents. 1st record since 1970.

Salix ×strepida (**S. cinerea ×myrsinifolia**) 61/2.11×14. **89**, E. Perth: river shingle, R. Tay, downstream of Rattray, NO186447, L. Tucker & M. C. Robinson, 2008. Present with both parents. 1st record since 1970.

Rorippa islandica 62/12.3. ***101**, Kintyre: scattered over an area of 10 square feet in disused gravel pit, Rhunahaorine, NR714506, I Teesdale, 2008, det. T. C. G. Rich.

Coronopus didymus 62/31.2. *©**91**, Kincardines.: entrance to dump, Auchenblae, NO725776, D. Welch, 2009, **herb. D. Welch**.

Brassica nigra 62/34.3. *©**H36**, Tyrone: dumped material in disused gravel pit, Teebane, H67805, I. McNeill, 2007, conf. T. C. G. Rich & P. Hackney, **BEL**.

†**Sinapis alba** 62/35.2. ©**H36**, Tyrone: waste ground, Lisaclare near Stewartstown, H872691, I. McNeill, 2007. 1st record since 1907.

Pyrola rotundifolia subsp. **rotundifolia** 66/1.3a. ®**80**, Roxburghs: wooded bank, above R. Tweed, Braeheads, St Boswells, NT593312, L. W. Gaskell, 2009, **herb. R. W. M. C.** ® **89**, E. Perth: at 700m in soligenous mire on mountain slope, Ben Gulabin, near Spittal of Glenshee, NO105724, M. C. Robinson, J. McIntosh, L. Tucker, J. Edgington and P. Bartlett, 2008, conf: J. Squirrel (by DNA). A huge colony, mixed with *Pyrola minor*, extending for 100 metres uphill. Several in flower.

Monotropa hypopitys 67/1.1. **67**, S. Northumb.: witherite spoil under *Corylus*, Settlingstones, NY844686, A. J. Richards, 2008. 4 km E of first site, also on mine spoil.

Anagallis minima 69/6.3. **39**, Staffs.: about 20 plants in ride under pines, The Million, SO843859, B. Westwood, 2009, **STO**. More nearby. 1st record since 1878.

Sedum forsterianum 73/5.11. ‡**89**, E. Perth: crag, Beal Hill, Rait, NO204274, L. Tucker, 2006, conf. M. C. Robinson. 1st record since 1970.

Saxifraga tridactylites 74/5.19. ***H36**, Tyrone: abundant on unused section of hard-surface playing-fields at Omagh, H459722, I. McNeill, 2009.

Rubus painteri 75/8.160. ***57**, Derbys.: Shallcross, SK0179, D. P. Earl, 2007.

Rubus conjungens 75/8.307. ***62**, N. E. Yorks.: edge of disused railway S of Ravenscar, SE9899, A. Newton, 2008.

Rubus halsteadensis 75/8.309. ***62**, N. E. Yorks.: hedgerow near disused station, Ravenscar, NZ9801, A. Newton, 2008.

Rubus latifolius 75/8.312. ***62**, N. E. Yorks.: large patch on waste ground, N side of railway, Battersby Junction, NZ588073, V. Jones & M. J. Yates, 2008, conf. A. Newton, **herb. V. Jones** & **herb. M. J. Yates**.

Rubus hindii 75/8.hin. ***62**, N. E. Yorks.: near Gribdale Terrace, NZ5811, A. Newton, 2008.

Potentilla erecta subsp. **strictissima** 75/9.13b. ***62**, N. E. Yorks.: a few plants in grassland amongst heather, Helwath Bridge, SE954995, V. Jones & M. Yates, 2009, **herb. V. Jones**.

Rosa arvensis × **sherardii** 75/21.4×16. **37**, Worcs.: field hedge, Lye Head, SO757724, R. Maskew, 2009. 4th recent record, 1st with *R. arvensis* as the female parent.

Rosa spinosissima × **sherardii** 75/21.5×16. **37**, Worcs.: field hedge, Grafton Flyford, SO968558, R. Maskew, 2009. As hybrid with *R. sherardii* as female parent. 4th record, 2nd since C19.

Rosa canina 75/21.12. ***103**, Mid Ebudes: rock outcrop, Ben Feall, Coll, NM146547, D. A. Pearman, 2009, det. R. Maskew. Det. as group 'Transitoriae'. ***106**, E. Ross: roadside, Culrain, NH580935, R. Maskew, 2009. Det. as group 'Dumales'. ***106**, E. Ross: roadside, Strathcarron, NH581905, R. Maskew, 2009. Det. as group 'Transitoriae'.

Rosa ×dumalis (**R. canina** × **caesia** subsp. **caesia**) 75/21.12×13a. ***110**, Outer Hebrides: Loch A' Gheoidh, Lewis, NB053316, P. A. Smith, 2009, det. R. Maskew.

Rosa ×dumalis (**R. canina × caesia** subsp. **vosagiaca**) 75/21.12×13b. **13**, W. Sussex: frequent in scrub, Bramshott Bottom, SU802185, R. Maskew, 2009. 1st confirmed record since 1931. **106**, E. Ross, roadside, Strathcarron, NH588908, R. Maskew, 2009. Hybrid with *R. caesia* as female parent. 1st confirmed record since 1909. ***109**, Caithness: riverside scrub, Lybster, ND243351, K. Butler & R. Maskew, 2009. Several bushes of both the hybrid and reciprocal hybrid.

Rosa ×scabriuscula (**R. canina × tomentosa**) 75/21.12×15. **13**, W. Sussex: Bramshott Bottom, SU802184, R. Maskew, 2009. Hybrid with *R. tomentosa* as female parent. 1st confirmed record since 1929.

Rosa ×rothschildii (**R. canina × sherardii**) 75/21.12×16. **36**, Herefs.: Caeiron, Cefn Hill, SO284388, P. G. Garner & R. Maskew, 2009. Hybrid with *R. sherardii* as female parent. 1st confirmed record since 1943. ***109**, Caithness: riverside scrub, R. Thurso, ND111672, K. Butler & R. Maskew, 2009. Hybrid with *R. sherardii* as female parent.

Rosa ×toddiae (**R. canina × micrantha**) 75/21.12×19. **17**, Surrey: woodland margin, Forest Green, TQ114407, J. Leslie, 2009, det. R. Maskew. Hybrid with *R. micrantha* as female parent. 1st confirmed record since 1924. ***31**, Hunts.: edge of bridleway, Chamber's Dole, TL153929, D. Broughton, 2009, det. R. Maskew. Hybrid with *R. micrantha* as female parent.

Rosa ×cottetii (**R. caesia × tomentosa**) 75/21.13×15. ***58**, Cheshire: Chorlton near Chester, SJ404720, G. M. Kay, 2009, det. R. Maskew. Hybrid with *R. tomentosa* as female parent.

Rosa caesia subsp. **caesia** 75/21.13a. **106**, E. Ross: roadside, Culrain, Kyle of Sutherland, NH580936, R. Maskew, 2009. 1st confirmed record of subsp. *caesia* since 1909.

Rosa caesia subsp. **vosagiaca × sherardii** 75/21.13b×16. **106**, E. Ross: roadside, Culrain, Kyle of Sutherland, NH588926, R. Maskew, 2009. Several bushes of both the hybrid and reciprocal hybrid. 1st confirmed record since 1909. ***109**, Caithness: roadside scrub, Lybster, ND244352, K. Butler & R. Maskew, 2009. Hybrid with *R. sherardii* as female parent.

Rosa caesia subsp. **vosagiaca × rubiginosa** 75/21.13b×18. ***109**, Caithness: riverside scrub, Dunbeath, ND162294, R. Maskew, 2009.

Rosa ×perthensis (**R. sherardii × mollis**) 75/21.16×17. ***36**, Herefs.: Wern Agavenny, Cefn Hill, SO280396, P. G. Garner & R. Maskew, 2009. Hybrid with *R. mollis* as female parent. ***87**, W. Perth: Coals Naughton, NS934957, P. D. Stanley, 2009, det. R. Maskew. Hybrid with *R. mollis* as female parent. ***109**, Caithness: riverside scrub, R. Thurso, ND112672, K. Butler & R. Maskew, 2009. Hybrid with *R. mollis* as female parent.

Rosa ×suberecta (**R. sherardii × rubiginosa**) 75/21.16×18. ***107**, E. Sutherland: roadside bank, Bonar Bridge, NH604927, R. Maskew, 2009. ***109**, Caithness, riverside scrub, Dunbeath, ND159297, R. Maskew, 2009.

Rosa ×molliformis (**R. mollis × rubiginosa**) 75/21.17×18. ***107**, E. Sutherland: roadside, Strath Fleet, R. Maskew.

†**Prunus domestica** subsp. **insititia** 75/22.5b. *‡**89**, E. Perth: a dense thicket on boundary between orchard and field, Port Allen, Errol, R. Tay, NO250211, M. C. Robinson, 2007. Originating from trees originally planted in orchard.

Medicago sativa 77/18.2. ©***91**, Kincardines.: casual in Torry, NJ90, J. W. H. Trail, after 1894. Source - *Trail Memorial Volume* (1923).

Medicago sativa subsp. **varia** 77/18.2b. *©**80**, Roxburghs.: disturbed ground, near remains of old railway bridge, R. Teviot below Nisbet Mill, NT667250, L. W. Gaskell, 2009, **herb. R. W. M. C.**

Trifolium micranthum 77/19.13. ***91**, Kincardines.: graveyard, Banchory, NO707957, I. Green, 2009. ***93**, N. Aberdeen: short grass, St Fergus, NK112522, I. Green, 2009.

Epilobium ×subhirsutum (**E. hirsutum × parviflorum**) 84/1.1×2. ***H12**, Co. Wexford: two plants on waste ground, Arthurstown, S71501069, P. R. Green, 2007, **DBN**. With both parents.

Epilobium tetragonum 84/1.5. *‡**H12**, Co. Wexford: frequent in quarry, Knockgreany, T188705, P. R. Green, 2007.

Viscum album 87/1.1. ‡**89**, E. Perth: 3 plants on two very old apple trees in garden, Marlee Manse, Kinloch, NO150448, E. D. Cameron, 2008. 1st record since 1970.

†**Mercurialis annua** 91/1.2. *©**H36**, Tyrone: dump at Gortacladdy, H690768, I. McNeill, 2006, det. Edinburgh Botanic Gardens.

Anthriscus caucalis 107/6.2. ©**H36**, Tyrone: dump of discarded mushroom compost, Fury Valley, H557498, J. Harron & I. McNeill, 2002. 1st record since 1939.

Pimpinella major 107/13.1. *‡**H36**, Tyrone: roadside bank at Ballyetra, H161792, I. McNeill, 2006. Probably casual.

†**Aethusa cynapium** subsp. **agrestis** 107/20.1b. *__55__, Leics.: about 40 plants in disturbed ground near new lagoon, Rutland Water Nature Reserve, SK882077, A. Lear, 2009.

Pastinaca sativa 107/40.1. ©**H36**, Tyrone: roadside at Derrymeen, H858636, I. McNeill, 2007. 1st record since 1930s.

†**Torilis arvensis** 107/43.2. ®©**10**, Wight: single plant in gateway, Brighstone, SZ426825, P. D. Stanley, 2009.

Centaurium erythraea 108/3.2. *__79__, Selkirks.: rough ground near site of old gas works, Netherdale, Galashiels, NT509348, J. A. Murray, 2009.

Atropa belladonna 110/3.1. ‡**67**, S. Northumb.: gates of Exhibition Park, Newcastle, NZ246653, A. & G. Young, 2005, **herb. G. A. Swan**. 1st record since 1970.

Polemonium caeruleum 114/1.1. *‡**101**, Kintyre: unreclaimed peat moss by road, Aros Moss, NR677240, I. Teesdale & A. Stewart, 2007. Garden throw-out. Established.

Symphytum tuberosum 116/4.3. ‡**H36**, Tyrone: Baronscourt, H361831, BSBI party, 2001. 1st formal record since 1902.

Myosotis sylvatica 116/15.7. *©**H12**, Co. Wexford: waste ground, Arthurstown, S714107, P. R. Green, 2007.

Myosotis ramosissima 116/15.9. **101**, Kintyre: in short turf on roadside rocks, Keil Point, Southend, NR673076, I. Teesdale & A. Stewart, 2007. 1st record since 1970.

†**Lamium confertum** 118/5.5. **101**, Kintyre: Carskiey beach, NR661077, I. Teesdale & A. Stewart, 2006. Also found at 2 other sites in Campbeltown area. 1st record since 1970.

Euphrasia officinalis subsp. **monticola** ×**confusa** 124/20 ×9. *__67__, S. Northumb.: unmown rushy area within upland hay meadow, Loudside, NY804474, J. O'Reilly, 2007, det. A. J. Silverside. Ø

Euphrasia arctica × **nemorosa** 124/20.5×7. *__67__, S. Northumb.: herb-rich upland hay meadow, Dryburn Cleugh, NY786536, J. O'Reilly, 2007, det. A. J. Silverside.

Parentucellia viscosa 124/23.1. **101**, Kintyre: hundreds of plants in ungrazed meadow, Killean, NR695453, I. Teesdale & A. Stewart, 2007. 1st record since 1970.

Orobanche elatior 125/2.4. *__10__, Wight: trackside on chalk, Chillerton, SZ476830, T. Tutton, 2009, det. F. J. Rumsey. 1st confirmed IW record but known locally from this site for over 30 years.

Orobanche hederae 125/2.8. *__62__, N. E. Yorks.: several plants on ivy in back yard, Amber Street, Saltburn, NZ666215, J. Thompson, 2009, det. V. Jones.

Utricularia stygia 128/2.4. *__101__, Kintyre: small spring at base of cliff, Cruach Lusach, NR781829, T. C. G. Rich, 2006, **NMW**. Also 1999 record for Danna loch but no details.

Utricularia minor 128/2.6. **89**, E. Perth: calcareous flush, Loch Moraig, Blair Atholl, NN906663, M. C. Robinson, 2009. 1st record since 1970.

Campanula latifolia 129/1.11. ©**101**, Kintyre: small patch of woodland at edge of disused quarry, Campbeltown, NR727196, I. Teesdale & A. Stewart, 2007. 1st record since 1970.

Galium parisiense 130/6.14. *©**57**, Derbys.: open waste ground, old Staveley Works, SK416750, A. Willmot, 2009.

†**Cichorium intybus** 135/12.1. ©**H36**, Tyrone: re-seeded area at Derryloran Industrial Estate Cookstown, H801764, I. McNeill, 2006. 1st record since 1950s.

Taraxacum richardsianum 135/25.44. *__67__, S. Northumb.: Dipton Forest, NY965615, A. J. Richards, 2007, **herb. G. A. Swan**.

Taraxacum ceratolobum 135/25.47. *__89__, E. Perth: moorland path, Ben Vrackie, NN941611, M. B. Usher, 2008, det. A. J. Richards, **E**.

Taraxacum cymbifolium 135/25.50. *__89__, E. Perth: at 630m on steep grassy slope, Ben Vrackie, NN950629, M. B. Usher, 2008, det. A. J. Richards, **E**.

Taraxacum excellens 135/25.61. *__62__, N. E. Yorks.: verge by A171 near Pinchinthorpe, NZ582157, V. Jones, 2009, det. A. J. Richards, **herb. V. Jones**.

Taraxacum haematicum 135/25.65. *__67__, S. Northumb.: High Shields, Hexham, NY935627, A. J. Richards, 2007, **herb. G. A. Swan**.

Taraxacum cophocentrum 135/25.120. *__62__, N. E. Yorks.: grassland at edge of arable, Hovingham Carrs, SE663766, V. Jones, 2009, conf. A. J. Richards, **herb. V. Jones**.

Taraxacum longisquameum 135/25.158. *__62__, N. E. Yorks.: verge by A171, Nunthorpe, NZ536140, V. Jones, 2009, det. A. J. Richards, **herb. V. Jones**.

[**Pilosella ×stolonifera** (**P. officinarum** × **aurantiaca**) 135/27.2×6. **39**, Staffs.: SO78, 2004. Reported in an earlier volume of *Watsonia*. No specimen: determination now very uncertain.]

Pilosella officinarum subsp. **euronota** 135/27.2eur. *__57__, Derbys.: disused railway, Clowne, SK502754, G. M. Kay, 2009. 1st record for sub-species in vc 57. Ø

Pilosella officinarum subsp. **officinarum** 135/27.2off. *__57__, Derbys.: grassland, Elmton churchyard, SK503735, G. M. Kay, 2009. 1st record for sub-species in vc 57. Ø

Pilosella officinarum subsp. **trichosoma** 135/27.2tri. *__57__, Derbys.: rock outcrop, disused railway, Clowne, SK4975, G. M. Kay, 2009. 1st record for sub-species in vc 57. Ø

Hieracium anglorum 135/28. *__62__, N. E. Yorks.: Silpho near Scarborough, SE99, J. Cryer, 1909, det. P. D. Sell, **CGE**.

Hieracium angustisquamum 135/28. *__62__, N. E. Yorks.: several plants on roadside bank, 2km N of Stape, SE798953, V. Jones, 2002, det. D. J. McCosh and P. D. Sell, **herb. V. Jones**.

Hieracium apiculatidens 135/28. *__62__, N. E. Yorks.: Sutton Bank, SE58, C. West, 1961, det. P. D. Sell, **CGE**.

