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Use of herbarium material for mapping the distribution of *Erophila* (Brassicaceae) taxa *sensu* Filfilan & Elkington in Britain and Ireland

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ABSTRACT

Specimens held in herbaria are a major botanical resource in Britain and Ireland but are currently being under-utilised by botanists in Britain and Ireland. The distribution of the taxa within the genus *Erophila* in Britain and Ireland has been selected as an example to illustrate the importance of herbarium specimens and one use for the collections.

Keywords: Erophila verna, Erophila majuscula, Erophila glabrescens.

INTRODUCTION

Herbarium specimens are a major botanical resource which can be used for a range of purposes including taxonomic research, verification of identification, to provide geographical, historical and ecological information, and as an educational resource. The long history of collecting in Britain and Ireland means that a wealth of plant material is held in publicly accessible collections in Museums, Universities and other institutions around the British Isles.

Herbaria are currently being under-utilised by botanists in Britain and Ireland. For example, Rich & Sydes (1999) investigated two species included in the Scarce Plants Project and were able to trace 209 records in nine major herbaria additional to the 40 records in the Scarce Plants Database. The under-utilisation of herbaria may be a function of the increasing quality of books and illustrations allowing identification without comparison against a set of reference material, and the change in attitude to collecting related to concern for conservation of the plants. It may also simply be due to botanists, being unaware of the importance of existing collections or that they are accessible to the public. Limited public spending and increasing financial pressures have meant that it is becoming increasingly difficult to justify spending money on maintaining and enhancing

TABLE	1.	NUMBER	(AND	%) 0	FRECO	DRDS	OF	EROF	HILA	SPECIES	FROM
DIFFERENT PARTS OF THE BRITISH ISLES											

Area	E. majuscula	E. verna	E. glabrescens
Southern England (v.cc. 1-32)	65 (50%)	656 (48.5%)	59 (22%)
Northern England (v.cc. 33, 34, 36-40, 53-70)	24 (18.5%)	320 (23.5%)	84 (31.5%)
Wales	11 (8.5%)	116 (8.5%)	21 (8%)
Scotland	17 (13%)	122 (9%)	61 (23%)
Ireland	13 (10%)	128 (9.5%)	39 (14.5%)
Channel Islands	0 (0%)	11 (0.8%)	2 (0.7%)



FIGURE 1. Distribution of all *Erophila* records held in the Fielding Druce herbarium, University of Oxford (**OXF**), showing the strong local representation.

herbaria which are not being used. Some financial controllers have even questioned the value of keeping herbaria at all.

The distribution of the taxa within the genus *Erophila* in Britain and Ireland has been selected as an example to show one role that herbarium collections can play in botanical research, as one of a range of issues being considered by the Herbarium Managers' Group of the UK Systematics Forum. The UK Systematics Forum was set up in 1994 to promote co-ordination and communication between the major UK collections-holding institutions and the wider systematics community, and a national strategy for systematic biology research has been drawn up in which zoological and botanical collections play a major role.

Filfilan (1984; summarised in Filfilan & Elkington 1988, 1998, and Elkington 1991) carried out a cytotaxonomic study of *Erophila* populations in Britain, the results of which were correlated with those of Winge (1940). Three groups of cytotypes were distinguished at the specific level: *Erophila majuscula* Jordan, a densely hairy diploid, *E. verna* (L.) Chevallier *sensu stricto*, a medium polyploid, and *E. glabrescens* Jordan, a sparsely hairy to glabrous high polyploid. The distributions were summarised by vice-county in Filfilan & Elkington (1998), but no distribution maps were presented. Hectad (10 km × 10 km square) maps of these species are required for the B.S.B.I. *Atlas* 2000 project, but relatively few records have been verified to species level. The opportunity was taken to draw together records for these species in selected major herbaria to show the wealth of information available.



Figure 2. Distribution of Erophila majuscula based primarily on herbarium records.

