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An account of *Orobanche* L. in Britain and Ireland

J. RUMSEY and S. L. JURY

Department of Botany, University of Reading, P.O. Box 221, Reading, Berkshire, RG6 2AS

ABSTRACT

Morphological descriptions are given of the 14 species of *Orobanche* (Orobanchaceae) recorded in the British Isles, together with separate keys for identifying fresh material and herbarium specimens. Accounts of the history of the species are presented together with illustrations and distribution maps. The variation in *Orobanche minor* is accounted for with the recognition of four varieties.

INTRODUCTION

The genus *Orobanche* is renowned as a taxonomically very difficult one. In most cases this is a result of many of the useful characters becoming lost on drying, and the lack of adequate field notes. Plants which are very distinct in the field become reduced to a hideous brown uniformity when pressed. Therefore, herbarium specimens are often incorrectly determined (an average of 5–10% in fact). The loss of characters on drying, considerable intra-specific variation, confusing synonymies, incorrectly cited names and badly described species with poor types (often with different species on the same sheet) have done little to generate interest in the genus. Too many botanists have shown a reluctance to deal with this genus in herbaria, perpetuating the myth that the species are impossible to identify once dried. Certainly, *Orobanche minor* Sm. and its close relatives often cannot be positively determined without descriptive notes made at the time of gathering, but all other species from the British Isles are distinct enough not to need any additional information.

It is hoped that this account will stimulate other botanists to study, identify and record members of this fascinating parasitic genus in Britain and Ireland, as well as clear up some errors and confusions made in the past.

If more than one English name is in common usage, then they are all given, but the first is the name recommended by Dony, Jury & Perring (1986).

Chromosome numbers are given where known. Counts from British material (Hambler 1958) are marked by an asterisk. All other counts are from European material (Moore 1982).

Distribution maps are based on herbarium material from **BM**, **CGE**, **E**, **K**, **LIV**, **MANCH**, **NMW** and **RNG**, together with selected records from the Biological Records Centre.

CHARACTERS OF TAXONOMIC IMPORTANCE

Populations of *Orobanche* species are often enormously variable with regard to such characters as size, colouration and pubescence, yet these details are seldom recorded on specimen labels. Because of this variation and their use in the taxonomy of the genus, care should be taken not to rely on a single character in isolation.

Most of the British species have a restricted host range and it is therefore important to identify and record this. Unfortunately, this seemingly simple task is often almost impossible: it is not easy (nor often desirable!) to dig up the plants to observe connections between host and parasite. If the host species has to be guessed, this should be stated, and other surrounding species noted. Too often an incorrect plant has been given as the host and this has wrongly influenced later determination.

Other characters to pay particular attention to include: the overall stature of the plant; the degree of swelling at the base (though where a species has several host species, such as *Orobanche minor*, these host taxa will obviously influence the *Orobanche* morphology); colour and degree of stem

pubescence; length and pubescence of bracts; presence or absence of bracteoles; length, shape and venation of the calyx (though this may vary considerably on a single plant); position, shape and size of the lobes of the upper and lower corolla lips, the height of insertion of the stamens, the position and degree of the stamen pubescence, and the colour and degree of fusion of the stigma lobes.

Pubescence of the anthers has been used as an important diagnostic character for taxa within section *Trionychon* Wallr. but not for those within other sections of the genus (Webb & Chater 1972). All British taxa of section *Orobanche* have hairless anthers.

Preliminary investigations of seed morphology (Rumsey unpubl.) reveal great variability in size and shape from single capsules and preclude reliable discrimination of the taxa considered here with a single exception. *O. ramosa* L. subsp. *ramosa* is distinct in having a secondary layer of reticulation to the surface of the cells and not just the small circular to ovoid pits seen in all other British taxa.

KEYS TO THE SPECIES

Two keys are provided. The first is for fresh material and includes characters not available from herbarium specimens; for these the second key should be used. However, as more reliable characters are included in the first key, this should be used whenever possible.