Hieracium argillaceum 135/28. *__62__, N. E. Yorks.: Ellerbeck near Goathland, NZ80, J. E. Little, 1913, det. P. D. Sell, **CGE**.

Hieracium consociatum 135/28. *__62__, N. E. Yorks.: very locally frequent on wall of old railway siding, Battersby Junction, NZ591076, V. Jones, 1991, conf. D. J. McCosh, **herb. V. Jones**.

Hieracium daedalolepiodes 135/28. *__62__, N. E. Yorks.: occasional on bridge embankment, A174, Skinningrove, NZ711189, V. Jones, 2007, conf. D. J. McCosh, **herb. V. Jones**.

Hieracium inaequilaterum 135/28. *__62__, N. E. Yorks.: occasional on face of disused limestone quarry, Arden Bank, near Hawnby, SE512905, V. Jones, 2007, conf. D. J. McCosh, **herb. V. Jones**.

Hieracium nemophilum 135/28. *__62__, N. E. Yorks.: castle walls, York, SE65, W. A. Thompson, 1844, det. P. D. Sell, **CGE**.

Hieracium prominentidens 135/28. *__62__, N. E. Yorks.: large clump in rough railway grassland, Middlesbrough, NZ489212, V. Jones, 2000, conf. D. J. McCosh, **herb. V. Jones**.

Hieracium tricolorans 135/28. *__62__, N. E. Yorks.: common on face of disused limestone quarry, Arden Bank, near Hawnby, SE512905, V. Jones, 2003, conf. D. J. McCosh, **herb. V. Jones**.

Hieracium uiginskyense 135/28. *__62__, N. E. Yorks.: abundant over a wide area on sand dunes and grassland, South Gare, N of Redcar, NZ52N, V. Jones, 2007, det. D. J. McCosh, **herb. V. Jones**.

Hieracium silvaticoides 135/28. *__62__, N. E. Yorks.: Hawnby, SE58, J. A. Wheldon, 1884, det. P. D. Sell, **CGE**.

Hieracium decolour 135/28. *__62__, N. E. Yorks.: scattered plants on limestone cliff face, Peak Scar, near Hawnby, SE529883, V. Jones, 2002, conf. D. J. McCosh, **herb. V. Jones**.

Hieracium argenteum 135/28. *__93__, N. Aberdeen: rock outcrop, King Edward, NJ721561, D. Welch, 2009, det. D. J. McCosh, **herb. D. Welch**.

Pulicaria dysenterica 135/37.1. **101**, Kintyre: two small patches in damp meadow at back of the beach, Innean Bay, NR598166, I. Teesdale & A. Stewart, 2007. 1st record since 1970s.

Chamaemelum nobile 135/54.1. ®**10,** Wight: mown grass common, Lake Green, SZ586839, G. Toone, 2009. Last recorded from this site in 1856.

†**Matricaria recutita** 135/59.1. **101**, Kintyre: field margin by beach, Macharioch, NR741093, I. Teesdale & A. Stewart, 2007. Arable weed. 1st record since 1970. *©**H36**, Tyrone: recently disturbed ground at Cookstown, H805785, I. McNeill, 2005, det. S. Reynolds.

Juncus foliosus 151/1.6. *__H36__, Tyrone: Corcloghy Lough, H562474, J. Harron, 2002.

Eriophorum latifolium 152/1.2. ®**H36**, Tyrone: area of limy seepage on Dunnaree Hill, H311714, D. McNeill, 2007. 2nd hectad in county.

Carex ×boenninghausiana (**C. paniculata** × **remota**) 152/16.1×15. *__10__, Wight: beneath willow carr, Freshwater Marshes, SZ345864, P. D. Stanley, 2009, conf. M. S. Porter. First IW record since 1893.

Carex ×pseudoaxillaris (**C. otrubae × remota**) 152/16.5×15. ***10**, Wight: neutral grassland verge, Newtown, SZ443881, P. D. Stanley, 2009, conf. M. S. Porter. First IW record since 1858. ®**10**, Wight: woodland ride on clay, Swainston, SZ423904, C. R. Pope, 2009, conf. M. S. Porter.

Carex spicata 152/16.7. *‡**80**, Roxburghs.: at 300m on road verge, Whitrope, NT526003, R. W. M. Corner, 2009, **herb. R. W. M. C.** ***89**, E. Perth: a single plant in setaside in damp pasture, Myreside, near Errol, NO223251, M. C. Robinson & L. Tucker, 2008, conf. M. S. Porter.

Carex extensa 152/16.43. ***93**, N. Aberdeen: saltmarsh, Loch of Strathbeg, NK073599, I. Green, 2009.

Carex ×elytroides (**C. acuta × nigra**) 152/16.65 × 67. ***79**, Selkirks.: wet old river channel of Ettrick, south-west of Cacrabank, NT302166, R. W. M. Corner, 2008, conf. M. S. Porter. **herb. R. W. M. C.**

Festuca ×fleischeri (**F. arundinacea × gigantea**) 153/12.2×3. ***10**, Wight: roadside verge, Freshwater, SZ345863, P. D. Stanley, 2009, det. T. A. Cope.

X **Festulolium holbergii** (**Festuca arundinacea × Lolium perenne**) 153/12.2×13.1. *© **H36**, Tyrone: field at Carncorran near Castlederg, H294828, I. McNeill, 2007, det. T. A. Cope. Determination: certainly a *Festuca/Lolium* hybrid, highly likely to be X *F. holmbergii*. 1st record for any *Festuca/Lolium* hybrid.

Festuca ovina subsp. **ovina** 153/12.8a. ***67**, S. Northumb.: Emblehope Burn, NY7595, Q. Groom, 2008, conf. A. Copping.1st confirmed record.

Festuca ovina subsp. **hirtula** 153/12.8b. ***67**, S. Northumb.: disused mine workings, Blakehope Fell, NY852944, Q. Groom, 2008, conf. A. Copping.

Poa infirma 153/18.1. ***5**, S. Somerset: in crack alongside the wall outside 20, Ponsford Road, Minehead, SS973458, J. Webb, 2007, conf. R. FitzGerald.

Holcus ×hybridus (**H. lanatus × mollis**) 153/33.1×2. ***55**, Leics.: arable field margin, Ullesthorpe, SP497873, C. A. Stace, 2007, **LTR**.

Fritillaria meleagris 158/11.1. *©**101**, Kintyre: wooded area in cutting, Campbeltown old railway, NR721199, I. Teesdale & A. Stewart, 2007. Naturalised and spreading in wooded area.

Epipactis phyllanthes 162/3.7. ®**39**, Staffs.: two spikes beneath Hybrid Balsam Poplars by Wom Brook, Wombourne, SO872927, A. Ferguson, 2009, conf. C. B. Westall.

Spiranthes romanzoffiana 162/7.3. **101**, Kintyre: three plants on shore of Aucha Lochy, NR726223, Kintyre Botany group, 2006, det. J. McIntosh.1st record since 1970. Also seen 2007. ®**H27**, W. Mayo: growing on limestone, Errew Abbey, Lough Conn, G170120, F. Horsman, 2001. 8 plants in an extensive area, including 1 triple plant.

Hammarbya paludosa 162/10.1. ***89**, E. Perth: at 600m in bog, Ben Gulabin near Spittal of Glenshee, NO 107727, L. Tucker, 2009. 40 plants, mostly in one colony.

Dactylorhiza ×carnea (**D. maculata × incarnata**) 162/18.2×3. ***93**, N. Aberdeen: marsh, Blairfowl, Methlick, NJ809386, D. Welch, 2009. With parents.

Neotinea maculata 162/19.1. ®**H27**, W. Mayo, Drummin, Lough Cullin, G2305, F. Horsman, 2002. 4 plants growing with large numbers of *Spiranthes romanzoffiana* and (introduced) *Sisyrinchium californicum*.

NEOPHYTES AND CASUALS

‡**Selaginella kraussiana** 2/1.2. ***H36**, Tyrone: several patches on lawn at Holy Hill House, near Artigarvan, H383997, I. McNeill, 2008, **BEL**.

[‡**Matteuccia struthiopteris** 16/1.1. **91**, Kincardines.: woodland in den, NO798869, D. Welch, 2007. Location and finder not given in previous entry - *Watsonia* 27 p.381.]

‡**Cedrus deodara** 20/6.1. ***91**, Kincardines.: edge of woodland, Kingcausie, NJ866005, D. Welch, 2009. ***93**, N. Aberdeen: churchyard, Bourtie, NJ804248, D. Welch, 2009.

‡**Cedrus libani** 20/6.lib. ***55**, Leics.: several big trees in woodland, Grace Dieu, SK432181, R. Smith, 2009.

‡**Helleborus argutifolius** 28/3.arg. ***89**, E. Perth: river shingle, R. Tummel, Moulinearn, Pitlochry, NN968542, M. C. Robinson, 2006.

‡**Aconitum lycoctonum** subsp. **vulparia** 28/6.2. ***62**, N. E. Yorks.: several plants in rough grassland, Amotherby Parish Church, SE750734, W. A. Thompson, 2009.

©**Aconitum carmichaelii** Debeaux 28/6.car. ***101**, Kintyre: one established clump on verge of B843, Stewarton, NR691200, I. Teesdale & A. Stewart, 2006, conf. D. R. McKean. Ø

‡**Anemone apennina** 28/9.2. *__H12__, Co. Wexford: large patch on field bank on side of R746, Prospect, S9660, P. R. Green, 2007.

‡**Clematis montana** 28/12.4. *__H12__, Co. Wexford: large patch in field hedge on west side of the N11, Coolishal, T13405749, P. R. Green, 2007.

‡**Fumaria reuteri** 31/5.4. ®**10**, Wight: dumped roadside soil, Freshwater, SZ349857, P. D. Stanley, 2009, det. T. C. G. Rich. *©**101**, Kintyre: two plants growing wild in garden, High Askomil, Campbeltown, NR727290, I. Teesdale, 2005, det. T. C. G. Rich. New to Scotland. Identified from potted material.

‡**Ficus carica** 35/2.1. *__67__, S. Northumb.: Skinnerburn Lane, Newcastle, NZ222632, J. Durkin, 2001.

‡**Soleirolia soleirolii** 36/3.1. *__80__, Roxburghs.: riverside cliff, Tweed near Benrig, St Boswells, NT606310, L. W. Gaskell, 2008, det. R. W. M. Corner, **herb. R. W. M. C.** **101**, Kintyre: walls, southern shore of Campbeltown Loch, Campbeltown, NR7120, I. Teesdale & A. Stewart, 2007. Plentiful in area. 1st record since 1970.

‡**Alnus cordata** 40/2.2. *__H12__, Co. Wexford: single self-sown tree at base of wall opposite church, Duncannon, S73020840, P. R. Green, 2007.

©**Phytolacca acinosa** 41/1.1. *__10__, Wight: 3 plants self sown by footpath, Steephill, SZ545767, C. R. Pope, 2009. Probably originated from nearby Botanic Garden.

‡**Chenopodium quinoa** Willd. 43/1.qui. *__91__, Kincardines.: dump, Drumlithie, NO798819, D. Welch, 2009. Ø

©**Chenopodium strictum** 43/1.str. *__10__, Wight: disturbed ground (development site), Newport, SZ495893, P. D. Stanley, 2009, det. E. J. Clement.

‡**Chenopodium suecicum** 43/1.sue. ©**H36**, Tyrone: re-seeded road verge at Enniskillen, E of Cookstown, H874755, I. McNeill, 2005, det. J. R. Akeroyd. 1st record since 1896.

©**Bassia scoparia** 43/2.1. *__62__, N. E. Yorks.: edge of waste ground, Douglas Street, Middlesbrough, NZ503193, V. Jones & W. A. Thompson, 2009, **herb. V. Jones**.

©**Amaranthus retroflexus** 44/1.1. *__67__, S. Northumb.: cracks in pavement, Quayside, North Shields, NZ356681, A. J. Richards *et al.*, 2008, **herb. G. A. Swan**. Locally abundant and well established.

‡**Amaranthus blitum** 44/1.bli. *__55__, Leics.: about 15 plants on roadside, West Knighton, City of Leicester, SK595007, U. Hamzoui, 2009.

©**Lychnis coronaria** 46/18.1. *__H12__, Co. Wexford: several plants on waste ground, Arthurstown, S714107, P. R. Green, 2007.

‡**Dianthus deltoides** 46/25.5. *__60__, W. Lancs.: Plain Quarry, Dalton, SD552761, A. McLay, 2009. Comm. G. Halliday.

‡**Persicaria amplexicaulis** 47/1.7. *©**89**, E. Perth: a single plant on river side of car park on edge of woodland, Black Spout Wood, Pitlochry, NN951575, M. C. Robinson, 2008.

©**Fagopyrum tataricum** (L.) Gaertn. 47/3.tat. *__H12__, Co. Wexford: single plant on verge of the Gorey By-pass, Polands Cross Roads, T21946946, P. R. Green, 2007, **DBN**. Ø

‡**Fallopia sachalinensis** 47/5.2. *__91__, Kincardines.: policies, Fasque House, NO646753, D. Welch, 2009.

©**Rumex dentatus** 47/8.den. *__55__, Leics.: one plant under tree in pavement, Oadby, SK620008, U. Hamzoui, 2008.

‡**Hypericum calycinum** 51/1.1. *__H36__, Tyrone: scrubby ground near Maydown Bridge, H818520, I. McNeill, 2008.

‡**Hypericum ×inodorum** (**H. androsaemum × hircinum**) 51/1.3×4. *©**101**, Kintyre: hedge by farm track, Campbeltown, NR710208, I. Teesdale & A. Stewart, 2007, det. N. K. B. Robson. Garden escape or birdsown?

‡**Hypericum canadense** 51/1.17. ®**H27**, W. Mayo: many plants, Derrinkee, L999721, F. Horsman, 2001.

‡**Hypericum forrestii** 51/1.for. *©**101,** Kintyre: waste ground near airport, Aros Moss, NR682221, Ian Teesdale, 2008.

©**Malva alcea** 53/1.2. *__10__, Wight: field edge, St Lawrence, SZ532762, E. Pratt, 2009.

©**Abutilon theophrasti** 53/6.1. *__H12__, Co. Wexford: single plant in pasture, Duncannon, S72930848, P. R. Green, 2007.

‡**Sarracenia purpurea** 54/1.1. *__57__, Derbys.: moorland flush, Stoke Flat, SK254767, A. Willmot, 2010. About 25 plants, some with remains of flowers.

‡**Populus ×canescens** (**P. alba** × **tremula**) 61/1.1×2. *__89__, E. Perth: large thicket suckering from planted specimens on edge of old orchard, Port Allen, Errol, R. Tay, NO250211, M. C. Robinson, 2007.

‡**Populus trichocarpa** 61/1.4. *__91__, Kincardines.: streamside, Drumlithie, NO790809, D. Welch, 2009. *__93,__ N. Aberdeen: roadside, Forgue, NJ596434, D. Welch, 2009.

‡**Sisymbrium orientale** 62/1.6. ©__80__, Roxburghs.: disturbed ground, site of old railway station, Galashiels, NT495361, L. W. Gaskell, 2009, **herb. R. W. M. C.** 1st record since 1916.

‡**Barbarea verna** 62/11.4. *__67__, S. Northumb.: Tyne Green, Hexham, NY933648, J. Bowyer, 2008, **herb. G. A. Swan**. Population subsequently killed by herbicide.

‡**Cardamine corymbosa** 62/14.cor. *__55__, Leics.: garden, Markfield, SK484117, E. Penn-Smith, 2008, det. T. C. G. Rich. The 1st record for which details can be traced. *__H36__, Tyrone: weed in R. Irvine's garden, Cookstown, H801776, R. Irvine, 2004, det. I. McNeil. Seen again as roadside weed a short distance away at H801778 by I. McNeill, 2007.

‡**Rapistrum rugosum** 62/40.1. *©__H36__, Tyrone: dumped material in Carland Quarry, H792666, I. & A. McNeill, 2007, det. P. Hackney, **BEL**.

©**Crambe hispanica** L. 62/41.his. *__H36__, Tyrone: waste ground at Doons, H729799, I. McNeill, 2008, det. T. C. G. Rich, **BEL**. Probably first Irish record. Ø

‡**Eruca vesicaria** 62/ERC.ves. *©__H36__, Tyrone: re-seeded road verge at Quinn's Corner, H728603, I. McNeill, 2004, det. T. C. G. Rich.

‡**Sedum spurium** 73/5.7. *__93__, N. Aberdeen: old quarry, Fyvie, NJ790362, D. Welch, 2009.

‡**Astilbe ×arendsii** (**A. japonica** × **chinensis** × **rosea**) 74/1.1×chi×ros. *__60__, W. Lancs.: edge of old gravel pit, Worton, SD517730, E. F. Greenwood, 2009.

©**Bergenia crassifolia** 74/3.1. *__89__, E. Perth: dumped soil at roadside, Welton Industrial Estate, Blairgowrie, NO189445, M. C. Robinson, 2006.

‡**Tellima grandiflora** 74/8.1. *__55__, Leics.: woodland, Groby Rifle Range, SK525077, S. F. Woodward, 2007.

‡**Spiraea ×arguta** (**S. multiflora** × **thunbergii**) 75/3.mul×thu. *__57__, Derbys.: Ilkeston, SK4642, C. & M. Smith, 2008.

‡**Rubus odoratus** 75/8.5. *©__H36__, Tyrone: dump in disused quarry at Mountfield, H534785, I. McNeill, 2001.