METHODS

Data on specimens were abstracted onto standard "pink cards" from material held in the following herbaria (abbreviations follow Kent & Allen 1984): **BEL** (74 sheets), **BM** (400 sheets, c. half the material), **DBN** (145 sheets, mostly named by Elkington & Filfilan), **E** (c. 200 sheets, partly named by Elkington & Filfilan), **K** (129 sheets, c. half the material), **LANC** (25 sheets, Cumbria material determined by T. T. Elkington only), **LIV** (155 sheets), **MANCH** (157 sheets), **NMW** (161 sheets, partly named by Elkington & Filfilan), **OXF** (189 sheets, many with up to 5 or 6 collections on each sheet), **RNG** (114 sheets) and **TCD** (32 sheets). Identifications by T. T. Elkington and/or S. A. Filfilan were accepted directly, with other material named by T. C. G. Rich. Grid references were allocated to the most appropriate hectad (10 km \times 10 km square) following standard B.R.C. practice, though in some cases the original locations were not known with certainty (e.g. "near Manchester"; **LIV**). The handwriting on some sheets was difficult to read, and minor discrepancies were encountered between apparent duplicates. The labelling on some sheets is so poor (e.g. Druce's material in **OXF**) that some records were not included to avoid errors. Other records with illegible handwriting, or where the locality was ambiguous or could not be traced, have not been included on the maps.



FIGURE 3. Distribution of Erophila verna sensu stricto based primarily on herbarium records.

A few additional records published in the literature and other records held by the Biological Records Centre (BRC), Monks Wood have been included, but no systematic search for other records has been carried out so that the maps very largely represent the data held in herbaria. The pink cards have been deposited at BRC, to which requests for details of the records should be addressed.

RESULTS

The exercise in collating records also provided an opportunity to test the taxonomy, which on the whole was found to work well. *E. majuscula* is a distinct species with a dense rosette (due to the short petiole), dense hairs and obovate fruits. In most cases identifications were checked by measuring seed sizes. *E. glabrescens* by comparison is sometimes difficult to separate from *E. verna*, and the dividing line between the two on sparsely hairy plants would appear to be somewhat arbitrary. The extent to which the petals are bifid does not appear to correlate well with hairiness and has not been used by TCGR. On mixed sheets, plants allocated to this species were almost always the smallest, and one wonders if hairiness is somewhat dependent on growth/habitat. A strict view of *E. glabrescens* has been taken to include only the most sparsely hairy plants. Most material was referable to the variable *E. verna sensu stricto*, of which a broad view has been taken.



Figure 4. Distribution of Erophila glabrescens based primarily on herbarium records.

The correspondence between different herbaria and with specimens named by Filfilan and Elkington was found to be good, though it would not be too surprising if some duplicate collections in different herbaria have been given different names. It was not possible to name some immature or senescent material. Mixed collections do occur quite regularly, matching the situation in the field. Some *Erophila* names have been used historically in a different sense to how they are used by Filfilan & Elkington, and it is not possible to use old names, with the possible exception of material named as *E. virescens* Jordan by E. S. Marshall, which is usually *E. majuscula*.

The herbaria were found to have very strong representations of local material, with patchy representation of specimens from elsewhere. For example, Fig. 1 shows the distribution of all *Erophila* records held in **OXF**, which, as might be expected, shows a strong concentration from Oxfordshire.

The maps for the three species are shown in Figs 2–4. Records for *E. verna* s.s. var. *praecox* (Steven) Diklic were also abstracted from some, but not all, herbaria, and are shown in Fig. 5. The numbers of records from various parts of the British Isles are summarised in Table 1.

The numbers of distinct collections per decade (i.e. excluding duplicates) are summarised for all three species in Fig. 6. The changes with time reflect variation in collecting effort rather than changes in frequency of the plants (Rich 1997). There is a peak in collecting around the turn of the century when botanists such as E. S. Marshall and J. E. Little collected large quantities of material. Most post-1980 records are from Cumbria, Monmouthshire and Ireland.



FIGURE 5. Distribution of Erophila verna var. praecox based on herbarium records.

DISCUSSION

The maps show how the large number of specimens held in UK and Irish collections can be used to provide valuable information on distribution. With any taxonomic revision there is an immediate requirement for information to bring the data up to a comparable standard with other taxa, and the collections provide an efficient means of doing this. Other taxa in the British Isles for which additional data are required for the *Atlas 2000* project include the *Juncus bufonius*, *Utricularia intermedia* and *Luzula multiflora* aggregates.