KEY TO FRESH MATERIAL

1. Flowers with bracteoles; capsule valves free above 2
1. Flowers without bracteoles; capsule valves coherent above 4
2. Stem usually simple, c. 8 mm diameter; corolla narrowly campanulate; on *Achillea millefolium* ..... 3. *purpurea*
2. Stem branched, slender, c. 5 mm diameter; corolla infundibuliform or tubular-infundibuliform; on various hosts 3
3. Flowers 18–35 mm, infundibuliform; pedicels to 20 mm; anthers hairy ..... 2. *aegyptiaca*
3. Flowers 10–18 mm, tubular-infundibuliform; pedicels to 8 mm; anthers glabrous 1. *ramosa*
4. Plant with conspicuous sweet scent 5
4. Plant unscented, or if with a scent, then foetid 7
5. Stigma cream to reddish-pink at anthesis; corolla lips divergent ..... 12. *crenata*
5. Stigma purple, orange or dark-red at anthesis; corolla lips not divergent 6
6. Corolla 20–32 mm; stem yellowish or pale pink; on Rubiaceae ..... 7. *caryophyllacea*
6. Corolla 15–20 mm; stem purplish-red; on *Thymus* ..... 5. *alba*
7. Stigma lobes yellow, at least at first 8
7. Stigma lobes purple, red or brown 13
8. Corolla longer than 18 mm; stems usually 8 mm or more wide; plants usually over 40 cm tall 9
8. Corolla to 22 mm, but usually less than 18 mm; stems less than 8 mm wide, plants usually less than 40 cm tall 12
9. Flowers campanulate; stamens inserted less than 2 mm above base of corolla tube; parasitic on shrubby legumes ..... 4. *rapum-genistae*
9. Flowers broadly tubular; stamens inserted more than 2 mm above base of corolla tube; not parasitic on Leguminosae 10
10. Stigma becoming reddish-purple; lower lip conspicuously ciliate; stamens inserted 2–3 mm above base; parasitic on *Berberis* ..... 14. *lucorum*
10. Stigma not becoming reddish; lower lip at most minutely ciliate; stamens inserted 3–6 mm above base; parasitic on Compositae 11
11. Upper lip two-lobed, lower lip with the middle lobe the largest; style exserted; parasitic on *Petasites* and *Tussilago* ..... 13. *flava*
11. Upper lip entire to shallowly two-lobed, lower lip with subequal lobes; style not exserted; parasitic on *Centaurea* spp., usually *C. scabiosa* ..... 8. *elatior*
12. Stem purplish; flowers with a constricted mouth, spike lax; parasitic on Araliaceae, usually *Hedera* ..... 11. *hederae*
12. Stem yellow; flowers not constricted; spike short and dense; parasitic on Compositae, usually

Hypochaeris ..... 10. *minor*

13. Corolla broadly cylindrical-campanulate, with dark glands distally; filaments glabrous at base, glandular above ..... 6. *reticulata*
13. Corolla tubular or narrowly campanulate, without dark glands; filaments glabrous to hairy below, glabrous above 14
14. Plant very pale, hairy; upper lip porrect; filament bases with shaggy covering of whitish hair; calyx with long filiform limbs; parasitic on *Picris*, and occasionally *Crepis*; very rare 9. *loricata*
14. Plant variously suffused with purple; upper lip forwardly directed; filament bases sub-glabrous, rarely hairy; calyx teeth acute but never filiform; on various hosts .....10. *minor*

KEY TO HERBARIUM MATERIAL

1. Flowers with bracteoles (sometimes lost); corolla constricted just above the ovary; capsule valves free above 2
1. Flowers without bracteoles; corolla, if constricted, then only at distal end; capsule valves coherent above 4
2. Stem usually simple, c. 10 mm diameter; flowers glandular-puberulent ..... 3. *purpurea*
2. Stem usually branched, c. 5 mm diameter; flowers glandular-pubescent 3
3. Corolla 18–35 mm, infundifolium; pedicels to 20 mm; anthers hairy ..... 2. *aegyptiaca*
3. Corolla 10–18 mm, tubular-infundibuliflorum; pedicels usually c. 3 mm; anthers glabrous .. .. 1. *ramosa*
4. Bracts villous; lips of corolla divergent, corolla (14–) 20–30 mm, pale, but lips conspicuously veined ..... 12. *crenata*
4. Bracts hairy, but never villous; lips of corolla not divergent, corollas of various sizes and colouration 5
5. Flowers broader than 7 mm diameter 6
5. Flowers narrower than 7 mm diameter 9
6. Corolla conspicuously campanulate, pubescent; filaments inserted less than 2 mm above base 7
6. Corolla widely tubular to narrowly campanulate, sub-glabrous; filaments inserted more than 2 mm above base 8
7. Stigma very dark, filaments hairy below ..... 7. *caryophyllacea*
7. Stigma pale, filaments glabrous below ..... 4. *rapum-genistae*
8. Corolla with dark glands; stamens inserted 2–4 mm above base, subglabrous below .... 6. *reticulata*
8. Corolla without dark glands; stamens inserted 4–6 mm above base, hairy below . 8. *elatior*
9. Plant to 75 cm; stem to 12 mm wide; flowers in upper third of stem; stamens inserted 4–6 mm above base, filaments glandular above ..... 8. *elatior*
9. Plants almost always less than 60 cm; stem to c. 8 mm wide, occasionally more; stamens inserted less than 4 mm above base, filaments glabrous above 10
10. Stamens inserted less than 2 mm from base; calyx usually entire; stem to c. 25 cm; flowers shiny, dark red-brown ..... 5. *alba*
10. Stamens inserted more than 2 mm from the base; calyx usually bifid; stem usually more than 25 cm; flowers dull, variously coloured, but not dark red-brown 11
11. Corollas usually constricted just behind mouth; spike usually lax with flowers extending for more than three quarters of the stem; usually forming a conspicuous terminal 'bud' .... 11. *hederae*
11. Corollas never constricted behind mouth, spike dense; flowers usually restricted to top half of the stem, without conspicuous terminal bud 12
12. Plants with some darker colouration on stem or flowers ..... 10. *minor*
12. Plants orange-brown, without conspicuous dark pigmentation 13
13. Plant usually greater than 30 cm; corolla to 23 mm, usually c. 19 mm, upper lip porrect; calyx with long filiform segments; flowers densely packed but covering up to half of the stem .... 9. *loricata*
13. Plant usually less than 30 cm; corolla c. 14–16 mm, upper lip forwardly directed; calyx segments acute but never longly filiform; flowers usually restricted to top third of stem .... 10. *minor*