‡**Acaena anserinifolia** 75/18.2. __62__, N. E. Yorks.: four small patches on bare stony ground, Meeting House car park, Helmsley, SE613837, C. I. Gillings, 2009, det. V. Jones, **herb. V. Jones**.

‡**Malus hupehensis** (Pamp.) Rehder 75/27.hup. *©__101__, Kintyre: in moorland beside road, Dalsmirran, NR645135, I. Teesdale & A. Stewart, 2007, conf. D. R. McKean & H. McHaffie. Remote location. Ø

‡**Cotoneaster salicifolius** 75/32.10. *__89__, E. Perth: edge of amenity area, side of R. Ericht, Blairgowrie, NO178456, M. C. Robinson, 2007, det. J. Fryer. Planted or bird-sown.

‡**Cotoneaster rehderi** 75/32.35. *__93__, N. Aberdeen: roadside, Rathen, NK001609, D. Welch, 2009.

‡**Cotoneaster mairei** 75/32.mai. *__39__, Staffs.: between the rails of a railway line, Bromley, SO903887, C. B. Westall, 2006.

‡**Cotoneaster marginatus** 75/32.mar. *__89__, E. Perth: scrub at side of track, Glen Tilt road, NN881691, M. C. Robinson, 2008, det. J. Fryer. Planted or bird-sown.

‡**Crataegus persimilis** 75/35.5. *__55__, Leics.: roadside, Sapcote, SP502930, G. Calow, 2007.

‡**Lathyrus grandiflorus** 77/15.7. *©__H36__, Tyrone: waste ground in Cookstown, H6806785, I. McNeill, 2007.

‡**Lathyrus latifolius** 77/15.9. *__H12__, Co. Wexford: a single clump on waste ground, Arthurstown, S714107, P. R. Green, 2007.

©**Melilotus indicus** 77/17.4. *__91__, Kincardines.: casual in Torry, NJ90, J. W. H. Trail, after 1893. Source - *Trail Memorial Volume* (1923).

©**Medicago intertexta** (L.) Mill. 77/18.int. *__91__, Kincardines.: by railway, Nigg, NJ90, J. W. H. Trail, 1910. Source - *Trail Memorial Volume* (1923). Ø

‡**Trifolium pannonicum** 77/19.17. *__H12__, Co. Wexford: road verge along the Gorey By-pass, Ballinclay, T10075472, P. R. Green, 2007, **DBN**.

‡**Gunnera tinctoria** 80/1.1. *__93__, N. Aberdeen: lakeside, Fyvie Castle, NJ766390, D. Welch, 2009. Escape from policies. *__101__, Kintyre: well established in forestry ditches (eg Ballochgair), NR780269, I. Teesdale & W. Byford, 2009.

‡**Fuchsia magellanica** 84/5.1. *__55__, Leics.: one large bush on woodland edge, Grace Dieu, SK431177, H. Ikin, 2008.

‡**Aucuba japonica** 85/2.1. *__62__, N. E. Yorks.: several small self-sown plants scattered in rough copse, Brass Castle Lane, Nunthorpe, NZ529143, V. Jones, 2009. Unusual to find seedlings.

‡**Euphorbia maculata** 91/2.2. *__55__, Leics.: several plants spreading slowly in pavement, West Knighton, City of Leicester, SK596008, U. Hamzoui, 2007. Still present 2009.

‡**Linum usitatissimum** 94/1.2. ©**H36**, Tyrone: dump at Lisaclare, H872691, I. McNeill, 2007. 1st formal record, but presumably must have been a frequent casual in Tyrone pre-1960 when flax was a major crop in N. Ireland.

‡**Acer villosum** C. Presl 99/1.vil. *__60__, W. Lancs.: near Haweswater, Silverdale, SD479767, M. Wilcox, 2009. Ø

‡**Oxalis exilis** 102/1.4. *__101__, Kintyre: walls, paths, gardens, Witchburn Road, Campbeltown, NR715202, I. Teesdale & A. Stewart, 2007.

‡**Oxalis tetraphylla** 102/1.12. *©__62__, N. E. Yorks.: several plants self-sown on waste ground, West Street, Yarm, NZ417129, V. Jones & W. A. Thompson, 2009, **herb. V. Jones**.

‡**Geranium pyrenaicum** 103/1.14. ©__101__, Kintyre: sand dunes on edge of Macrihanish Golf Course, NR642208, I. Teesdale & A. Stewart, 2007, det. A. Norton. 1st record since 1970.

‡**Geranium macrorrhizum** 103/1.17. *©__101__, Kintyre: road verge, Kildalloig Bay, NR747196, I. Teesdale & A. Stewart, 2007, det. A. Norton. Garden escape which disappeared in 2007.

©**Tropaeolum majus** 104/1.maj. *__101__, Kintyre: top of the beach, Davaar Point, NR753195, I. Teesdale & A. Stewart, 2007. Persistent colony for at least 5 years.

‡**Heracleum mantegazzianum** 107/41.2. ®__10__, Wight: established by footpath, Bembridge, SZ642885, C. R. Pope, 2009.

©**Solanum physalifolium** 110/8.3. *__62__, N. E. Yorks.: disturbed grass verge, Water End, York, SE590528, V. Jones & W. A. Thompson, 2009, **herb. V. Jones**.

©**Petunia ×hybrida** (**P. axillaris × integrifolia**) 110/PET.axi × int. *__H12__, Co. Wexford: single self-sown plant in pavement crack, New Ross, S7127, P. R. Green, 2007.

‡**Phacelia tanacetifolia** 115/1.1. *©__89__ E. Perth: edge of field above Pitroddie Den, NO200253, M. C. Robinson & L. Tucker, 2007. *©__H12__, Co. Wexford: common on road verge along the Gorey By-pass, Ballinclay, T102546, P. R. Green, 2007.

‡**Echium plantagineum** 116/2.2. *©__H36__, Tyrone: waste ground at Doons, H729799, I. McNeill, 2008.

‡**Mentha ×villosa** (**M. spicata × suaveolens**) 118/23.3×4. __101__, Kintyre: at back of the beach, Macharioch, NR738090, I. Teesdale & A. Stewart, 2007, det. R. M. Harley. Var. *alopecuroides*. Established garden escape. 1st record since 1970.

‡**Mentha ×rotundifolia** (**M. suaveolens × longifolia**) 118/23.4×lon. __101__, Kintyre: near the beach, Kilkerran Road, Campbeltown, NR744194, I. Teesdale & A. Stewart, 2007, det. R. M. Harley. 1st record since 1970.

‡**Mimulus guttatus** 124/4.2. __101__, Kintyre: damp area beside Skeroblin Loch, NR703260, I. Teesdale & A. Stewart, 2007. Also by Tangy Burn NR680268. 1st record since 1970.

©**Mimulus ×hybridus** (**M. cupreus ×smithii**) 124/4.cup×smi. *__H12__, Co. Wexford: four plants self-sown at base of wall, Ballyhack, S705108, P. R. Green, 2007. Ø

©**Antirrhinum hispanicum** Chav. subsp.**hispanicum** 124/7.his. *__60__, W. Lancs.: top of wall surrounding supermarket car park, Carnforth, SD499706, J. Clarke, 2009, det. E. J. Clement. Ø

©**Chaenorhinum origanifolium** 124/8.1. *__62__, N. E. Yorks.: self-sown plants in pavement crack, Castlegate, Malton, SE792715, V. Jones, 2009, conf. W. A. Thompson, **herb. V. Jones**.

‡**Asarina procumbens** 124/10.1. *__39__, Staffs.: on retaining wall bordering waste ground, Crown Bank, Talke, SJ825529, S. R. Hinsley, 2009.

‡**Digitalis lutea** 124/14.2. *__57__, Derbys.: abandoned garden, The Old Cheese Factory, Brailsford, SK254416, C. & M. Smith, 2009. Garden was abandoned prior to 1995.

‡**Veronica polita** 124/16.2. __101__, Kintyre: roadside weed, Campbeltown, NR7220, I. Teesdale & A. Stewart, 2007. 1st record since 1970.

©**Sutera cordata** Kuntze 124/SUT.cor. *__H12__, Co. Wexford: single plant self-sown at base of wall, Mary Street, New Ross, S71932758, P. R. Green, 2007, **DBN**. Ø

‡**Campanula persicifolia** 129/1.4. *©__67__, S. Northumb.: disused railway line, Shiremoor, NZ309716, A. & G. Young, 1996.

©**Phuopsis stylosa** 130/4.1. *__62__, N. E. Yorks.: self-sown on steps, Oswaldkirk, SE623790, V. Jones, 2009.

‡**Lonicera japonica** 131/6.6. *__62__, N. E. Yorks.: prolifically naturally regenerating in trackside scrub, Brotton, NZ681193, V. Jones & W. A. Thompson, 2009. *__H12__, Co. Wexford: waste ground, Arthurstown, S714107, P. R. Green, 2007.

‡**Taraxacum falcatum** 135/25.10. *__62__, N. E. Yorks.: edge of arable, Socarrs Lane, Hovingham, SE681763, V. Jones, 2009, det. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum chloroticum** 135/25.118. *__62__, N. E. Yorks.: river bank, Tees at Yarm, NZ416126, V. Jones & W. A. Thompson, 2009, conf. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum densilobum** 135/25.127. *__62__, N. E. Yorks.: grassland, N bank of R. Leven, E of Stokesley, NZ539091, V. Jones, 2009, conf. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum intumescens** 135/25.145. *__89__, E. Perth: beside woodland track, Mill Dam, Dunkeld, NO031461, M. B. Usher, 2007, det. A. J. Richards, **E**.

‡**Taraxacum leptodon** 135/25.154. *__62__, N. E. Yorks.: road verge by A171, Nunthorpe, NZ536140, V. Jones, 2009, conf. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum obliquilobum** 135/25.171. *__62__, N. E. Yorks.: road verge near Chapel Beck, Guisborough, NZ602157, V. Jones, 2009, det. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum pachymerum** 135/25.177. *__62__, N. E. Yorks.: trackside near Park House Farm E of Lealholm, NZ777070, V. Jones, 2009, conf. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum piceatum** 135/25.184. *__89__, E. Perth: woodland ride, Moulin, Pitlochry, NN943603, M. B. Usher, 2008, det. A. J. Richards, **E**.

‡**Taraxacum porrigens** 135/25.187. *__62__, N. E. Yorks.: river bank, Tees at Yarm, NZ416126, V. Jones & W. A. Thompson, 2009, conf. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum procerisquameum** 135/25.188. *__62__, N. E. Yorks.: side of woodland track, Quarry Bank Wood, SE581839, V. Jones, 2009, conf. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum sublongisquameum** 135/25.208. *__62__, N. E. Yorks.: verge of A172, Swainby, NZ473023, V. Jones, 2009, conf. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum trilobatum** 135/25.214. *__62__, N. E. Yorks.: grassy bank by farm lane, Barry Bank Farm, Ugthorpe, NZ800108, V. Jones, 2009, det. A. J. Richards, **herb. V. Jones**.

‡**Taraxacum valens** 135/25.218. *__62__, N. E. Yorks.: central reservation of A171 near Pinchinthorpe, NZ583157, V. Jones, 2009, conf. A. J. Richards, **herb. V. Jones**.

©**Crepis setosa** 135/26.set. *__H12__, Co. Wexford: two plants on verge of Gorey By-pass, Knockmullen, T16615817, P. R. Green, 2007.

‡**Hieracium aterrimum** 135/28. *__62__, N. E. Yorks.: very locally frequent on W side of disused railway N of Kilton Thorpe, NZ687182, V. Jones & W. A. Thompson, 2009, conf. D. J. McCosh, **herb. V. Jones**.

‡**Hieracium aviicola** 135/28. *__62__, N. E. Yorks.: very locally frequent on waste ground, Corus, near Redcar, NZ572245, V. Jones, 2007, conf. D. J. McCosh, **herb. V. Jones**.

‡**Hieracium firmirarum** 135/28. *__62__, N. E. Yorks.: very locally frequent, waste ground by The Fleet, Corus, near Redcar, NZ575244, V. Jones, 2007, conf. D. J. McCosh, **herb. V. Jones**.

‡**Hieracium spilophaeum** 135/28. *__62__, N. E. Yorks.: rocks, Sutton Bank, SE5182, J. G. Baker, 1853, det. P. D. Sell, **CGE**.

‡**Hieracium subaequialtum** 135/28. *__62__, N. E. Yorks.: scattered plants on mine deposit, Kilton Tip, NZ695171, V. Jones, 1991, conf. D. J. McCosh, **herb. V. Jones**.

‡**Hieracium salticola** 135/28. *__62__, N. E. Yorks.: frequent in rough grassland and railway waste ground, Maze Park by Tees, Middlesbrough, NZ4618, V. Jones, 2002, **herb. V. Jones**.

‡**Hieracium scotostictum** 135/28. *__62__, N. E. Yorks.: locally frequent on wall, Gilling East, SE613769, V. Jones, 2005, conf. D. J. McCosh, **herb. V. Jones**.

‡**Hieracium sublepistoides** 135/28. *__62__, N. E. Yorks.: very locally frequent under trees by track, Grey Towers, Nunthorpe, NZ585135, V. Jones, 1991, conf. D. J. McCosh, **herb. V. Jones**.

‡**Hieracium severiceps** 135/28. *__62__, N. E. Yorks.: locally frequent on ashy industrial waste ground, Corus, Grangetown, NZ545211, V. Jones, 2008, conf. D. J. McCosh, **herb. V. Jones**.

‡**Aster ×versicolor** (**A. laevis × novi-belgii**) 135/41.3×4. *__67__, S. Northumb.: steep slopes N of Tynemouth Haven, NZ379653, A. J. Richards, 2008, **herb. G. A. Swan**. Well established but probably hortal.

‡**Santolina chamaecyparissus** 135/51.1. *__10__, Wight: established on maritime cliffs, Bembridge, SZ650870, E. Pratt, 2009.

‡**Anthemis austriaca** Jacq. 135/55.aus. *__55__, Leics.: locally frequent in disturbed ground, Watermead Country Park, SK606108, J. Sells, 2009, det. J. Partridge. *__H12__, Co. Wexford: plentiful on road verge, Holmestown, S96892226, P. R. Green, 2007. Ø

‡**Leucanthemella serotina** 135/57.1. *__39__, Staffs.: one clump in rough grassland by a roundabout, Ladymoor, SO941952, C. B. Westall, 2009.

©**Leucanthemum paludosum** (Poir.) Bonnet & Barratte 135/58.pal. *__H12__, Co. Wexford: single plant in pavement crack on edge of car park, New Ross, S7127, P. R. Green, 2007, **DBN**. Ø

‡**Senecio inaequidens** 135/62.3. *__60__, W. Lancs.: single plant on verge of northbound M6, SD538351, M. S. Porter, 2009.

©**Senecio vernalis** 135/62.16. *__H12__, Co. Wexford: common on road verge along the Gorey By-pass, Knockduff, T15765767, P. R. Green, 2007. **DBN**.

©**Senecio minimus** Poir. 135/62.min. ®__10__, Wight: in Botanic Garden beneath tree ferns, Steephill, SZ549769, P. D. Stanley, 2009, det. E. J. Clement. Ø

‡**Ambrosia artemisiifolia** 135/74.1. *©__H36__, Tyrone: dump 2km E of Gortin, H511854, I. McNeill, 2007, det. J. L. Mason.

‡**Elodea nuttallii** 138/4.2. *__91__, Kincardines.: pool by farm, Ecclesgreig, NO732660, D. Welch, 2009.

‡**Arum italicum** 147/5.2. *©__101__, Kintyre: roadside verge, West Darlochan, NR677230, I. Teesdale & A. Stewart, 2007.

‡**Lemna minuta** 148/2.4. *__91__, Kincardines.: ditch in farmland, St Cyrus, NO737632, D. Welch, 2009. *__H36__, Tyrone: flooded quarry-floor at Mount Stewart, H460569, I. McNeill, 2003, det. P. Hackney. Frequent in H36 by 2007.

‡**Juncus tenuis** 151/1.2. *©__10__, Wight: disturbed waste ground, Newport, SZ501896, P. D. Stanley, 2009.

‡**Carex buchananii** 52/16.buc. *__H12__, Co. Wexford: a single clump on waste ground in field gateway, New Ross, S70882515, P. R. Green, 2007.

‡**Avena sterilis** 153/28.4. *©__H36__, Tyrone: weed in cereal crop at Garvaghy near Eglish, H792555, I. McNeill, 2007, det. P. Hackney.

‡X**Agropogon lutosus** (**Polypogon monspeliensis** × **Agrostis stolonifera**) 153/39.1×46.4×2. (Poir.) P. Fourn. *__10__, Wight: roadside verge, Dodnor, Newport, SZ501917, P. D. Stanley, 2009. Ø

‡**Agrostis scabra** 153/39.9. *__H38__, Down: waste ground, by the Musgrave Channel, Belfast Harbour, J361760, I. McNeill, 2009, conf. T. B. Ryves.

©**Polypogon maritimus** Willd.153/46.mar. *__57__, Derbys.: open waste ground, old railway sidings, Derby, SK365360, A. Willmot, 2009, det. T. B. Ryves. About 50 fruiting clumps. Ø

©**Anisantha tectorum** 153/52.4. *__H12__, Co. Wexford: two clumps on verge of the Gorey By-pass, Moneylawn, T132563, P. R. Green, 2007.