Whilst perhaps up to 20% of the *Erophila* material in different herbaria is duplicated (often material distributed through Botanical Exchange clubs), the majority is unique and often shows a strong local representation. For instance, there is much material from Edinburgh in **E**, from the Merseyside area in **LIV** and from Glamorgan in **NMW**. It is thus important to examine material from a range of herbaria to obtain a general overview of the distribution. However, a comparison of the summary map of all records (Fig. 7) with that from the *Atlas of the British flora* (Fig. 8) shows that some areas are still under-represented in herbaria compared to the frequency in the field, and caution is required in drawing firm conclusions about distribution or frequency based on herbarium material alone. Nonetheless, the information is invaluable for indicating which species may be present in an area and hence should be searched for.



FIGURE 6. Number of records per decade for *Erophila majuscula* (□), *E. verna* (■) and *E. glabrescens* (×)



FIGURE 7. Distribution of Erophila verna sensu lato combined from Figs 1-5.



FIGURE 8. Distribution of Erophila verna sensu lato (Perring & Walters 1962).

The maps show that *E. majuscula* is the least common species, collected most frequently in southern Britain (Table 1) and becoming scattered or rare elsewhere. It is probably sufficiently uncommon to qualify as a Nationally Scarce species. *E. glabrescens* is not common but is widespread, and may be the commonest taxon in the north and west of both Britain and Ireland. *E. verna* s.s. is the commonest and most widespread species.

Examination of the herbarium material has also resulted in additional records for many Vicecounties to be found. The lists of Vice-counties for which we have seen specimens of each species are as follows (78 records new to the list of Vice-counties given in Filfilan & Elkington 1998 are given in **bold**):

- *E. majuscula*: V.c. **1**, **5**, **6**, 7, 9, 11, **12**, 13, 14, 16, 17, 18, 20, **21**, 22, 23, 26, **27**, 28, 31, **32**, 33, 34, 38, **40**, **41**, **49**, 50, **51**, **55**, 57, 58, **59**, 62, 64, 65, **68**, 78, 80, 82, 83, **85**, **90**, 95, H9, H15, H17, H21, H22, H37, H38 and H40.
- *E. verna*: V.c. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, **36**, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, **48**, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 62, 64, 65, 66, 67, 68, 69, 70, 72, **73**, **76**, **77**, 78, 79, 80, **82**, 83, **84**, 85, 86, 87, 88, 89, 90, **91**, **92**, **94**, **95**, **96**, **97**, **98**, **99**, **100**, **103**, **105**, 106, 107, 108, 109, 110, 111, H1, H2, H3, H4, H5, H6, H7, H8, H9, H10, H11, H12, H13, H15, H16, H17, H18, H19, H20, H21, H22, H23, H24, H25, H26, H30, H31, H33, H35, H36, H37, H38, H39 and H40.

E. glabrescens: V.c. **1**, 3, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, **21**, 23, **24**, 26, **27**, **28**, 29, 30, **31**, **33**, 34, 35, 36, **37**, 38, **40**, **41**, **42**, 43, **44**, 46, **47**, **49**, 51, 52, 54, 55, 56, 57 58, 59, 60, 62, 63, 64, 65, 66, 69, **70**, **72**, 73, **74**, **76**, 77, 78, 79, 80, **81**, 82, **83**, 85, 88, **89**, 90, **94**, **95**, 96, 98, 100, 101, 106, 107, 108, 109, 110, **111**, **H6**, **H8**, H9, H11, H15, **H16**, H17, H20, **H21**, **H23**, **H27**, **H28**, **H30**, **H34**, **H36**, **H38**, H39 and S.

Filfilan & Elkington (1998) suggested that the map of *E. verna* subsp. *spathulata* (Lang) Walters in Perring (1968) was applicable to their var. *praecox*. However, a number of the populations in the west with short fruits are *E. glabrescens* rather than *E. verna*; Perring's (1968) map is therefore not completely consistent with the modern treatment. The different distribution of this variety suggests that there may be some merit in retaining it as a taxon, though what the ecological basis for the difference in distribution is requires investigation (e.g. van Andel *et al.* 1986).

The importance of herbarium material to botanical research must be stressed to the B.S.B.I. membership. Whilst many herbaria only lend specimens to recognised institutions (e.g. local Museums), and some do not have the resources to post material, in most cases requests to visit or borrow material will be welcomed.

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