DESCRIPTIONS OF TAXA

1. **Orobanche ramosa** L., *Sp. Pl.* 633 (1753).
Phelipaea ramosa (L.) C. A. Mey., *Enum. Pl. Cauc.* 104 (1831).

English name: Branched Broomrape.

Illustrations: Figs 1A, 4A. Photographs in Polunin & Huxley (1965: pl. 180), Huxley & Taylor (1977: pl. 274); drawings in Sowerby (1794, 3: t. 184), Martin (1965: pl. 66).

Flowering stem 5–30 cm, slender, glandular, usually branched and with a small bulbous base; yellowish suffused purple from below. Inflorescence rather lax. Bracts ovate-lanceolate, shorter than calyx; bracteoles equalling calyx, lanceolate. Calyx teeth c. 6–8 mm, lanceolate-acuminate, shorter than tube. Corolla 10–15(–17) mm, cream, blue or violet distally, whitish at base, glandular-pubescent, sub-erect at base, erecto-patent distally, constricted in the middle; base inflated, upper lip with two rounded lobes, recurved, lobes of lower lip deflexed, obtuse, entire or denticulate. Stamens inserted 3–6 mm above corolla base, just below constriction; filaments glabrous to pubescent at base; anthers glabrous or sparsely hairy at base. Stigma lobes white or bluish. Flowering July to late September. 2n=24.

Introduced but now extinct in the British Isles. Formerly parasitic on *Cannabis sativa*, when this was grown commercially in East Anglia, but recorded parasitizing over 300 species, including *Medicago sativa*.

The taxonomy of this species has been very confused in the past with over 20 variants having been described. Webb & Chater (1972) have sunk all into three rather ill-defined subspecies. The British and Irish material is referable to subsp. *ramosa*. Webb & Chater suggested that differentiation proceeded along ecological rather than geographical lines. Of these subspecies, two are restricted to southern Europe and N. Africa; only *O. ramosa* subsp. *ramosa* extends as a weed further north, being reported from 25 European countries. However, it is now regarded as extinct in six of the most northern of these, Britain included. The plant can only be regarded as a persistent casual with a lengthy history. It was known to Dillenius (Ray 1724: 288) in Suffolk at Beckles [sic] and was then considered tolerably plentiful. By the time *English Botany* was published (Sowerby 1794) the plant had become scarce and very local. This was a result of the reduction of the once great hemp cultivation in East Anglia. From 1820 onwards, the plant becomes little more than a sporadic casual throughout England, being last recorded in the 1920s. The claim for native status in the Channel Islands was based on a single specimen from La Moye, Jersey collected by A. Webster on 10 June 1913 and housed at **BM**. This was originally determined as *O. purpurea* Jacq. but correctly redetermined by Pugsley (1940). He considered it possibly native, as it was widely distributed throughout France. However, the species sensu lato is restricted as a native to the Mediterranean region and this claim should be dismissed.

Fig. 8 shows the distribution from the literature and specimens traced so far; there is a further unlocalized pre-1900 record from Kent (Philp 1982: 197).

2. **O. aegyptiaca** Pers., *Syn. Pl.* 2: 181 (1806).
Phelypaea aegyptiaca (Pers.) Walpers, *Repert. bot. syst.* 3: 463 (1844).

English name: Large-flowered Branched-broomrape.

Illustrations: Figs 1B, 4B.

Flowering stem 15–20 cm, usually branched, slender, glandular-pubescent. Inflorescence rather lax. Lower flowers usually conspicuously pedicellate. Bracts (3–)6–8(–10) mm, ovate lanceolate shorter than calyx; bracteoles filiform to lanceolate shorter than calyx. Calyx teeth to 9 mm long, lanceolate-subulate equalling to exceeding tube. Corolla 20–35 mm, lilac distally, with darker veins, cream proximally, straight or slightly curved, conspicuously infundibuliform in distal part. Stamens

inserted 3–6 mm above corolla base; filaments ± hairy below, sometimes sparsely so above; anthers villous. Stigma lobes white or bluish. Flowering period July to September. 2n = 24. Casual, parasitic on tomatoes and a wide range of other hosts.