‡**Cortaderia richardii** 153/62.ric. *__H12__, Co. Wexford: one self-sown clump on waste ground, Wexford, T032222, P. R. Green, 2007.

©**Echinochloa crus-galli** 153/68.1. *__H36__, Tyrone: dump site 2km E of Gortin, H511854, I. McNeill, 2007.

‡**Lilium martagon** 158/12.1. *__101__, Kintyre: hedge beside road, Killdalloig area, NR755185, I. Teesdale & A. Stewart, 2003. Var. *album*. Has flowered for 4 years since discovery.

‡**Lilium pyrenaicum** 158/12.2. *__H36__, Tyrone: strongly established along roadside S of Beagh, H507618, I. McNeill, 2000.

‡**Polygonatum** ×**hybridum** (**P. multiflorum** × **odoratum**) 158/14.1×2. *©__101__, Kintyre: damp woodland, former grounds of`Glenbarr Abbey, NR672364, J. Muscott, M. Clarkson & J. Murray, 2008, conf. I. Teesdale.

‡**Scilla bithynica** 158/19.bit. *__62__, N. E. Yorks.: well established and naturally regenerating on roadside bank, A170 in Brompton-by-Sawdon village, SE945822, W. A. Thompson, 2009.

©**Hyacinthus orientalis** 158/21.1. *__39__, Staffs.: two plants on waste ground, Cardinal Point Industrial Park, Fazeley, SK198032, R. D. Martin, 2009.

‡**Allium roseum** 158/24.3. *©__57__, Derbys.: Long Eaton, SK499327, C. & M. Smith, 2008.

‡**Allium triquetrum** 158/24.7. *__55__, Leics.: roadside, Sapcote, SP502930, G. Calow, 2007.

*©**101**, Kintyre: roadside, Beallachageachan Brae, NR672385, I. Teesdale & A. Stewart, 2004. Probable escape from nearby garden.

‡**Nectaroscordum siculum** 158/25.1. *__55__, Leics.: thriving clump in woodland ride, Ason Firs, SP453942, C. A. Stace, 2009.

‡**Leucojum vernum** 158/31.2. *__89__, E. Perth: in ornamental woodland, Kindrogan Field Centre, NO054628, M. C. Robinson, 2006. Recorded during BSBI Scottish Vice-County Recorder workshop and seen by several recorders.

‡**Narcissus poeticus** 158/33.3. *©**89**, E. Perth: shingle island in R. Tay, Kercock, NO143399, M. C. Robinson, 2006. *__101__, Kintyre: roadside verge, Gartnacopaig, NR628145, I. Teesdale & A. Stewart, 2007. Garden escape from abandoned farm house.

‡**Sisyrinchium montanum** 159/2.2. *__67__, S. Northumb.: Billy Mill, North Shields, NZ336693, A. & G. Young, 1995.

‡**Crocus vernus × tommasinianus** 159/8.1×2. *__62__, N. E. Yorks.: locally abundant in grassland under trees, Eston Cemetery, NZ546187, V. Jones, 2005, conf. V. Jones & W. A. Thompson in 2009, **herb. V. Jones**. Long-established with abundant natural regeneration.

‡**Crocus tommasinianus** 159/8.2. *©**101**, Kintyre: Killdalloig area, NR755183, I. Teesdale & A. Stewart, 2007. Garden escape.

‡**Crocus chrysanthus × biflorus** 159/8.6×bif. *__62__, N. E. Yorks.: grassland, York Cemetery, SE612507, V. Jones & W. A. Thompson, 2009, **herb. V. Jones**.

‡**Schizostylis coccinea** 159/SCH.coc. *__101__, Kintyre: beside forestry road, Feochaig, NR763134, I. Teesdale & A. Stewart, 2007. 100m from house - self sown or garden throw-out. Established.

Book reviews

Exploring environmental history: selected essays. T. C. Smout. Pp. 248. Edinburgh University Press, Edinburgh. 2009. Hardback. Price £60.00. ISBN 978-0-7486-3513-9.

After a career as an economic and social historian, T. C. Smout, Historiographer Royal for Scotland, turned to environmental history after reading Oliver Rackham's book *The history of the countryside*. This attractively produced book includes 13 essays he has written on the subject in the last two decades. Although they have been published previously in books, journals, conference proceedings or *Festschriften*, most will probably be new to B.S.B.I. members (I had come across only three of them previously). Many have been revised for republication or extended to discuss subsequent criticism. Their focus is Scottish, but like all good essay writers Smout leads the reader from the particular to more general considerations.

In the first essay, Smout contrasts the American approach to environmental history, which describes "misunderstanding and violent misuse" of wilderness areas, to the European writers who deal with a long-settled continent. Clearly the European and American experiences are very different, but is it simply a difference in timing? Is Smout's view of the European experience before 1945 as "relatively benign and gradual landscape change" only possible because we have forgotten what riches we once had, and because time has mellowed the impact of forest clearance, fenland drainage and the agricultural improvement that followed parliamentary enclosure?

Turning to Scottish matters, 'The Highlands and the roots of green consciousness, 1750–1990' explores the paradox that appreciation of the Highlands has usually come from outsiders, although these can be divided between those who regard the area as a giant adventure playground and those who resort to it for spiritual renewal. The figure of Frank Fraser Darling (1903–1979) looms large in this and other essays, and he really deserves an essay to himself. He was an Englishman (I was surprised to learn) and a visionary inspired by a completely erroneous view of Highland history. Another theme is the question of who should decide on policy in the Highlands. Smout argues provocatively, but surely correctly, that they "belong to a wider British society than seems to be visible from Inverness".

The next seven essays deal with woodland history, the history of bogs, agricultural improvers in Scotland and a comparison of Scotland, Ireland and Iceland. The main conclusions reached by Rackham and other woodland historians are supported by these studies: most woods were cleared in prehistory, surviving woods are not destroyed simply by clear-felling (in the east, at least) and are preserved by use but disappear if they have no use. There are, however, very distinctive themes to Scottish woodland history. Woodland was never valued as highly as in lowland England as peat was preferred as a fuel, stone was all too plentiful as building material and the east-coast towns could easily import timber from Scandinavia. The availability of peat, Smout considers, helps explain the low percentage cover of woodland in Scotland and Ireland (the failure of the Icelanders to manage their birch woods sustainably is less easy to understand). In the highly oceanic west there is some evidence to suggest that regeneration of pine woods sometimes failed after clear-felling, leading to woodland loss. In the Scottish climate, woodland was particularly important as winter shelter for cattle. Landlords had more power than their counterparts elsewhere and the balancing of competing interests which is such a feature of English woodland history is less apparent in Scotland, although comparison is difficult as Smout writes about the period from 1600 onwards whereas English woodland historians often concentrate on earlier centuries. Smout touches on the myth of the Great Wood of Caledon, recently espoused by the Green Party ("history does not have to be accurate to be influential: too much of human experience suggests that the more inaccurate it is, the greater its leverage"). He also examines the association of trees with historic figures such as Mary Queen of Scots, John Knox, Rob Roy and Bonnie Prince Charlie. Most, he thinks, are "another fruit of the Romantic imagination", an identical conclusion to that reached independently in England by David Coombe in his excellent essay 'Of Milton and mulberries' hidden away in *Christ's College [Cambridge] Magazine* **72**: 15–20 (1987).

As Smout points out, environmental history covers many disciplines but "there are not many polymaths". The botanist will regret the absence from his woodland history of any consideration of plants other than trees. Questions which we would like answered are not even asked. Does Scotland have fewer plants restricted to woodland than lowland England, and, if so, is the explanation climatic, a reflection of the differing landscape or historical? What long-term effects have cattle had on the vascular plants, bryophytes and lichens of Scottish woodland? Little ecological work is cited in the essays, not even the highly pertinent analyses of the problems of being a tree in an oceanic environment published by Smout's fellow emeritus professor at St Andrews, R. M. M. Crawford. Despite these omissions, I was still taken aback to read a description of Tansley and his colleagues' ecological work in the 1940s and 1950s as "in danger of becoming an arcane 'pure' science .... unrelated to the social sciences and so irrelevant to society".

The last four essays are a more miscellaneous group. The most important one, 'The alien species in twentieth-century Britain: inventing a new vermin', has already proved influential. Smout shows that concern about problematic alien species (the new vermin) has recently been extended to cover all alien species, and alien genotypes of native species. He makes a strong case against this blanket condemnation. However, his argument that there is a philosophical problem in distinguishing native from alien species because it "rests on a view that humanity is not part of nature" leaves me unconcerned. If that is a problem, it is one that can be left to the philosophers.

This is an immensely stimulating book. As someone unfamiliar with modern historical writing, I particularly appreciated the way Smout takes recent historical approaches and applies them to Scottish environmental history – his analysis of history in terms of energy wealth, for example, or the idea that before 1800 societies were more anxious to minimise internal social friction and economic risk than to maximise the use of resources. All the essays are superbly written, as Smout refuses to use "the preposterous language of post-modernism" and scorns geographers who "are fond of saying that we 'construct' nature, though in reality they cannot even construct a wren". The book is therefore not only a painless introduction to modern environmental history but a positive pleasure. If you think £60 is too much to pay for a relatively slender volume, order it from your local library.

C. D. PRESTON

Flora of Great Britain and Ireland, Vol 3., Mimosaceae - Lentibulariaceae. P. D. Sell & G. Murrell. Cambridge University Press, Cambridge, 2009. Hardback. £130.00. ISBN 978-0521-55337-7.

The third of the five volumes of this massive work details many important families: Scrophulariaceae, Lamiaceae, Apiaceae and Fabaceae for instance. There are few surprises in format or approach, so that generalities voiced in reviews of earlier volumes (*Watsonia* **22**: 122–3, **28**: 100–1) are not repeated here. The present volume concerns more families with woody plants however, and it becomes evident that the authors have attempted to treat almost every tree and shrub planted outside domestic gardens. How many of the 34 *Eucalyptus* or 24 *Acer* ever become naturalised here?

When most subsidiary taxa are subspecies or varieties it becomes evident that placing of infraspecific taxa before the species accounts of distribution, ecology and origins causes the latter to become confused; a good example is *Anthyllis vulneraria*. Also, infraspecific taxa are included in the generic keys, causing the latter to become unnecessarily cluttered. It would have been better if infraspecific taxa had been keyed out separately under each species.

In comparison with earlier volumes I did detect two welcome changes of emphasis, which may reflect the taxa covered here. Accounts of crop plants and herbs are often accompanied by informative descriptions of their history, culture and usage. Also, there are anecdotal accounts of observations made by the authors in their native Cambridgeshire. For instance, they note that that presumptively native *Anthriscus sylvestris* var. *sylvestris* is replaced by apparently adventive var. *latisecta* not only as you travel south, but as you approach village boundaries. Rather than giving the Flora a Cantabocentric spin, these

touches, and there are many, add an important and accessible context to minor taxa.

I have to say that I disagreed with some of the terminology used. For hermaphrodite (or in American 'cosexual') flowers, the term 'monoecious' is used commonly (although not for every family), but this term usually implies that both male and female unisexual flowers co-occur. Many of the statements regarding status are rather arbitrary. *Ajuga chamaepitys* is said to be native and *Lamium amplexicaule* to be introduced, without qualification. I doubt if many people would wish to be dogmatic about either, whatever, in the context of archaeophytes, these words mean anyway.

In such a vast work, distributional and ecological errors are inevitable, although some may mean that insufficient revision occurred after the publication (2002) of 'The New Atlas'. *Veronica praecox* occurs in Oxfordshire, *Orobanche purpurea* in Cumberland, *Ligusticum scoticum* is still in Northumberland, *Polemonium caeruleum* has two native sites there, *Gentiana verna* has been introduced into north-west Scotland and *Geranium sanguineum* var. *lancastriense* is widespread in Cumberland. *Ulex gallii* does not occur 'in suitable habitats throughout'. It is absent from most of eastern England. *Melampyrum sylvaticum* is extinct in England.

There are other errors. The *Trifolium* key is a terrible mess (lead 14 should be 16), even if you are reconciled to the *T. repens* aggregate appearing twice (why?) and know the difference between 'pinnately trifoliolate and digitately trifoliolate' which I regret to say I don't, and the glossary does not help. This seems to be the main means of separating *T. occidentale* (there are others!). *Polygala serpyllifolia* flowers are not 'mainly blue', at least round here, where *Astragalus danicus* is mostly a plant of fixed sand.

There are a number of new taxa and combinations. *Euphrasia salisburgensis* becomes *E. hibernica*, and *E. reayensis* and *E. notata* are described from the Highlands. The allotetraploid hybrid between *Centaurium litorale* and *C. erythraea* in Lancashire is raised to specific level as *C. intermedium*. *Ononis repens* has been controversially lost and is *O. spinosa* subsp. *procurrens*. There are spiny versions of *O. repens*, but it is possible to separate the taxa on several other characters and they have different ecologies. *Gentianella anglica* (including *cornubiensis*) and *G. uliginosa* have become varieties of *G. amarella*, thus downgrading two endemic taxa at a stroke. The 'Giant Hogweed' is no longer *Heracleum mantegazzianum*, but it is not yet clear to which taxon most of our fast-spreading monsters belong.

As for previously published volumes, it is for the comprehensive accounts of aliens, and the detailed infraspecific taxonomy that most people will want to acquire this expensive volume. It remains to be seen whether this work will engender a new enthusiasm for subspecies and varieties.

JOHN RICHARDS

The wild flora of Kew Gardens: a cumulative checklist from 1759. T. Cope. Kew Publishing, Kew. 2010. Paperback. £30.00. ISBN 978-1-84246-401-4.

This checklist of a comparatively small area (300 acres or 120 ha) underlain by Bagshot sands and gravels reveals a surprisingly high level of plant diversity; whether this is due to a high level of deliberate or accidental introductions, or intensity of recorder effort (with an cadre of expert taxonomists close at hand), or because of the vagaries of management or neglect of uncultivated areas within the garden, is not entirely explained. Tom Cope, supported by many colleagues, began to survey the Kew estate in his own time, and latterly this work was recognized as a valuable contribution to Kew's aim of preserving biodiversity on its home turf. The result is a fascinating micro-flora of London's best-known botanic garden covering the whole period from the decade of its foundation to the present day.

In total, 1,032 first records of 'wild' vascular plant taxa were made at Kew, including archaeophytes. In the checklist, species which were only ever found in cultivation at Kew are highlighted in pale blue; the remainder are treated as accidental, either as survivors of the original native flora or as adventive introductions or escapes from cultivation. In the early years of the botanic garden, a surprising

number of native British species were cultivated at Kew, as is shown by Hill's *Hortus Kewensis* of 1768, but this reflects a more general interest during the latter part of the 18th century in the cultivation of native species of the British flora, much to the detriment of certain rarities such as *Cypripedium calceolus* (recorded growing at Kew in 1768 by Hill). Although records have been included from the herbarium of Rev. Samuel Goodenough, one of the earliest visitors to the garden, there does not seem to have been any notice taken of the Kew collections in the herbarium of Sir James Edward Smith at **LINN**.

Some of the later records of Kew's wild flora were published in the various reports of the Botanical Exchange Club in its various guises; Dr Cope has provided a most useful appendix in which the various un-numbered parts of these publications are given informal part numbers, making it possible to cite and date the records more accurately.

Although at £30 this is a rather ambitiously priced paperback, it can be recommended as a thoroughly scholarly and detailed account of the wild flora of England's premier botanical garden.

JOHN EDMONDSON

Grasses of the British Isles. T. Cope & A. Gray. B.S.B.I. Handbook No. 13. Botanical Society of the British Isles, London. 2009. Paperback. £18.00. ISBN 978-0-901158-420; Hardback. £21.50. ISBN 978-0-901158-413.

Grasses are one of the most interesting groups of angiosperms, due to their broad distribution in all continents and to their ecological and economic importance as leading components of diverse ecosystems and main sources of food, forage and energy. The new handbook of the B.S.B.I. contributes to increase the knowledge of the grass family in the British Isles through the revision of its largest monocot group. The work by Tom Cope and Alan Gray constitutes the largest handbook, with 220 species described and illustrated, published so far by the B.S.B.I. This book is an updated version of the classical "Grasses: a guide to their structure, identification, uses and distribution in the British Isles" by C. E. Hubbard (1954, 1968, 1984 editions, the latest revised by J. C. A. Hubbard), which was a baseline reference for most agrostologists and amateur botanists in Europe.

One of the main advantages of the new handbook, apart from extending the number of described and illustrated grass species from 158 to 220, is that this provides a uniform and systematically ranked succession of keys and descriptions, starting from tribes, to genera within tribes, and then to species within genera. This facilitates the user to frame systematically each species within its higher rank groups and, at the same time, avoids redundancy in descriptions of features common to higher ranks. The described grass taxa are systematically arranged following the classification adopted in the work of Clayton & Renvoize (1986) for suprageneric categories of world grasses. However the authors have deliberately ignored contributions from recent grass phylogenetic studies that depart from Clayton & Renvoize's system.

The descriptions of the species are concise and accurate, the measurements have been re-assessed and additional data on cytogenetics, ecology, infraspecific divisions and hybrids have been appropriately documented and discussed. The book is magnificently illustrated. The authors have chosen not to describe or illustrate some organs or parts of the plant (e. g. anatomical leaf-blade sections, except in some *Festuca* species) that could provide taxonomical characters, or others (e. g. lodicles, ovaries, seeds) that could be of interests for taxonomists and breeders. Apart from slight differences in the inclusion or exclusion of some recently introduced aliens, compared with other recent Floras of the British Isles (e. g. Stace 2010), the book broadly covers 113 native and 60 introduced grass species with the exception of cultivated bamboos. The regional distributions of the grasses are derived from the *New Atlas of the British and Irish Flora*, and the synonyms have been concisely summarized in the Index to genera and species. This is a remarkably portable book that will be extremely useful to all those field botanists and amateurs that want to identify and acquire a deeper knowledge of the diversity of the western European grasses.

PILAR CATALÁN

Cotoneasters. J. Fryer & B. Hylmö (foreword by Roy Lancaster). Timber Press, Portland. 2009. Hardback. £30.00. ISBN 978-0-88192-927-0.

Cotoneasters are very common in the urban and suburban environment and commonly naturalise as they have fruit which is attractive to birds and seeds which germinate and establish readily,. In the wild they are mainly species of dry habitats, often in scrub in relatively dry climatic regions. Most of the forty or so species which have become naturalised in the British countryside are apomictic, and some have become quite seriously invasive, especially on chalk and limestones. However, as the native *C. cambricus* is itself apomictic, there is no risk of genetic contamination, and apparently the presence of the naturalised species to some extent protects the native species.

Only a very few species are commonly cultivated and these are not necessarily the most attractive – just the ones known to landscape architects and propagated by nurseries. Unlike many Timber Press monographs, this one provides keys to almost all the species described, those which aren't keyed being annotated 'not in key'. Anyone who has worked with apomictic genera such as *Sorbus, Taraxacum* or *Hieracium* knows how much work a publication such as this has involved, as the differences between similar microspecies can be very slight, especially on the herbarium sheet. However, when these differences involve height, habit, or colour, they can make a large difference to the appearance of the living plant.

This monograph seems to be primarily aimed at a horticultural audience, but it is also likely to be the standard botanical reference for the genus for many years. It is a pity that so few professional botanists take on such systematic monographic work, especially on woody genera. We are therefore greatly indebted to these two amateurs who have not had the security of an institutional post and salary while carrying out their work. The authors are relatively unusual in the taxonomic fraternity in that they have also grown the plants they study. They clearly know the plants extremely well in the living state as well as in the herbarium. One situation where this is particularly evident is where a species whose chromosome number is unknown is noted as being apomictic because it grows true from seed. This knowledge has required many years of experience raising plants from seed and noting the variation (or, more usually, the lack of it) in the offspring. It is clear that, as in related genera such as *Sorbus, Malus,* and *Crataegus*, all diploids are probably sexual (whether self-compatible or self-incompatible), while all polyploids (triploids, tetraploids, pentaploids and hexaploids) are almost totally apomictic, though it is perhaps not stated in as many words. The apomictic *Cotoneaster* species are pseudogamous, requiring pollination for endosperm production and seed set even though the embryo is produced asexually. As stated, most of the apomictic species are tetraploid. This is because they are usually highly pollen fertile and so can self-pollinate. Uneven ploidy levels such as triploids are often largely pollen sterile and so require pollination by another species to induce seed set and are therefore usually less free fruiting, and therefore less attractive horticulturally.

I have very few criticisms. It would have been interesting to hear something of the authors' ideas on the evolution and phytogeography of the genus, what the ancestral *Cotoneaster* might have looked like, and the directions of evolution within the genus. However, with so many polyploid apomictic taxa of uncertain origin this might be difficult. The publication of this book, and especially the comment that there are only about 10% of the known species are diploid and sexual, has already led to at least one molecular phylogeneticist recognising the genus as particularly interesting and obtaining material from the diploids available. I would like to have seen more information on which collections have given rise to the populations in cultivation and perhaps collection numbers for the chromosome counts. However, this would probably be of interest to a very limited number of readers and may have been excluded by the editors. Proof reading seems to have been very thorough and I have only, so far, detected one minor error, the omission of the nutlet number for *C. bullatus* in the key on page 220 – the answer would seem to be (4)5 from the description.

At £30 this book is very good value for such a thoroughly researched and well-produced monograph likely to remain the standard work on a very important genus for a very long time.

H. A. McAllister

A Flora of Suffolk. M. N. Sanford & R. J. Fisk. Pp. 552. D. K. & M. N. Sanford, Ipswich. 2010. Hardback. £40.00 ISBN 978-0-9564584-0-7.

I share the popular distrust of glossy books, as their glossiness is often a sign that appearance has been given priority over content. My heart sank, therefore, when I opened this extremely glossy Flora, but it did not take me long to realise that this first impression was quite wrong. *A Flora of Suffolk* is in fact an excellent account of the charophytes, bryophytes and vascular plants of Suffolk, one of the most rural and attractive of the English counties and one which, we are told, is "far from flat", reaching 128 m at its highest point.

In 'A personal introduction', Martin Sanford tells us that his mother's family have lived in Suffolk for at least twenty generations, and the book is imbued with a sense that the plants we see in the county are the result of thousands of years of human occupation and exploitation of the landscape. The introductory material devotes 20 pages to landscape history and draws on numerous works by Suffolk authors such as Thomas Tusser's *Five hundreth pointes of good husbandrie* (1573) and Robert Reyce's *Breviary of Suffolk* (1618), as well as on the published accounts of visitors. A fascinating series of graphs shows changes in the acreage of cultivated crops and the numbers of farm animals since 1860 (though plotting the graphs over a relevant photograph gave me an unpleasant feeling of sensory overload). This is followed by an account of the habitats of Suffolk, illustrated by photographs and coincidence maps of their characteristic species. Although Suffolk has, like everywhere else, suffered greatly from agricultural improvement in recent centuries (as shown, for example, by a map of the reduction in heathland from 1783 onwards), a surprising number of fragments of species-rich habitats survive inland, and the coast has some extensive, and often surprisingly quiet, tracts of semi-natural habitats.

The Victorian Floras of Suffolk, by Henslow & Skepper (1860) and Hind (1889), were rather pedestrian. *Simpson's Flora of Suffolk* (1982) was the only 20th century account and in this book Sanford does not really face up to its limitations. Francis Simpson is clearly a local hero but outsiders are not likely to be convinced by the description of his Flora as "a classic of its kind". It is in fact *sui generis*, one of the most eccentric of Floras and one which contains some original material of great interest but few localised records in the Flora (or its supporting archive) and rather too many dubious records, especially of hybrids, which are not backed up by voucher specimens. The absence of a large corpus of detailed older records limits the opportunity to analyse change in the Flora. In an introductory chapter Martin Sanford makes the best of the available material, listing extinct species, discussing native colonists, showing that few species have changed significantly at the 10-km square scale and demonstrating that change in the county parallels that in Britain as a whole (the main exception being a group of arable weeds which are declining nationally but holding their own in the county). However, the species accounts show the alarming decline in recent decades of some of the rarest species in the county, particularly the Breckland perennials *Artemisia campestris*, *Festuca longifolia* and *Thymus serpyllum*. An interesting table quantifies the extent to which species are Suffolk specialities.

The species accounts give details of the habitats of all Suffolk's species and cite localities for the rarer plants. Local specialities such as *Primula elatior, Pulmonaria obscura* and *Trifolium ochroleucon* are particularly well-covered, as are some charismatic aliens including *Fritillaria meleagris* and (in Suffolk) *Colchicum autumnale*. Like the introductory chapters, these accounts draw on a wide range of sources. Take as an example *Ribes uva-crispa*, an ordinary species about which few Floras have anything interesting to say. Although it is often thought to be native, we learn that Edward I's fruiterer imported bushes from France in 1275, paying threepence each, "hardly likely if it was growing here as a native". Sanford then draws on *The vocabulary of East Anglia* (Dawson Turner *et al.*, 1830) in his discussion of its English name Feaberry, its abbreviation to Feabes (pronounced Fapes) in East Anglia and its relationship to Fapes Hill near Finningham. Tetrad maps are provided for many species, often showing records over an appropriate soil or habitat map. Many species show patterns determined by the light Breckland soils in the north-west of the county and the Sandlings of the east, with a large wodge of clay between them. The maps usually show records from 1980 onwards, with earlier

records occasionally included as a separate symbol. The maps are admirably clear, although some of the attempts to map three taxa together (e.g. *Silene alba, S. dioica* and their hybrid) are over-ambitious. The occurrence of naturalised populations of native species is often mentioned in the text but unfortunately these records are not distinguished on the maps. Photographs occur throughout the text. They are mainly sharp, rather clinical close-ups, some of them of disembodied flowers, which usefully compare some similar species but rarely provide any sense of place (those of *Lupinus arboreus* and other coastal species are splendid exceptions). A few photographs of native species (e.g. *Caltha palustris*, *Nymphaea alba*) appear to represent alien genotypes, and that of *Juncus bufonius* agg. looks to me as if it could be *J. foliosus*, which is not otherwise mentioned in the Flora.

The Flora integrates records from B.S.B.I. national projects, county surveys of churchyards, protected roadside verges, nature reserves, ponds and veteran trees, 'Phase II' surveys of grasslands and woodlands and tetrad recording specifically for this Flora. The coverage is good, especially in the north of the county where an experienced team who cut their teeth on *A Flora of Norfolk* (1999) contributed many records. There are excellent accounts of some infraspecific taxa, such as the subspecies of *Medicago falcata* and the taxa of the *Prunus domestica/spinosa* complex. In general, however, recording of difficult and critical taxa is similar to the national average, so that *Lycium* records have to be aggregated, most recorders have not distinguished the subspecies of *Ranunculus ficaria* and the commoner *Salix* hybrids appear to be under-recorded (there are no recent records of *S. caprea* × *viminalis*). These difficulties are honestly described, but what can we do as a botanical society to raise our standards so that the relatively straightforward subspecies and hybrids are well recorded? Should this not be a higher priority than recording the same areas every decade to our current standards?

Whereas the vascular plant records in the Flora draw on many different surveys, the substantial account of the bryophytes (68 pages) is largely the work of one man, Richard Fisk. The maps are based on records from 70% of the county's tetrads. To cover two vice-counties in such detail is a remarkable achievement, especially as they were very badly under-recorded before the start of the current survey. This coverage has certainly not been achieved by simply and superficially recording only the most easily identified species. Plants requiring microscopic study, such as the tuberous *Bryum* species, are conspicuously well-recorded. This bryophyte Flora will be an invaluable source of information on the habitats and frequency of mosses and liverworts in lowland England.

In the past many tetrad Floras have been simply atlases of vascular plant distributions, often lacking any historical records and with only a meagre text. The recent *Flora of Hertfordshire* (2009) by Trevor James and this Suffolk Flora, which combine tetrad maps with a detailed and original text, are encouraging signs of how the genre is developing. The dichotomy between 'tetrad' and 'traditional' Floras, never absolute, should become a thing of the past as future authors realise that a fusion of the two traditions can give a much better book than either a traditional Flora without maps or a simple atlas.

C. D. PRESTON

Flora of County Tyrone. I. McNeill, with the assistance of P. Hackney. Pp x, 374. National Museum Northern Ireland, Cultra. 2010. Paperback. £25.00. ISBN-978-1 905989-17-1.

This handsome, weighty volume redresses Robert Lloyd Praeger's negative opinion of the botanical delights of Ulster's largest county. Handsome beyond doubt, illuminated by luminous photographs of plants and landscapes (mainly by Robert Thompson, who also designed the book), and with a crisp layout and colourful dot-maps, the publisher has done Ian McNeill and his county proud. Weighty, too, topping 2 kg, with 384 generous (219 × 274 mm) pages: this is not a flora for slipping into your backpack before you tramp through the heather and drizzle in search of new records. In fact, you need to sit at a table because the open volume is almost too unwieldy to hold. The combination of handsome design and generous bulk means Tyrone's first flora should stay at home and I have no doubt there will be many copies soon on display in the county's drawing-rooms.

I do not mean to demean this book by implying somehow it is a "coffee-table" flora, for it is presents a very solid and thorough piece of work. It is a county flora of the best kind, based on carefully documented and meticulously mapped records. Its origin goes back, in the context of the author and his family, to half past ten on a night in July 1980 when David McNeill, then a teenager, spotted an orchid in a marshy cutting on a disused railway, the first time this particular species had been recorded in Tyrone. "The exceptional beauty of the marsh helleborine flower ... confirmed for us the thrill and excitement that can come from botanical exploration, and led to 25 years and more of field recording." That story also points to a charming aspect of this book: it is a rather personal one and Ian McNeill has no qualms about whimsy or fancy-free phytogeography. You do not often read in a flora that a species may have arrived by bus from Belfast, or the instruction: "Thread them on a stalk of grass, and, when you have accumulated a good number, offer them to your beloved ...". I get the impression that Ian and his two sons throughly enjoyed themselves in the field, utterly confident that their domestic arrangements were flawless: "a hot meal on the table [would always] welcome the weary botanists home."

The flora of County Tyrone commences with a long chapter on the topography and botany — a carefully charted meander through the valleys and over bogs, farmland and hills, with the highlights of the prime sites listed. It is a thoroughly Praeger-esque chapter, redolent of *The botanist in Ireland* (which contains only two meagre pages about Tyrone). There are chapters on geology (by Philip Doughty) and climate (by Nicholas Betts) and a lengthy gazetteer of place-names (including for bewildered outsiders some hints on pronunciation). The floristic part is arranged according to "Stace 1997", so the most recent nomenclatural earthquakes, especially among orchids, have been sidestepped. There are no plant descriptions. Each species's status is indicated and its local ecology summarized, Habitat records follow, often divided into "old" and "recent", and the distribution maps, based on 5 × 5 km squares, also have colour-dated dots.

I have two trifling cavils about the praiseworthy flora: very few of the superb photographs of plants are dated and localized (were they not taken in the county?), and the naturalists active before 1900 get almost no mention. Regarding the latter point, Edmund Murphy and Theobald Jones, who together discovered cloudberry (*Rubus chamaemorus*), Tyrone's botanical enigma, on the Sperrin Mountains in 1826, are noticed, but not Robert Brown, "*Princeps botanicorum*", one of the greatest botanists of the nineteenth century. He marched (literally, with his regiment) through Tyrone on more than one occasion, and in his diary on 21 July 1800 recorded water lobelia (*Lobelia dortmanna*) at Baronscourt Lough and, on 22 July, pale butterwort (*Pinguicula lusitanica*) close to Strabane. Of lesser significance perhaps, Dr James Shuter observed moonwort (*Botrychium lunaria*) at Dungannon according to a list of Irish plants published in 1807 and 1808 by James Townsend Mackay. Incidentally, all these plants are portrayed in this new flora: exceptionally, the lobelia, photographed by Ronnie Irvine (p. [59]), and a cloudberry leaf, photographed by David Holyoak (p. 203), have both dates and localities.

Reading Ian McNeill's book was a "trip down memory lane" for me. Many of the places are familiar from my childhood—their names trip off my tongue. I remember Dr George Gillespie as a stalwart of Fermanagh (not Tyrone) Field Club: he gets much credit for ensuring the survival of botanical records from the pre-1940s.

The B.S.B.I. supported the publication of *The flora of County Tyrone* and I commend this friendly, family-made book to all members, no matter where you live. It'll provide excellent browsing and, who knows, you too might get the urge to "add 30 new plants" to Omagh's "square" or to wander off into the "curiously negative" Sperrins in search of cloudberries. A curious fact: Jones and Murphy reported that the cloudberry was in bloom in 1826, but no one has seen flowers on this most inscrutable plant since then.

CHARLES NELSON

Flowers of the Norfolk Broads. S. Harrap. Pp 80. Norfolk Nature Guides. 2010. Paperback. £8.99. ISBN 978-0-9558579-1-1.

There is a big problem for those that are not professional botanists or serious amateurs, who want to identify wild plants. The floras are highly technical, lack illustrations and are expensive and heavy and the popular books of illustrations are often good but the illustration and the real plant often differ a bit, the keys are usually incomplete and not everything is figured, so one can be never entirely sure of an identification. For perhaps a large group of people who simply want to know the names of the more obvious flowers even the latter alternative may be off-putting, and it is this group that we need as allies to win the current conservation battle. One solution is a small, inexpensive book of good photographs targeted at a specific habitat or area.

This is what Simon Harrap, an independent naturalist and photographer in Norfolk has done for the more prominent flowers of the Norfolk Broads. He has concentrated on fen flowers, though he also includes some of the more prominent aquatics, and has not spurned *Phragmites, Typha, Cladium, Schoenoplectus* and *Sparganium*. About a hundred species are illustrated by good photographs and notes on particular characters; for the most part, accurate identification will be possible. There are some problems. A few photographs do not show enough detail (some ferns and umbellifers, for example), there is no key, and several hundred other species that occur in the area will remain a mystery. A few species have been eclectically included, though the average visitor will not see them (*Luronium natans, Liparis loeselii, Utricularia intermedia*). But for the most part this is a wise selection and a casual visitor to one of the Broadland boardwalks or nature trails in summer will be rewarded with at least a dozen names (either common or scientific) in an afternoon. That is enough to give confidence to go further. The book also gives a very brief history of the Broads, their habitats and problems, as background. No doubt the book will be on sale in local outlets, but could be of value in alkaline wetlands elsewhere. You can buy it through a website (www.norfolknature.co.uk).