This plant has only ever once been recorded from Britain. This was a casual occurrence on tomatoes in St Leonards Nursery near Hastings, W. Sussex in 1952. The plant was discovered by a schoolboy working at the nursery. He removed a small portion which was given to Mr D. Brightmore. This sprig was despatched to Kew for identification (22.9.1952, *Brightmore*, **K**!). Two photographs taken by Mr Brightmore are mounted on a sheet in Lousley's herbarium, now at **RNG**. The plant did not recur. This weedy species from south-eastern Europe may appear again in this country as a casual.

3. **O. purpurea** Jacq., *Enum. Stirp. Vindob.* 108, 252 (1762).
O. caerulea Vill., *Hist. Pl. Dauph.* **2**: 406 (1787).
Phelypaea caerulea (Vill.) C. A. Mey., *Enum. pl. Cauc.* 104 (1831).

English names: Purple Broomrape, Yarrow Broomrape.

Illustrations: Figs 1C, 4C. Photographs in Bichard & McClintock (1975: pl. 51), Petch & Swann (1968: pl. 72); drawings in Ross-Craig (1966: pl. 22), Butcher (1961: 283), Sowerby (1797, **6**: t. 423), Garrard & Streeter (1983: 140).

Flowering stem 15–45 cm, simple, occasionally branched from the base, usually when damaged, glandular-puberulent, mealy, especially above; dark bluish-grey, rarely yellow. Inflorescence dense, usually restricted to the top third of the shoot. Bracts 8–15 mm, lanceolate; bracteoles linear, shorter than calyx. Calyx 8–16 mm, mealy-hairy with lanceolate-acute teeth, equalling tube. Corolla 18–26(–30) mm, dull bluish-purple suffused with yellow at the base, or rarely pale lilac, erecto-patent or inflected, patent distally, about twice as long as calyx; tube constricted just below middle; upper lip of two sub-acute lobes recurved; lower lip of three sub-equal lobes ovate-elliptical, rounded to apiculate. Stamens inserted 5–8 mm above base of corolla, just below constriction; filaments glabrous to subglabrous; anthers glabrous, or rarely sparsely hairy at base and along sutures. Stigma white or pale blue. Flowering end of May until August. 2n=24. Native, parasitic on *Achillea millefolium*.

This native plant has a long history in Britain, if we accept John Goodyer's 1621 Hampshire record (Ray 1689: 174), but this has also been ascribed to *Limodorum abortivum* and *Epipactis purpurata*! However, we believe it is fairly certain he found *Orobanche purpurea* since the location and ecology favour this interpretation. It was subsequently recorded from Norfolk in 1779 (Petch & Swann 1968: 194), Suffolk in 1828 (Simpson 1982: 304) and collected on the Isle of Wight in 1841 by Bromfield (Bevis, Kettell & Shepard (1978) give the first record erroneously as 1846). It was found on the Channel Isles in 1839 (Marquand 1901) and it is there that most botanists of the period saw it.

Orobanche purpurea has been confused with the introduced *O. ramosa* and with the purplish forms of *O. minor*. This species has also been known as *O. caerulea* Vill., but *O. purpurea* Jacq. has priority. Confusion has occurred in the past with *O. arenaria* Borkh. from north-eastern France and Central Russia southwards to southern Spain and the Mediterranean, but this is a parasite of *Artemisia*, with hairy anthers, larger flowers and a different pigmentation. Material from Braye Bay, Alderney has, in some cases, sparsely hairy anthers and this could account for the mistake. It is interesting to note that the two extant populations in Guernsey have atypical colouration, i.e. they have yellow stems with lilac flowers, and thus more closely resemble *O. arenaria*.

Orobanche purpurea has always been found on *Achillea millefolium* in this country, generally on cliff-tops, or near the sea, although inland pasture sites have been known, e.g. Hoddesdon, Hertfordshire and the extant locality at Stoke in Hampshire. A summary of its distribution is given in Fig. 9.

This is a declining species, having become extinct in many of its British sites, although a new record has recently been reported near Senhouse Dock, Maryport, Cumbria by Milne (1986: 191). It is threatened by natural and human erosion and by land use changes. It has certainly declined on

the Isle of Wight, where it is more or less restricted to the Sandown area, due to over-collection which may have played a part in its demise elsewhere.