BRIAN MOSS

Obituaries

MICHAEL WALPOLE F.C.A., F.L.S.
(1933–2009)

Born in the Leicestershire market town of Loughborough on 13 February 1933, Mike Walpole was a rare man who maintained a 50 year long involvement in the natural history and conservation of the wildlife of his home county, while also establishing himself as a leading figure on the national scene too. He also somehow managed to do all of this while holding down a senior position in the business world, as well as being a devoted family man. Mike was married to his wife Ann for more than 50 years and had two children and four grandchildren.

Educated at Loughborough Grammar School, Mike qualified as a Chartered Accountant in 1955. Four years later he joined Towles Ltd, a Loughborough hosiery company, where he worked until his retirement in 1994. By that time he had become Financial Director and Company Secretary. A big man with a larger than life personality, Mike Walpole had personalized number plates on his Mercedes cars and he was well known for his liking for red wine and cigars. A gifted pianist at school, he later played the organ for services at Emmanuel Church, Loughborough, but much of his life outside of work revolved around natural history.

It was in the early 1960s that a dynamic and prolific group of local naturalists formed the Loughborough Naturalists' Club. Mike Walpole was one of them, becoming a member of the Club in 1961 and serving as Meetings Secretary, Chairman and Bryophyte Recorder. In 1962 Mike was elected a member of the Council of the Leicestershire Trust for Nature Conservation (later the Leicestershire and Rutland Wildlife Trust), serving for a remarkable 46 years until 2008. From 1964–1975 he was Honorary Secretary of the Trust and Chairman from 1975–1986. It is clear that in the 1960s and 1970s Mike was in the centre of all that was happening in nature conservation in Leicestershire and that he was hugely influential. He wrote the chapter on nature conservation in a major work on the county (Pye 1972), in which his knowledge and vision for the future shines through. It is particularly interesting to note his focus on the need for more educational facilities and places to provide 'stimulation to growing minds and refreshment to tired men and women from cities and towns'. There was concern that people might otherwise only have access to 'barren, drab and unstimulating acres of land'. The Trust's files show that Mike was forthright in his desire to conserve special places, on behalf of the Trust, never fearing a fight. While he and others were able to secure some fine nature reserves, much else was lost and Mike was clearly affected by this, saying at a low moment years later that 'no-one cares'.

Nevertheless, Mike's personal contacts continued to be hugely beneficial to the Trust and in 1997 he persuaded a local charity to donate £75,000 towards the purchase of a substantial part of Loughborough Big Meadow, one of the largest and last remaining Lammas meadows in Britain. During the 1990s he was also Chairman of the Charnwood Wildlife Project, a joint initiative between the Trust and Charnwood Borough Council, for a number of years.

Mike was a constant presence on the Trust's Conservation Committee too, but his real love was for its Charnwood Lodge Nature Reserve. Established in 1961 as the Shirley Clarke Nature Reserve, Mike was instrumental in persuading the late Miss C. Clarke to bequeath the reserve to the Trust in 1972 and it subsequently became known as Charnwood Lodge Nature Reserve. Covering nearly 500 acres, this is one of the largest inland nature reserves in the Midlands, but Mike was totally unmoved when it was declared a National Nature Reserve in the 1990s, concerned that enhanced status might result in more visitors than could be catered for and unwanted government regulation.

Charnwood Lodge is a wonderfully wild place, a constant surprise for visitors from outside of Leicestershire. Mike was determined to keep it wild and had promised Miss Clarke that its character would not be changed, for example through recreational use. His fierce protection of the site did not endear him to some, but almost 50 years on the site retains that essential wild character. Adoption of an

Mike Walpole driving a tractor, c. 2005.

almost siege mentality had almost certainly partly come about because of what Mike had seen happening to other good places in the county and his concerns were only reinforced in the early 2000s when much of the reserve, to Mike's dismay, was declared access land under the CRoW Act. His early optimism for nature conservation was further severely dented when officials showed little concern for the potential for unrestricted public access to change the nature of Charnwood Lodge. He believed that nature conservation was playing second fiddle to access and recreation in the minds of politicians and that the officers just jumped to their tune. Fortunately, there were some at local authority level who were prepared to be more pragmatic and a compromise was struck that has worked well so far.

Proud to consider himself an amateur and a volunteer, Mike fought hard to try and ensure that the importance of amateurs and volunteers were not lost in the fast changing world of the late twentieth century. Charities were successful at capturing funds that enabled them to employ professional staff, but while this brought some benefits it also threatened to reduce the involvement of volunteers as well as the charities' independence, because of the need to secure funding to pay salaries.

As well as being an expert on finance and computers (he could write his own programs, for example for the BSBI membership database), Mike could drive a tractor and operate a chainsaw. He was not too impressed when the Trust insisted he go on a certificated course for the latter, however, to meet Health and Safety requirements. As he once said in his typically blunt and to the point way, 'I'm an awkward b****r'! He really enjoyed practical tasks and warmed particularly to other volunteers who were willing to give up their spare time to work on nature reserves. Sometimes he had a sharp word for those who did not.

Mike joined the BSBI as a member in 1960 and from 1971 to 1997 served as Honorary Treasurer and also a member of the Society's Council. During those years he kept a wise hand on the Society's organisation and finances and was described as 'the father figure to the Society and BSBI activities' (Briggs 2010). He was also Membership Secretary for many years and Chairman or a member of many committees, including BSBI Co-ordinating, later the Executive Committee, the Publications Committee, Chairman 1991–1997, the Committees for the Welch Bequest, the BSBI Taxonomic Database (Leicester), and the Warburg Fund. Mike was also BSBI Referee for Herbals and Local Floras of the British Isles. He gave a lecture on early local Floras at the BSBI Conference on Local Floras held in Liverpool in 1991 and was also elected an Honorary Member in the same year.

Books were a real passion of Mike's. He liked to describe himself as a natural history bibliophile, with a special interest in British Floras, and collected over a period of more

than 50 years. The story goes that he cycled to a nearby village to make his first purchase, but by his death he had amassed a library of an estimated 10,000 books, reputedly worth half a million pounds. They were housed in a purpose built extension to his house, which was lined with shelves, the books eventually three deep as the collection outgrew the available space.

Mike was often said to own the best private collection of botanical books in Britain, but he collected other books too, for example on his home county of Leicestershire. Lack of space eventually forced him to increasingly specialize in British Floras and he sold much of the rest of his collection.

Bloomsbury Auctions of Mayfair finally prepared the collection for sale after Mike's death producing a very useful catalogue. Mike had said that he intended to catalogue his collection himself after he retired, but in the event he was just as busy after retirement as before and he never found the time to do it. In the Bloomsbury catalogue, John Collins describes Mike as a 'bold, even reckless buyer....an essential ingredient in any serious collector'. This is very interesting, because when it came to the affairs of the Wildlife Trust, or the management of Charnwood Lodge Nature Reserve, Mike was quite the opposite of reckless. At one meeting the Trust's first Director informed the trustees that he was 'walking a tightrope' on a particular issue. Mike snorted that the trouble with walking tightropes was that you were likely to fall off! He was ultra cautious in almost anything remotely risky or experimental, the one exception being buying nature reserve land, which he thought was by far the most important function of a Wildlife Trust.

A few lucky ones were invited to take a look at his collection, but Mike only allowed one public viewing. That was way back in 1968, when 60 items were exhibited for six days at the Loughborough School of Librarianship. Amongst the items in his 'continental' botany collection was a first edition of Redouté's eight volume *Les Liliacées*, valued at between £100,000–£150,000 and said to be 'among the most important monuments of botanical illustration ever to be published'. It is a pity that more people were not able to enjoy seeing treasures such as this, but perhaps the practicalities defeated Mike, who in the notes for his 1968 exhibition said that 'he hopes to spread appreciation of the delights of natural history illustration'.

Mike was the Honorary Treasurer to the committee that produced the *Flora of Leicestershire* (Primavesi & Evans 1988) and compiled the comprehensive bibliography it contains. His knowledge and enthusiasm for orchids was demonstrated in a detailed article on the orchids of his home county (Walpole 1968/9). In the 1960s he and two other local naturalists travelled long distances in their quest to seek out and photograph all of the British orchid species. Mike even once arranged a family holiday so that he could recruit the assistance of his children, with the incentive of a suitable reward, to locate the Lady's-slipper. The Isles of Scilly became a favourite destination and such was his liking for routine he was very disappointed one year when the hotel room on the islands that he and Ann had stayed in every year for nearly 30 years was unavailable.

Mike died in Leicester on 11 December 2009 after a long illness. His contribution to natural history and nature conservation was recognised in an invitation to a Queen's Garden Party and by an award for 'services to the community' by the retiring High Sheriff of Leicestershire. Ian Evans, former Assistant Director (Natural Sciences) with the Leicestershire Museums Service and Mike's friend of nearly 50 years, paid tribute to him saying that 'He was a man of his time, when a gifted, enthusiastic and energetic individual could make a huge contribution to natural history and nature conservation, without the need of any formal qualifications in those areas. We may not see his like again' (Evans 2010).

MICHAEL JEEVES

REFERENCES

BRIGGS, M. (2010). Michael Walpole FCA. *BSBI News* **113**: 2.

EVANS, I. (2010). Michael Walpole F.C.A, F.L.S: An Appreciation. *Loughborough Naturalists' Club Annual Report* **2009**: 7–9.

EVANS, P. A. & PRIMAVESI, A. L. (1988). *Flora of Leicestershire.* Leicestershire Museums.

WALPOLE, M. (1968/9). Orchids in Leicestershire. *Annual Report Leicestershire Trust for Nature Conservation*, **1969**: 27–39.

WALPOLE, M. (1972). Nature Conservation, in PYE, N. (ed) *Leicester and its Region.* Leicester: Leicester University Press, pp 181–192.

PETER SHAW GREEN
(1920–2009)

Peter Green was born on 11 September 1920 in Rochester, Kent, the youngest son of John and Elizabeth Green. Peter's father was an Engineer attached to the Royal Air Force and so the family moved around the United Kingdom as well as having one tour in Egypt whilst Peter was growing up. However, Peter had a fine and stable education at Taunton School for Boys, where besides his academic studies he joined the school's cadet corps, rising to Officer by the time he left school to enter University. With excellent academic results he entered King's College, London to study Botany. With the outbreak of the Second World War and with his cadet background he was soon called up and was quickly commissioned into the Northumberland Fusiliers as an Officer. Captain Peter Green was a crack shot and soon he was training new recruits how to accurately use their rifles on Salisbury Plain. As the war progressed he returned to his regiment where they were part of the Italian Campaign. After a serious bout of Typhoid he went on to serve in Greece. Whilst still in the Army in 1946 he married Winifred Brown with whom he had studied at King's College before the war. On demobilisation he returned to finish his degree at King's College and in 1948 he went on to take up the post of Assistant Lecturer at Birmingham University, where his lifelong friendship with Professor Jack Hawkes began. In 1951 Peter joined the staff of the Royal Botanic Garden, Edinburgh where his lifetime research interest in the Oleaceae was kindled and the first of the many scientific research papers on this family appeared. Always a team player and a gentle and instinctive tutor, the disturbing atmosphere of Edinburgh at that time led him to migrate with his family in 1960 to become the Horticultural Taxonomist at the Arnold Arboretum of Harvard University.

Peter's already wide taxonomic knowledge grew enormously at this time as he taught the students, curated the herbarium and identified a large and steady flow of cultivated material both live and herbarium material.

If this was not enough, he developed a major programme of fieldwork in the Western Pacific studying the genus *Jasminum*.

In 1966, Peter turned down the offer of tenure by Harvard University and instead returned to Britain to take up a post in the Australian Section of the RBG Kew under Dr Ronald Melville, whom he very soon afterwards succeeded to head up the section. In 1969, he was made Principal Scientific Officer, the career grade for a senior scientist at Kew at the time. As head of the Australian Section he had inherited a massive backlog of Australian and Pacific Islands herbarium material to identify, he set about the task with his team with great vigour and enthusiasm, whilst at the same time naming very large numbers of specimens arriving from the Solomon Islands' Forestry Department.

Peter Green, 1977. Photo reproduced with the kind permission of the Director and the Board of Trustees, Royal Botanic Gardens, Kew.

Peter's hard work, helpfulness and cheerfulness was recognised by all his colleagues around the world and so they all felt a particular pleasure when in 1969 he was promoted to Deputy Keeper of the Herbarium and Library, on the retirement of Edgar Milne-Redhead. With this post came the editorship of the Kew Bulletin, a task he thoroughly enjoyed, despite again inheriting a large backlog of manuscripts. His steady and helpful editing both cleared the backlog with the 'KB' returning to a more regular publishing programme. There was also a very positive spin-off as he helped to develop many Kew staff's skills in preparing papers for publication, although some found his meticulous attention to detail some-what irritating.

During this time, his very wide knowledge gained whilst at The Arnold Arboretum, particularly as a consequence of his visits to Lord Howe Island, and also the research into the flora that he had carried out, stood him in good stead when as a world expert on this area he spoke out publicly. Peter never did shrink from speaking up for anything he felt strongly about and so it was in order to protect the endemic Fauna and Flora of Lord Howe Island that in 1970 he called for the eradication of all the introduced Goats, Pigs and Rats that were decimating this unique habitat. It caused irritation in some quarters but it showed the beginning of what was to be the start of Peter's long and positive support for plant conservation, later to be developed so strongly at The Royal Botanic Gardens, Kew.

With Pat Brenan as Keeper and Peter, his deputy, the whole restructuring of the way the Herbarium was organised was undertaken. These two quiet and confident men reorganised the staff, under newly founded Assistant Keeper posts to form Taxonomic units moving away from the regional structures of the past. It was a smooth transition that soon resulted in a more efficient and more productive out-put than ever before, both improving the naming services for the wider botanical community and in the delivery of more quality scientific papers from the staff.

The sudden resignation of the Director, Professor Jack Heslop-Harrison in 1975 caused a series of rapid changes in the senior management of Kew, Pat Brenan becoming Director and Peter becoming Keeper of the Herbarium and Library as well as Deputy Director, both posts that he held until he retired in 1982 on reaching compulsory retirement age under the rules of the Civil Service of the day. Although these last few years were mainly taken up by administrative tasks Peter never lost the opportunity, often in the evening to spend time on his 'pets' the Oleaceae and *Jasminum* in particular. A very perceptive comment in the Middlesex Chronicle in December 1982 suggested that 'Peter Green retires to start work'. How familiar that phrase is in the world of Taxonomy and how true in Peter's case.

As an Honorary Research Fellow of RBG, Kew, Peter, like many colleagues before and since, came into the herbarium most days and this allowed him to write taxonomic accounts of the Oleaceae for the *Flora of China and Thailand* as well as the majority of the text for the *Flora of Australia*, Volume 49, that dealt with the complete flora of Norfolk and Lord Howe Islands. Another very special illustrated work, published in 1996 brought together the very best skills of Peter's writing and Mary Grierson's Botanical Artistry in a volume called *A Hawaiian Florilegium, Botanical Portraits from Paradise*, published by the National Tropical Botanic Garden. This work appeared after a long delay and after many persuasive letters sent by Peter to ensure Mary's, let alone all his hard work, saw the light of day. These major works were supplemented by a substantial number of other Oleaceae and Jasmine papers that were gathered together to be presented for the award of D.Sc. that was presented by Kings College in 1997, to the pleasure of Peter's many friends and colleagues. A final and so appropriate a volume was published in 2009, written by Peter in collaboration with Diana Miller entitled *The Genus Jasminum in Cultivation*, thus bringing together both of his botanical loves, cultivated plants and his favourite genus *Jasminum*. What a fitting summation for a very fine gentleman and botanist.

To this point, this review is of Peter Green's professional life but, like so many biologists, he was generous of his 'free' time with many other organisations and causes. At Kew, he was a Vice President of the Kew Guild from 1977, becoming its President 1982–1983.

His involvement with the BSBI covers 69 years, having joined in 1945. During this time, he served on the Publications Committee for many years becoming Secretary from 1968 to 1973. He was also general referee for garden plants from 1995 to 2000, replying to the many queries from members with patience, good humour and authority. Peter attended BSBI Exhibition Meetings and Conferences with regularity, also assisting with their organisation when they were held at RBG, Kew. Peter brought all his skills and interests to bear when he edited the proceedings of the Conference on Horticulture and Field Botany, the joint meeting with the BSBI and RHS, held in September 1972. His constant support for BSBI activities made him many friends throughout the Society and he is certainly going to be missed by them all.

I would like to thank Dr I. K. Ferguson and Professor S. Owens and Mary Briggs for all the help they have provided in drawing this information together.

GREN LUCAS

PETER FREDERICK YEO
(1929–2010)

Peter Yeo was born at Kingston-upon-Thames on 30 March 1929. After schooldays at Clayesmore School he went up to Queens' College, Cambridge in 1948 to read the Natural Sciences Tripos, taking Part II Botany in 1951. He went on to postgraduate work for his PhD with Professor T. G. Tutin at Leicester, in the then-fashionable field of 'experimental taxonomy' working on the British species of *Euphrasia*. In 1953, he was appointed Taxonomist and Librarian at Cambridge University Botanic Garden, a post he held until his retirement in 1993.