Reports of the occurrence of the plant in Cornwall have been rejected by Margetts & David (1981: 228), yet a specimen exists in **BM** (*Yackle*). The Kent station was on a disused allotment near Bishopsbourne (*Brooke*, **BM**). This small colony persisted for three years after the initial record was made. The Somerset record in the Red Data Book (Perring & Farrell 1983) is, we believe, incorrect. The Dorset record cited by Good (1984) may be correct, but we have seen no specimens, and are somewhat dubious. The plant is now apparently extinct in the Tenby area, from Chepstow and Hoddesdon, Hertfordshire. In the last site it was known from 1839 until about 1940. The plant is still extant in the Isle of Wight, having been recorded from nine stations. It is now reduced to four stations, one with a single plant in 1976 (Bevis, Kettell & Shepard 1978). In Hampshire the plant was found in a new locality in 1976 by the Rev. P. J. Chandler in a paddock at Stoke (Lady Anne Brewis, pers. comm.) where it still appears intermittently. It has also appeared on a nearby lawn. The local landowner attempts to conserve it, protecting it from hungry ponies, who seem partial to it! A specimen at **CGE** (20.6.1903, *Shedfield*) but with no other details represents the only other Hampshire record. In Norfolk the plant has eight comparatively recent localities, but is not now present in all of these. Cliff–falls would seem to be the main threat to survival. It has always been sporadic and local here, but these are still the best British, non Channel Islands populations. In Lincolnshire the plant was first discovered near a grain elevator in the Immingham Docks in 1929, and was still present in 1938 when it was dismissed as a grain alien (E. J. Gibbons, pers. comm.). However, it was rediscovered nearby in 1972 at the clay pit, Eastfield Road, N. Killingholme, growing with *O. minor*. This site is now a municipal tip. Large clumps of Yarrow were thus transplanted to a new site at the edge of the pit, provided by Conoco Ltd and elsewhere. Some of these transplants flowered in 1983. The remaining plants, which are marked and deliberately left will no doubt not survive. The new Cumbrian locality is also associated with railway lines within dockland and *O. minor* is present nearby near the northernmost extension of its range, perhaps suggesting a shared recent introduction.

The sorry decline of this species has resulted in it being given the N.C.C. category 8V; its populations are now monitored. Two stations are now present within local trust reserves and two more sites are S.S.S.I.s.

J. Scott managed to germinate seed of this species and, although it persisted for several years, it did not flower (J. Scott, pers. comm.). As transplants have proved successful it is likely that the plant may on occasion act as a short-lived perennial, but it is probably often monocarpic.

4. **O. rapum-genistae** Thuill., *Fl. Paris*, 2nd ed., 317 (1800).
O. major L., *Sp. Pl.* 632 (1753), pro parte.
O. rapum auct.

English names: Greater Broomrape, Broomrape.

Illustrations: Figs 2D, 5D. Photographs in Bichard & McClintock (1975: pl. 50 & dust jacket), Polunin (1969: pl. 131); drawings by Martin (1965: pl. 66), Ross-Craig (1966: pl. 23), Garrard & Streeter (1983: 150).

Perennial. Flowering stem simple, 20–90 cm, glandular-hairy, yellowish-red tinged, usually strongly swollen at base. Inflorescence rather dense, laxer below, extending over most of the shoot; lowest flowers well-separated. Bracts 15–30 mm, linear-lanceolate. Calyx 8–15 mm, each lip usually equally bifid. Corolla 20–25 mm, pale yellow to reddish outside, more strongly red inside, sub-erect to erecto-patent, campanulate; upper lip almost entire with spreading margins, lower lip with the middle lobe largest, all lobes ciliate; back of corolla curved throughout, glandular pubescent. Stamens inserted not more than 2 mm above base; filaments glabrous below, glandular-pubescent above. Style glandular-pubescent; stigma lobes yellow, distant. Flowering period May to early August. Visited by bees. n=19*. Native, parasitic on shrubby Leguminosae.

Identification of the plant is usually straight forward, although in some respects its common name is misleading, as *O. elatior* is often a taller plant. *Orobanche rapum-genistae* is usually stouter, with larger flowers and has a different colouration, being red-brown rather than yellowish-brown. The specific name means literally Turnip of Broom, a reference to the usually swollen base, and is not, as might be expected, an allusion to its 'shameful' life style. This species is the most obviously perennial of those found in Britain, the dead spikes being found next to those of the current year. This enables the plant to persist, even when the locality is unfavourably disturbed. However, if the host is destroyed, as happened in Bedfordshire and Hertfordshire in the severe winter of 1962/3, then the colony may be lost.

This species was at one time the most widespread and frequently encountered species of *Orobanche* in Britain. It was confused with *O. elatior* (for discussion on this see under *O. elatior*) and *O. caryophyllacea*. Unfortunately, this species has undergone a remarkable decline, for reasons which are not yet apparent. In the middle of the last century it was found in over 25 vice-counties, extending as far north as Dumfriesshire. By 1930 its range had not changed markedly, but the number of stations had dramatically decreased. This decline has continued into the 1970s, but may now have stabilized. The plant is probably now extant in c. 20 vice-counties, but in many it is restricted to a single site where its continued existence must be considered precarious. A summary of its distribution is given in Fig. 10.

The plant can persist for longer periods; thus, it was first recorded in Lincolnshire at its sole locality in 1894 and, in spite of applications of weedkiller and the area being used as a caravan site, it probably still persists. Recent records were made in 1978 (nine plants), 1980 ("2 clumps") and 1983 (three plants) (E. J. Gibbons, pers. comm.). In Sussex the plant is also reduced to a single station with a critically low population size. In 1983, two plants were all that remained after its host was largely grubbed out to open a trackway (L. B. Burt pers. comm.). The 1983 find in Norfolk (Plant Records in *Watsonia* **15**: 136, 1984), the first for over 60 years, suggests careful search may reveal this plant in more localities and vice-counties. A thriving population was recorded from N. Essex in the mid-1960s (Jermyn 1974: 146), and may still be extant, but its exact location is unknown to the vice-county recorder (K. J. Adams, pers. comm.). In Ireland, where the plant was first recorded in 1727, it now seems restricted to Co. Cork, Co. Waterford, Co. Wexford and Co. Wicklow, and, while never common, it was present in three other vice-counties and it has decreased quite markedly both in number and size of populations, and had thus been accorded 'protected' status. The plant is also tolerably plentiful on sea cliffs in Jersey and Alderney where it parasitizes *Cytisus scoparius* subsp. *maritimus*. In most British localities it preferred *Cytisus scoparius* subsp. *scoparius*, but many records exist for *Ulex europaeus*, and indeed, this is favoured in its Irish sites. A series of plants was collected in Kent in 1837 on *Genista tinctoria* (*Stevens*, **BM**), but these are the only specimens recorded for this host that we have found. A 1968 sighting on Broad Beans in a Herefordshire garden was probably the introduced *O. crenata*. As most counties still have adequate populations of *Ulex europaeus* and *Cytisus scoparius* it is probable that the decline is due to some other reason. The species is now restricted to the mildest parts of Britain, being predominantly south-western and coastal, and thus the climate may be suspected as being involved in its demise. Evidence for a climatic change corresponding to the time of extinction of most colonies is provided by the behaviour of other more mediterranean elements in our flora. However, the decline has been exacerbated by the destruction of many of our larger stands of shrubby legumes. *Orobanche rapum-genistae* seems to occur only where the host is frequent. Many promising host colonies now exist on motorway banks and along railways, and it is to be hoped that the plant will recolonise such areas.

5. **O. alba** Stephan ex Willd., *Sp. Pl.* **3**: 350 (1800).
O. rubra Sm., *English Botany*, t. 1786 (1805).
O. epithymum DC., *Fl. franc.* **3**: 490 (1805).

English names: Thyme Broomrape, Red Broomrape.

Illustrations: Figs 1D, 4D. Photographs in Polunin, (1980: pl. 47), Rosvall (1979a: 37, Fig. 3B & E, & journal cover); drawings in Martin (1965: pl. 66), Ross-Craig (1966: pl. 26), Butcher (1961, **2**: 285), Garrard & Streeter (1983: 149).

Flowering stems simple, usually 8–25 cm (occasionally to 45 cm in European specimens), dark orange-red, glandular-pubescent, slightly swollen at base. Inflorescence dense to lax, flowers usually few. Bracts 12–25 mm, lanceolate, acuminate, glandular, equal in length to the corolla. Calyx 8–16 mm usually entire, occasionally bidentate. Corolla 15–25 mm, pale cream usually strongly suffused reddish-purple, glandular-pubescent especially distally, erecto-patent, slightly curved, more strongly so at the basal and distal ends; tube campanulate-cylindrical; upper lip entire or 2-lobed; lower lip glandular-ciliate, the 3 lobes about equal, the middle just the largest. Stamens inserted 1–3 mm above the base of the corolla; filaments hairy below, glandular above. Stigma red or purplish, the lobes joined. Flowering period late May to early September. Flowers fragrant, visited by bumble-bees. 2n=38. Native, parasitic on *Thymus*.

This species was described from Cave Hill, Belfast, Ireland by J. E. Smith in Sowerby (1805, t. 1786) under the name of *Orobanche rubra* Sm. from material sent by J. E. Templeton (LINN). It was not until much later that the British and Irish plants were identified as being merely a colour variant of the continental *Orobanche alba* Stephan ex Willd. The plant was not found in Cornwall until 1842, when the Lizard Peninsula became a botanical mecca. It has only been found parasitizing *Thymus* in Britain and Ireland; records from other hosts have, in all cases, proved to be *Orobanche minor*. Rosvall (1979b) records it on *Thymus serpyllum* in Gotland. The plant when fresh is completely unmistakable, having a scent likened by J. Templeton to that of *Lonicera grata*, and a striking red colour. Large herbarium specimens are sometimes incorrectly determined as *Orobanche hederae* or *Orobanche minor*. They may be told apart by the distinct glands on the corolla, the shape and venation of the calyx teeth (compare Figs 4D, 6C & 7D) and by the characteristic shiny red-brown colour of the *O. alba* pressed plants.