Peter was a close contemporary of mine. I too came up to Queens' in 1948, and we were fellow-members of the Part II Botany class in 1950/1951, along with Franklyn Perring and Richard West amongst others. Peter's years at Clayesmore, in the diverse and beautiful Dorset countryside between Blandford and Shaftesbury, cannot have been without influence on his interest in natural history. As an undergraduate, he had a good knowledge of birds as well as flowering plants and insects; I saw my first Bewick's swan in his company at Cambridge sewage works and other species on the Staines reservoirs. Our shared interests led to many joint forays into the country around Cambridge plant-hunting and collecting Hymenoptera, especially the early species of *Andrena* and *Halictus*. That led on to collecting bees and wasps farther afield, on the Surrey commons (then much more extensive than now) and elsewhere. Peter was always careful to avoid the stings of the bees and wasps he collected; I was less cautious, and learnt at first hand about the ready and momentarily-painful stings of the spider-hunting pompilid wasps. (If you hunt such well-armed prey as spiders, it pays to use quick knock-down ammunition, and shoot first!) But Peter's carefulness and forethought stood him in good stead in his research work later. He was a quiet and rather reserved and serious person, but with a lighter side too of which perhaps only those who knew him well were aware.

Peter joined the B.S.B.I. in 1951, and he was a Fellow of the Linnean Society for 34 years. He does not seem to have been much involved in the organisation of the B.S.B.I., but he was on the Publications Committee from 1978–1987, and was known to many members as Referee for *Euphrasia*, *Geranium* and *Aster*, and through his books. His PhD work led to a number of papers in *Watsonia* in the 1950s and 1960s. He later expanded his interest in *Euphrasia* to other geographic regions, first in a joint paper with Peter Sell (1970) on the North American species, then an account of the European species for *Flora Europaea* (1972; he was also author of *Geranium*, *Acaena* and *Ruscus* in later volumes), descriptions of the Turkish species of *Euphrasia* for the *Flora of Turkey* (1978), and finally a monograph of the European species (1978). He was awarded a Leicester DSc in 1974, to which his *Flora Europaea* (and other) work on *Euphasia* and his joint authorship of the 'New Naturalist' *Pollination of Flowers* will have contributed.

Peter's job at the Cambridge Botanic Garden was ideally suited to his careful and systematic nature, and capacity for patient and persistent work. It was not a place for gathering citation statistics in the competitive publish-or-perish world of modern academia. Peter published an amply respectable amount of solid taxonomic work in his years at the 'BG', as well as his splendid book *Hardy Geraniums* (1985), revised for a second edition in 2001; his continuing interest in Hymenoptera led to a 'Naturalists' Handbook on Solitary wasps with Sally Corbet in 1983 (2nd revised edition, 1995). His scientific publications span half a century between 1954 and 2004. His major contribution was his work on the Garden's herbarium and library, and in ensuring that the plants in the Garden itself were accurately named, and in this work he was ably supported by his long-time assistant the late Clive King. He was one those of whom it could be said *Si monumentum requiris, circumspice* [if you seek his monument – look around] but, outside the world of botanical gardens and plant taxonomy, those who could truly appreciate and value what Peter did over his 40 years tenure were all too few. He was on the Editorial Committee of the *European Garden Flora*, to which he contributed accounts of *Geranium* and *Aster*.

Some time around 1960, John Gilmour suggested that Peter and I might write a book for the 'New Naturalist' series on pollination. We agreed, and it soon became apparent that if we wanted photographs of insects visiting flowers we should have to take them ourselves.

That turned out to be part of my contribution to the book. We shared the text and drawings, Peter writing the chapters that leaned most heavily on the literature. His attention to detail and patience made him an ideal collaborator. If I had got something wrong, he would say so, in a reasoned and unprovocative way. His accounts of the mouth parts of the flower-visiting insects are scholarly and nicely accessible digests of some otherwise (for most people) esoteric entomological literature. Several books on pollination came out while we were working on ours, but as each appeared (Mary Percival, Faegri & Van der Pijl) we were able to breathe a sigh of relief: 'They haven't written *our* book.' There were interesting delays in production, one of which involved waiting for surface-mail from Tokyo, and led me to ask Michael Walter, then 'New Naturalist' editor, 'What is this; the Channel Tunnel?' (Now that we actually *have* a Channel Tunnel the force of that question in the 1970s is lost!). The book was well received, and led to Peter acquiring one of his few research students, Andrew Lack, who gained his PhD for a study of pollinator-relationships in chalk grassland (especially of the two native *Centaurea* species) on the Devil's Dyke near Newmarket.

In the 1990s we embarked on an update of the pollination book. We roped in a third author – Andrew Lack – who wrote roughly a third of the new book and suggested the new title. Peter's chapters on the pollinating insects acquired a 1990s twist (at the suggestion of Isobel Smales), with the insect mouth-parts in a series of 'boxes' nicely setting them apart from the body of the text. For Peter and me the new book highlighted how much had changed over 20 years, not only in pollination biology, but also in printing and book production. Looking back, those years of working with Peter were both a privilege and a pleasure.

On his retirement he and his wife Elizabeth moved to an idyllic stone-built village in rural Northamptonshire, but they soon moved back to Grantchester Meadows, prompted partly by Peter's continuing botanical involvement in Cambridge (a measure of his dedication and the esteem in which he was held by his peers), and partly by declining health.

We are all part of the great river of life, upon which it is given to few to make waves. All the institutions we value need talented but unobtrusive people like Peter to keep the wheels turning smoothly and productively. We should not underrate them or take them for granted. Peter's contribution, spanning half a century, was substantial and important. It is sad that Parkinson's disease should have overshadowed so much of his retirement.

MICHAEL PROCTOR

PUBLICATIONS OF P.F. YEO

(compiled by M.C.F. Proctor and C.D. Preston)

P.F.Y. is the sole author of all papers unless stated.

(1947). Display of Yellow Bunting. *British Birds* **40**: 211–212.
(1948). Renewed singing of Willow Warbler. *British Birds* **41**: 21.
(1949). Blackbird carrying nest-material in autumn. *British Birds* **42**: 59.
(1950). "Fly-catching" by Mistle-thrush. *British Birds* **43**: 403.
(1952). A possible hybrid between *Polygala vulgaris* L. and *P. calcarea* F. Schultz. [Exhibit.] *Botanical Society of the British Isles Year Book* **1952**: 56.
(1953). *Euphrasia vigursii* and *E. micrantha* × *anglica*. [Exhibit.] *Botanical Society of the British Isles Year Book* **1953**: 60.
(1954a). The cytology of British species of *Euphrasia*. *Watsonia* **3**: 101–108.
(1954b). Wild and cultivated specimens from six populations of *Euphrasia nemorosa*. [Exhibit.] *Proceedings of the Botanical Society of the British Isles* **1**: 90.
(1954c). *Halictus smeathmanellus* (Kirby) (Hym., Apidae) and its allies, in the Midlands. *Entomologist's Monthly Magazine* **90**: 221.
(1954d). *Pleione Pricei*. *Gardeners' Chronicle* **136**: 217.
(1955a). Artificial interspecific hybrids in *Euphrasia*. [Exhibit.] *Proceedings of the Botanical Society of the British Isles* **1**: 393–394.
(1955b). The species concept in *Euphrasia*, in Lousley, J.E. (ed.), *Species studies in the British flora*, pp. 128–133. Botanical Society of the British Isles, London.
(1955c). *Microdynerus exilis* (H.-S.) (Hym., Vespidae) in Middlesex and Kent. *Entomologist* **88**: 68.

(1956a). Hybridisation between diploid and tetraploid species of *Euphrasia*. *Watsonia* **3**: 253–269.
(1956b). The *Euphrasias* of Southern England. [Exhibit.] *Proceedings of the Botanical Society of the British Isles* **2**: 80–81.
(1956c). Bees and wasps in Bushy Park and at Hampton Hill, Middlesex. *London naturalist* **36**: 16–24.
(1957). August 25th, 1956. Guildford. *Proceedings of the Botanical Society of the British Isles* **2**: 421–423.
(1958). Some spring bees found in Cambridge gardens. *Nature in Cambridgeshire* **1**: 32–33.
(1959). *Fuchsia boliviana* and *Fuchsia corymbiflora*. *Baileya* **7**: 131–132.
(1960). The identity of *Aesculus neglecta* Lindley and *A. neglecta* 'Erythroblastos'. *Baileya* **8**: 59–61.
(1961a). Germination, seedlings and the formation of haustoria in *Euphrasia*. *Watsonia* **5**: 11–22.
(1961b). *Reseda stricta* Pers. *Proceedings of the Botanical Society of the British Isles* **4**: 273.
(1961c). Two *Bergenia* hybrids. *Baileya* **9**: 20–28.
(1961d). Records of Hymenoptera Aculeata from Leicestershire. *Entomologist's Monthly Magazine* **97**: 134.
(1961e). The bees and wasps of Cambridgeshire. *Entomologist's Monthly Magazine* **97**: 159–161.
(1961f). Rock garden Penstemons. *Gardeners' Chronicle* **149**: 277.
(1962a). A study of the variation in *Euphrasia* by means of outdoor cultivation. *Watsonia* **5**: 224–235.
(1962b). *Bergenia* × *Smithii*, the correct name for *B. cordifolia* × *B. purpurascens*. *Baileya* 10: 110–111.
(1962c). *Cotoneaster* 'Sabrina'. *Gardeners' Chronicle* **151**: 289.
SELL, P.D. & YEO, P.F. (1962). Some new North American eyebrights (*Euphrasia*). *Feddes Repertorium* **64**: 202–203.
(1963a). The identity of *Galanthus* × *grandiflorus* Baker. *Baileya* **11**: 59–61.
(1963b). The national species collection of tulips at Cambridge, 1962. *R.H.S. Daffodil and Tulip Year Book* **28**: 64–66.
(1963c). Some records of *Pompilus trivialis* Dahlb., *P. unguicularis* Thoms. and *P. wesmaeli* Thoms. (Hym., Pompilidae). *Entomologist's Monthly Magazine* **98**: 124.
(1963d). *Bombus soroensis* (Hym., Apidae) in Leicestershire – a correction, and *Coelocrabro ambiguus* (Hym., Specidae) in Cambridgeshire – a new record. *Entomologist's Monthly Magazine* **99**: 81.
(1964a). The growth of *Euphrasia* in cultivation. *Watsonia* **6**: 1–24.
(1964b). Resedaceae, in V.H. Heywood (ed.), Notulae systematicae ad Floram Europaeam spectantes no. 4. *Feddes Repertorium* **69**: 152–153.
(1964c). *Reseda* L., in Tutin T.G. *et al.* (eds), *Flora Europaea*, **1**: 346–349. Cambridge University Press, Cambridge.
(1964d). *Lonicera pileata* and *L. nitida* in cultivation. *Baileya* **12**: 56–66. Translated as *Lonicera pileata* and *L. nitida* in Kultur, *Deutsche Baumschule* **17**: 30–37, 1965.
(1964e). The nomenclature of *Verbena elegans*. *Gardeners' Chronicle* **156**: 570.
(1964f). Problems in the correct naming of plants in botanic gardens, in *XVIth International Horticultural Congress – 1962, Proceedings,* **5**: 89–91.
HOWARD, R.A., GREEN, P.S., BAKER, H.G. & YEO, P.F. (1964). Comments on "seed lists". *Taxon* **13**: 90–94.
(1965). The typification of *Lonicera nitida* Wilson. *Baileya* **13**: 173–174.
YEO, P.F. & KING, C.J. (1965). Methods of seed-exchange. An appeal to botanic gardens. *Taxon* **14**: 179–180.
(1966a). The breeding relationships of some European Euphrasiae. *Watsonia* **6**: 216–245.
(1966b). A revision of the genus *Bergenia* Moench (Saxifragaceae). *Kew Bulletin* **20**: 113–148.
(1966c). Two new species of *Ruscus* (Liliaceae). *Feddes Repertorium* **73**: 17–20.
(1966d). *Vitex lucens*. *Curtis's Botanical Magazine* **176**: tab. 487.
YEO, P.F. & KING, C.J. (1966). Methods of seed-exchange. *Taxon* **14**: 44.
(1967). Notes on some species of *Macleania* (Ericaceae). *Baileya* **15**: 45–59.
(1968a). The evolutionary significance of the speciation of *Euphrasia* in Europe. *Evolution* **22**: 736–747.
(1968b). *Euphrasia* L., in Perring, F.H. & Sell, P.D. (eds), *Critical supplement to the Atlas of the British Flora*, pp. 55–62. Thomas Nelson and Sons, London.
(1968c). *Glycyrriza* L., in Tutin T.G. *et al.* (eds), *Flora Europaea*, **2**: 127. Cambridge University Press, Cambridge.
(1968d). A contribution to the taxonomy of the genus *Ruscus*. *Notes from the Royal Botanic Garden, Edinburgh* **28**: 237–264.
(1968e). *Euphrasia stricta* Lehm. in Guernsey. *Proceedings of the Botanical Society of the British Isles* **7**: 383.
(1968f). Nomenclature proposals to the Seattle Congress. *Taxon* **17**: 735–741.
(1968g). *Aristolochia* confusion. *Gardeners' Chronicle* **163(9)**: 6.
MCCLINTOCK, D. & YEO, P.F. (1968). *Geranium ibericum* Cav., *G. platypetalum* Fisch. & Mey. and *G. magnificum* Hyl. *Proceedings of the Botanical Society of the British Isles* **7**: 389.
(1969a). Names ascribed by publishing authors to others. *Feddes Repertorium* **60**: 61–63. International Association for Plant Taxonomy.
(1969b). Two new *Geranium* species endemic to Madeira. *Boletim do Museu Municipal do Funchal* **23**: 25–35.

SYNGE, P.M., ed. (1969). *The Royal Horticultural Society Supplement to the Dictionary of Gardening*. Clarendon Press, Oxford. Includes accounts by P.F.Y. of *Aesculus, Androsace, Bergenia, Chrysanthemum, Cheiranthus, Corydalis, Cotoneaster, Euphrasia, Geranium, Hyacinthella, Lonicera, Macleania, Origanum, Polygonum, Rhamnus, Ruscus, Scutellaria, Viola* and *Vitex*.
(1970a). *Euphrasia brevipila* and *E. borealis* in the British Isles. *Watsonia* **8**: 41–44.
(1970b). New chromosome counts in *Euphrasia*. *Candollea* **25**: 21–24.
(1970c). The *Geranium palmatum* group in Madeira and the Canary Isles. *Journal of the Royal Horticultural Society* **95**: 410–414, with correction in **96**: 44 (1971).
(1970d). The identity of *Erodium sebaceum* Delile (Geraniaceae). *Baileya* 17: 83–90.
(1970e). New names in *Helichrysum* and *Felicia* (Compositae). *Taxon* **19**: 946.
(1970f). Further notes on *Bergenia*. *American Horticultural Magazine* **49**: 44–45.
SELL, P.D. & YEO, P.F. (1970). A revision of the North American species of *Euphrasia* (Scrophulariaceae). *Botanical Journal of the Linnean Society* **63**: 189–234.
(1971a). Revisional notes on *Euphrasia*, in V.H. Heywood (ed.), Notulae systematicae ad Floram Europaeam spectantes no. 11. *Botanical Journal of the Linnean Society* **64**: 353–361.
(1971b). Further observations on *Bergenia* in cultivation. *Kew Bulletin* **26**: 47–56.
(1971c). × *Solidaster*, an intergeneric hybrid (Compositae). *Baileya* **18**: 27–32.
(1972a). *Euphrasia* L., in Tutin T.G. *et al.* (eds), *Flora Europaea*, **3**: 257–266. Cambridge University Press, Cambridge.
(1972b). Cultivars of *Bergenia* (Saxifragaceae) in the British Isles. *Baileya* **18**: 96–112.
(1972c). Miscellaneous notes on pollination and pollinators. *Journal of Natural History* **6**: 667–686.
(1972d). Floral allurements for pollinating insects, in Emden, H.F. van (ed.), *Insect/plant relationships*, pp. 51–57. Royal Entomological Society of London, Oxford.
(1972e). A hybrid of *Mahonia siamensis*. *Journal of the Royal Horticultural Society* **97**: 35–38.
(1972f). *Mahonia siamensis* Berberidaceae. *Curtis's Botanical Magazine* **178**: tab. 605.
(1973a). The biology and systematics of *Geranium*, sections *Anemonifolia* Knuth and *Ruberta* Dum. *Botanical Journal of the Linnean Society* **67**: 285–346.
(1973b). *Geranium procurrens* Geraniaceae. *Curtis's Botanical Magazine* **179**: tab. 644.
(1973c). *Acaena*, in Green, P.S. (ed.), *Plants: wild and cultivated*, pp. 51–55. E.W. Classey, Hampton.
(1973d). The species of *Acaena* with spherical heads cultivated and naturalized in the British Isles, in Green, P.S. (ed.), *Plants: wild and cultivated*, pp. 193–221. E.W. Classey, Hampton.
(1973e). The Azorean species of *Euphrasia*. *Boletim do Museu Municipal do Funchal* **27**: 74–83.
PROCTOR, M. & YEO, P. (1973). *The pollination of flowers*. Collins, London.
(1974). Proposals to the Leningrad Congress on the nomenclature of hybrids. *Taxon* 23: 677–684.
(1975a). Some aspects of heterostyly. *New Phytologist* **75**: 147–153.
(1975b). The hybrid origin of some cultivated snowdrops (*Galanthus* – Amaryllidaceae). *Baileya* **19**: 157–162.
(1975c). The Yorkshire records of *Euphrasia salisburgensis*. *Naturalist* **no. 934**: 83–87.
(1975d). *Euphrasia* L., in Stace, C.A. (ed.), *Hybridization and the flora of the British Isles*, pp. 373–381. Academic Press, London.
(1975e). *Aster* L., in Stace, C.A. (ed.), *Hybridization and the flora of the British Isles*, pp. 412–413. Academic Press, London.
(1975f). *Geranium* species from Mount Victoria, Burma. *Notes from the Royal Botanic Garden, Edinburgh* **34**: 195–200.
(1975g). (242) *Santolina chamaecyparissus* subsp. *insularis* (Gennari ex Fiori) Yeo, stat. nov., in V.H. Heywood (ed.), Notulae systematicae ad Floram Europaeam spectantes no. 16. *Botanical Journal of the Linnean Society* **70**: 18.
YEO, P.F. & KIEFER, H. (1975). Some European Geraniums with Asiatic connections [exhibit], in Walters, S.M. & King, C.J. (eds), *European floristic and taxonomic studies*, p. 143. E.W. Classey, Faringdon.
(1976a). *Aster* L. (naturalized species), in Tutin T.G. *et al.* (eds), *Flora Europaea*, **4**: 112–116. Cambridge University Press, Cambridge.
(1976b). Artificial hybrids between some European diploid species of *Euphrasia*. *Watsonia* **11**: 131–135.
(1976c). *Prunus pseudocerasus*, the Yingtao Cherry (Rosaceae). *Baileya* **20**: 11–18.
(1976d). Materials for a Flora of Turkey XXXIII: *Euphrasia*. *Notes from the Royal Botanic Garden, Edinburgh* **35**: 53–59.
(1977a). Cranesbills and problems of their classification. *Yearbook of the British Pelargonium and Geranium Society* **22**: 18–23.
(1977b). *A guide to cranesbills (*Geranium*)*. Cambridge University Botanic Garden, [Cambridge]. A revised edition was published in 1980 and reprinted in 1981.
(1978a). *Euphrasia* L., in P.H. Davis (ed.), *Flora of Turkey and the East Aegean ialands*, **6**: 756–763.
(1978b). *Euphrasia*: a taxonomically critical group with normal sexual reproduction, in Street, H.E. (ed.), *Essays in plant taxonomy*, pp. 143–162. Academic Press, London.