The plant has undoubtedly declined somewhat in the British Isles. A summary of its distribution is given in Fig. 11. It is now believed absent from the east coast of Britain. The Lincolnshire station was possibly based on a misidentification, but its disappearance from Fife is more worrying, although careful searches here may yet reveal the plant to be still extant. In Cornwall its range has decreased, and it is now virtually restricted to the Lizard; elsewhere it was always very rare. Many of the Scottish populations have not been re-examined lately, but we should expect to find no real decline, since new stations are being discovered compensating for populations which have become extinct. Many of the remaining populations are undoubtedly very large, or perhaps it would be more accurate to say, have the potential to be very large. The plants are annuals, or possibly monocarpic and rely on good seed production and an adequate supply of the host, both features which can fluctuate from year to year, and it is therefore difficult to accurately assess population sizes. Thus, the plant is not threatened with extinction in Britain, unlike many of its close relatives. Collection in the past has probably not helped the plant, and may have caused its loss from some better known areas. Examination of herbarium material shows that collectors considered that to adequately fill a sheet many plants were needed! The Lizard population at Kynance certainly has survived this onslaught remarkably well. The habitat of the plants, on coastal rocky slopes, usually basalt, but sometimes serpentine, and in the Burren, Ireland, on limestone, is unlikely to be built upon. The only danger to the plant is erosion of cliffs, both by natural means, and by the increasing number of walkers around our coasts.

6. **O. reticulata** Wallr., *Orob. Gen.* 42 (1825).
O. pallidiflora Wimmer & Graeb., *Fl. siles.* **2**: (1829).

English name: Thistle Broomrape.

Illustrations: Figs 1E, 5A. Photographs in Lousley (1950): pl. 17), Sitwell (1984: 37); drawings in Ross-Craig (1966: pl. 27), Butcher (1961, **2**: 288) Garrard & Streeter (1983: 149).

Flowering stem simple, 15–70 cm, glandular-hairy, tinged yellowish-purple, slightly swollen below. Inflorescence rather dense, laxer below, often occupying most of the stem, the lowest flowers often well-separated. Bracts 12–25 mm, narrowly triangular equal to, to shortly exceeding corolla. Calyx 7–12 mm, bifid, upper segment largest. Corolla 12–22 mm, tinged creamy-yellowish, purple distally,

strongest around the margins, broadly cylindrical-campanulate, with dark glands, especially distally; upper lip with spreading lobes, lower with 3 equal lobes, the middle squarish. Stamens inserted 2–4 mm above the base of the corolla; filaments glabrous to sparsely hairy below, somewhat glandular to glabrous above. Stigma lobes purple, just touching at base. Flowering period June to August. Native, parasitic on thistles.

This rare British native was first reported in 1908, although the plant had been collected at a well-known locality in Mid-W. Yorks. as early as 1881 (*Webster*, **BM**). There is an earlier specimen, dated 1835, from "Notts." mistakenly identified as *O. major* by a collector whose material is of dubious provenance (*Cooper* in herb. H.C. Watson, **K**). The magnesian limestone does extend into this area and the past existence of *O. reticulata* in v.c. 56 is not improbable. A specimen from James Backhouse's Nursery, parasitic on *Cirsium heterophyllum* All. was collected in 1886, originating possibly by wind blown seed from the nearby native sites (*Backhouse*, **K**). At first, doubts as to the status of this species were expressed; certainly, its distribution is unique amongst British plants and is somewhat linked to roman roads and settlements (Fig. 12); however its European distribution lends plausibility to its consideration as a native species.

The plant has been found in fewer than ten localities, all on the magnesian limestone in north-western Yorkshire. However, early records of *O. major* and *O. minor* from other stations within the *O. reticulata* range are suspect and may indicate a greater abundance in the past. The usual hosts are *Cirsium arvense* L. and *C. eriophorum* Scop., but other thistles may be parasitized. The habitats include: unimproved pasture, roadsides, waste places and grassland overlying limestone.