(1978c). *Bomarea ×cantabrigiensis*. *The Garden* **103**: 214–215.
(1978d). A taxonomic revision of *Euphrasia* in Europe. *Botanical Journal of the Linnean Society* **77**: 223–334.
(1978e). *A partial account of* Euphrasia *in Turkey and the Caucasus*. Circulated as a xerox copy.
(1979a). *Geranium × monacense* Harz: *G. pharum* [sic]× *G. reflexum*. *BSBI News* **21**: 11.
(1979b). *Geranium* L. Key to Nepalese species, in Hara, H. & Williams, L.H.J., *An enumeration of the flowering plants of Nepal* **2**: 75–76. British Museum (Natural History), London.
(1979c). *Rubus* Tridel 'Benenden' (Rosaceae). *Baileya* 20: 152–161.
(1980a). *Ruscus* L., in Tutin T.G. *et al.* (eds), *Flora Europaea*, **5**: 73. Cambridge University Press, Cambridge.
(1980b). Proposals (72–75) affecting Articles 72 and 75 and Recommendations 73C and 73F of the International Code of Botanical Nomenclature, 1978. *Taxon* **29**: 700–701.
(1981a). Proposals to the Sydney Congress affecting the rules of nomenclature for hybrids. *Taxon* **30**: 260–273.
(1981b). Fruit-type classification in Geranium, in *XIII International Botanical Congress, Sydney, Australia 21–28 August 1981: abstracts*, p. 286. Australian Academy of Science, Sydney.
(1981c). *Erodium hymenodes*. *Geraniaceae Group News* **Winter 1981**: 8–9.
(1981d). *Euphrasia*, in Rechinger K.H., *Flora Iranica* **147**: 172–184. Akademische Druck- u. Verlagsanstalt, Graz.
YEO, P.F. & KING, C.J. (1981). *Catalogue of plants in the Cambridge University Botanic Garden*. Cambridge University Botanic Garden, Cambridge.
(1982a). Acaenas. *The Garden* **107**: 326–328.
(1982b). Fruit type and classification in *Geranium* L. [Exhibit.] *Watsonia* **14**: 235.
(1982c). Bestimmungsschlüssel für die europäischen Augentrostarten (Scrophulariaceae: Pedicularіae: *Euphrasia*). *Jahrbucher der Naussauischen Vereins für Naturkunde* **105**: 40–59.
(1982d). *Erodium pelargoniflorum* and *E. trifolium*. *Geraniaceae Group News* **7**: 8.
(1983). Records of some wasps and a bee (Hymenoptera Aculeata) from eastern England. *Entomologist's Monthly Magazine* **119**: 84.
YEO, P.F. & CORBET, S.A. (1983). *Solitary wasps*. Cambridge University Press, Cambridge.
(1984a). Fruit-discharge type in *Geranium* (Geraniaceae): its use in classification and its evolutionary implications. *Botanical Journal of the Linnean Society* **89**: 1–36.
(1984b). 17–18, *Geranium pylzowianum*, the 'rice-grain' *Geranium* and its mysterious ally. *Kew Magazine* **1**: 111–118.
(1984c). *Geranium candicans* and *G. yunnanense* of gardens. *The Garden* **109**: 36–37. [Actually published December 1963.]
WALTERS, S.M., BRADY, A., BRICKELL, C.D., CULLEN, J., GREEN, P.S., LEWIS, J., MATTHEWS, V.A., WEBB, D.A., YEO, P.F. & ALEXANDER, J.C.M., eds (1984). *The European garden flora*, **II**. Cambridge University Press, Cambridge. Includes accounts by P.F.Y. of *Alocasia* (with D.J. Leedy & T.B. Croat), *Amorphophallus*, *Anubias*, *Arum* (with D.A. Webb), *Biarum*, *Caladium* (with M.T. Madison), *Callopsis*, *Colocasia*, *Dieffenbachia*, *Dracunculus* (with D.A. Webb), *Homalomena* (with D.J. Leedy), *Nephthytis*, *Peltandra*, *Pinellia* (with D.A. Webb), *Pistia*, *Rhaphidophora*, *Rhektophyllum*, *Rhodospatha*, *Sauromatum*, *Schismatoglottis*, *Spathicarpa*, *Spathyphyllum*, *Stenospermation*, *Synandrospadix* and *Zantedeschia*.
(1985a). *Hardy Geraniums*. Croom Helm, London. (Re-published with minor corrections by B.T. Batsford, London, in 1992; a translation by M. Zerbst was published as *Geranium: Freiland-Geranien für Garten und Park* by Eugen Ulmer Verlag, Stuttgart, in 1988.)
(1985b). (57)–(58) Problems with the nomenclature of nothotaxa in the Sydney Code: alternative viewpoints and two proposals to amend. *Taxon* **34**: 337–341.
DAHLGREN, R.M.T., CLIFFORD, H.T. & YEO, P.F. (1985). *The families of the monocotyledons: structure, evolution, and taxonomy*. Springer-Verlag, Berlin.
(1986a). Hybrid nomenclature: principles, practice and problems. *Acta Horticulturae* **182**: 53–58.
(1986b). The nomenclature of *Helleborus lividus* Aiton sens. lat. (Ranunculaceae). *Taxon* **35**: 156–161.
(1986c). (89)–(90) Problems with the nomenclature of nothotaxa in the Sydney Code: a reconsideration with two proposals to amend and the withdrawal of two previous proposals. *Taxon* **35**: 185–188.
(1986d). (204)–(213). Alternative proposals for the amendment of Art. 46. *Taxon* **35**: 813–816.
(1986e). (321) Proposal to alter a recommendation in Appendix I of the Code. *Taxon* **35**: 884–885.
(1986f). (323A)–(327) Proposals to amend the Code for names of hybrids. *Taxon* **35**: 887–888.
(1986g). Growing *Geranium maderense*. *Geraniaceae Group News* **Summer 1986**: 6–7.
WALTERS, S.M., BRADY, A., BRICKELL, C.D., CULLEN, J., GREEN, P.S., LEWIS, J., MATTHEWS, V.A., WEBB, D.A., YEO, P.F. & ALEXANDER, J.C.M., eds (1986). *The European garden flora*, **I**. Cambridge University Press, Cambridge. Includes accounts by P.F.Y. of *Bellevalia*, *Brimeura*, *Caliphruria*, *Danaë*, *Daubenya*, Ephedraceae, *Eucharis*, *Eustrephus*, *Geitonoplesium*, *Gladiolus*, Gnetales (unattributed), *Hyacinthella*, *Hyacinthus*, *Lapageria*, *Pamianthe*, *Philesia*, *Ruscus*, *Semele*, *Tricyrtis* and *Vallota*.

(1987a). Secondary pollen presentation, in *XIV International Botanical Congress, Berlin (West), 24 July to 1 August 1987: Abstracts*, p. 225.
(1987b). John Scott Lennox Gilmour (1906–1986). [Obituary.] *Watsonia* **16**: 459–460.
WIDLER-KIEFER, H. & YEO, P.F. (1987). Fertility relationships of *Geranium* (Geraniaceae) Sect. *Ruberta*, *Anemonifolia*, *Lucida* and *Unguiculata*. *Plant Systematics and Evolution* **155**: 283–306.
(1988a). Response to Greuter's note on the name of the Corsican Hellebore. *Taxon* **37**: 468–469.
(1988b). *Ceonothus* 'Cynthia Postan', a fine compact shrub. *The Plantsman* **10**: 85–87.
(1988c). *Acaena, taxa with spherical heads, in Rich, T.C.G. & Rich, M.D.B. (eds), Plant crib, pp. 52–53. Botanical Society of the British Isles, London.*
(1988d). *Aster, Michaelmus [sic] daisies, in Rich, T.C.G. & Rich, M.D.B. (eds), Plant crib, p. 96. Botanical Society of the British Isles, London.*
(1988e). Report of the Committee for Hybrids. *Taxon 37: 438.*
(1988f). *Geranium sessiliflorum* × *G. traversii:* 'Stanhoe', a new cultivar name. *Geraniaceae Group News* **28**: 2–5.
(1988g). Native Americam geraniums cultivated in England. *Geraniums around the world* **36**: 4–7.
(1988h). *Geranium deltoideum* new to cultivation. *Geraniaceae Group News* **31**: 8–9.
(1989a). What is happening to the monocotyledons? *Plant Systematics and Evolution* **167**: 75–86.
(1989b). Additional notes on *Geranium swatense*. *Geraniaceae Group News* **32**: 5–6.
(1989c). Cranesbills for sun and shade. *Plants and gardens* **2**: 72–75.
(1989d). Undervalued begonia. *The Garden* **114**: 460.
WALTERS, S.M., ALEXANDER, J.C.M., BRADY, A., BRICKELL, C.D., CULLEN, J., GREEN, P.S., HEYWOOD, V.H., MATTHEWS, V.A., ROBSON, N.K.B., YEO, P.F. & KNEES, S.G., eds (1989). *The European garden flora,* **III**. Cambridge University Press, Cambridge. Includes accounts by P.F.Y. of *Celtis*, *Ulmus* and *Zelkova*.
(1990a). Butterbur forms – some answers. *BSBI News* **55**: 12.
(1990b). A redefinition of *Verbena brasiliensis*. *Kew Bulletin* **45**: 101–120.
(1990c). Up-date on *Begonia* 'Radium'. *The Garden* **115**: 386.
(1990d). Records of Sphecidae (Hym.) from Cambridge including two species new to vice-county 29. *Entomologist's Monthly Magazine* **126**: 101–102.
YEO, P.F. & WIDLER-KIEFER, H. (1990). The chemotaxonomy of *Geranium* (Geraniaceae). *Plant Systematics and Evolution* **173**: 1–15.
(1991a). The classification of Geraniaceae, in Vorster, P. (ed.), *Proceedings of the International Geraniaceae symposium held at the University of Stellenbosch, Republic of South Africa, 24–26 September 1990*, pp. 1–22. University of Stellenbosch, Stellenbosch.
(1991b). Lectotypification of the name *Erodium* L'Héritier and the correct names of the subdivisions of *Monsonia* Linnaeus, in Vorster, P. (ed.), *Proceedings of the International Geraniaceae symposium held at the University of Stellenbosch, Republic of South Africa, 24–26 September 1990*, pp. 227–233.
(1992a). *Ceonothus* 'Cynthia Postan': the parentage revealed. *The Plantsman* **14**: 45–47.
(1992b). A revision of *Geranium* L. in south-west China. *Edinburgh Journal of Botany* **49**: 123–211.
(1992c). *Erodium acaule*. *Geraniaceae Group News* **46**: 4–5.
(1993a). *Secondary pollen presentation: form, function and evolution.* (Plant Systematics and Evolution Supplementum 6). Springer-Verlag, Vienna.
(1993b). Platycodoneae, a new tribe in Campanulaceae. *Taxon* **42**: 109.
(1993c). *Reseda* L., in Tutin T.G. *et al.* (eds), *Flora Europaea*, **1**, 2nd ed.: 418–420. Cambridge University Press, Cambridge.
(1995). *Geranium antrorsum* stocks in cultivation. *Geraniaceae Group News* **58**: 12.
CULLEN, J., ALEXANDER, J.C.M., BRADY, A., BRICKELL, C.D., GREEN, P.S., HEYWOOD, V.H., JÖRGENSEN, P.-M., JURY, S.L., KNEES, S.G., LESLIE, A.C., MATTHEWS, V.A., ROBSON, N.K.B., WALTERS, S.M., WIJNANDS, D.O. & YEO, P.F., eds (1995). *The European garden flora,* **IV**. Cambridge University Press, Cambridge. Includes accounts by P.F.Y. of *Acaena* and *Bergenia*.
YEO, P.F. & CORBET, S.A. (1995). *Solitary wasps.* 2nd ed. Richmond Publishing Co., Slough.
PROCTOR, M., YEO, P. & LACK, A. (1996). *The natural history of pollination*. HarperCollins, London.
(1997a). Bees at Horningsea. *Nature in Cambridgeshire* **39**: 16–17.
(1997b). Me and my tree. *BWARS Newsletter* **Autumn 1997**: 7.
CULLEN, J., ALEXANDER, J.C.M., BRICKELL, C.D., EDMONDSON, J.R., GREEN, P.S., HEYWOOD, V.H., JØRGENSEN, P.-M., JURY, S.L., KNEES, S.G., MATTHEWS, V.A., MAXWELL, H.S., MILLER, D.M., NELSON, E.C., ROBSON, N.K.B., WALTERS, S.M. & YEO, P.F., eds (1997). *The European garden flora,* **V**. Cambridge University Press, Cambridge. Includes accounts by P.F.Y. of *Ardisia*, *Erodium*, *Geranium*, *Maesa* and *Myrsine*.
(1998a). Ruscaceae, in Kubitzki, K. (ed.), *The families and genera of vascular plants* **3**: 412–416. Springer, Berlin.
(1998b). *Acaena*, taxa with spherical heads, in Rich, T.C.G. & Jermy, A.C. (eds), *Plant crib 1998*, pp. 154–155. Botanical Society of the British Isles, London.

(1998c). *Aster 1. Michaelmas daisies, in Rich, T.C.G. & Jermy, A.C. (eds), Plant crib 1998*, pp. 303–304. Botanical Society of the British Isles, London.

(1998d). Not *G. tripartitum. Geraniaceae Group News* **68**: 20.

(1998e). BWARS field meeting, 12–19 July, 1997. *BWARS Newsletter Autumn* **1998**: 6–11.

(1999). How *Geranium flowers are adapted to their pollinators. Geraniaceae Group Associated Notes* **6**: 12–17.

CULLEN, J., ALEXANDER, J.C.M., BRICKELL, C.D., EDMONDSON, J.R., GREEN, P.S., HEYWOOD, V.H., JØRGENSEN, P.-M., JURY, S.L., KNEES, S.G., MAXWELL, H.S., MILLER, D.M., ROBSON, N.K.B., WALTERS, S.M. & YEO, P.F., eds (2000). *The European garden flora,* **VI**. Cambridge University Press, Cambridge. Includes accounts by P.F.Y. of *Aster*, *Kalimeris*, *Solidago* and × *Solidaster*.

(2001). *Hardy Geraniums*. 2nd ed. B.T. Batsford, London.

(2002a). A new identity for the Alderney Crane's-bill: *Geranium herrerae* Knuth. *BSBI News* **89**: 24–25.

(2002b). *Milton Country Park bees and wasps (Hymenoptera, Aculeata).* Friends of Milton Country Park, Cambridge.

(2003a). The taxonomic and conservation status of *Geranium purpureum* (Little-Robin) subsp. *forsteri*. *BSBI News* **93**: 30–33.

(2003b). The typification and correct citation of the name *Geranium purpureum* Vill. subsp. *forsteri* (Wilmott) H.G. Baker. *Watsonia* **24**: 533–535.

(2004). The morphology and affinities of *Geranium* sections *Lucida* and *Unguiculata*. *Botanical Journal of the Linnean Society* **144**: 409–429.

In addition, P.F.Y. reviewed books for various journals, including *Biological Journal of the Linnean Society*, *British Book News*, *Gardeners' Chronicle*, *Journal of Ecology*, *New Phytologist*, *Science Progress*, *The Garden* and *Watsonia*.

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