The species has been reported in error from Falmouth Docks, Cornwall in 1917 and from near Llandowey in 1905 by H. H. Knight. The Cornish plant was *O. minor*, and the Welsh one determined *O. reticulata* var. *procera* (W. D. Koch) G. Beck by Beck, but later as *O. picridis* Schultz (= *O. loricata* Reichenb.) by Graham and Melderis. The specimen more closely approaches the latter, and is certainly not *O. reticulata*. This specimen is responsible for Druce's addition of var. *pallidiflora* (Wimm. & Graebner) Beck to the British list. He is believed to have mis-read Beck's determination, sent on a postcard written in German. Pugsley (1940) deleted this variety, but it was resurrected at subspecific rank by Clapham (1952). The chief distinctions given are the glandulosity of the filaments, degree of pigmentation and differences in host range. Webb & Chater (1972) do not recognise any subspecies in *Flora Europaea*, and study of the British material supports this view. The full range of corolla pigmentation shown by this species is seen within our restricted gene pool, although individual populations are quite uniform. Host range can only be satisfactorily tested by cultivation experiments, and without associated morphological differences is impractical for traditional taxonomic recognition.

The plant is at least rarely perennial (Branson, 28/7/1956, **E**), and numbers fluctuate widely at its few British sites. It has been suggested that the plant is in decline, but little evidence for this exists. Such rumours are based on the sporadic flowering, e.g. at one station the following counts have been made: 1939 – 400+, 1966 – 1, 1967 – 6, 1987 – 100+, and at another: 1984 – 26, 1985 – 42, 1986 – 1, 1987 – 1000+. In most years each of the populations produce between none and 25 flower spikes, and so its future is precarious. Sites are endangered by changes in land use: ploughing, spraying, dumping, gravel working and road widening. The plant is present in at least one S.S.S.I., in a Yorkshire Wildlife Trust reserve, and it was planned to introduce it into another. It is given an 11E rating by Perring & Farrell (1983) and is fully protected by the law. As its hosts are scheduled weeds, a legal dilemma is possible!

7. **O. caryophyllacea** Sm. in *Trans Linn. Soc. Lond.* **4**: 169 (1797).
O. vulgaris Poiret in Lam., *Encyclop.* **4**: 621 (1797).

English names: Clove-scented Broomrape, Bedstraw Broomrape.

Illustrations: Figs 1F, 5B. Photographs in Huxley & Taylor (1977: pl. 271); Sitwell (1984: 35); drawings in Ross-Craig (1966: pl. 24), Butcher (1961, 2: 286), Martin (1965: pl. 66), Garrard & Streeter (1983: 150).

Flowering stem 15–40(–50) cm, simple, glandular-hairy, whitish, pale yellow or pale pink in colour with numerous to few flowers in a rather lax spike smelling quite strongly of cloves, especially in

warm weather. Bracts 17–25 mm, ovate-lanceolate, acuminate, more or less equal to the corolla. Calyx 10–17 mm, entire to ±equally bifid. Corolla 20–32 mm, same colour as stem, glandular pubescent, erecto-patent, campanulate, broadest just behind mouth, ±uniformly curved, upper lip emarginate, lower lip with subequal glandular-ciliate almost fimbriate lobes. Stamens inserted 1–3 mm above the base of the corolla tube, filaments hairy below, glandular above. Stigma dark purple, lobes distant. Flowering period mid-May to late July. Visited and pollinated by bumble-bees. $2n=38$. Native, parasitic on Rubiaceae.

This species may be known when fresh, by its large, pale-coloured flowers with a strong, fragrant scent. In dried specimens the mid-brown, non-shiny flowers, which are rather hairy and of characteristic shape, combined with a dark stigma, make the plant unmistakable.

The plant was discovered in several stations in the Folkestone and Dover area by the Rev. Gerard Smith in May 1830. It has not markedly declined in general range in this area, but some populations have undoubtedly been lost, and others have dwindled; a roadside verge site has recently been lost through road widening (Perring & Farrell 1983) who also state: ". . . only two stations are now known, neither with large populations". This is contrary to information in Philp (1982). The plant is undoubtedly very rare, having been assigned an N.C.C. threat number of 12E, but is now fully protected under the Wildlife and Countryside Act of 1981. Two Kent populations are protected in S.S.S.I.s. A summary of its distribution is given in Fig. 13.

Several sources have perpetuated the myth that the plant is only found on *Galium mollugo* L. in Britain. The population near Sandwich, which in a good year may number over 100 specimens, is found mainly on *Galium verum* L. Plants from other Kentish localities have also been found on *G. verum*. Milne-Redhead (1985) has introduced the plant to the natural order beds at the Royal Botanic Gardens, Kew, where it persists on several genera of the Rubiaceae.

Two main types of habitat are preferred by this species: stabilized sand dunes, as at Deal and Sandwich, and hedgebanks and scrub, as at the base of the chalk downs and undercliff in the Dover area.

It is suggested by some that these British populations, being found at this south-eastern extremity of Britain, where the Channel is narrowest, is the result of wind-blown seed from France. It seems strange that the plant has not spread further over the chalk in southern England, once it had its foot in the English door. The distribution would suggest an environmental reason for its restricted range, yet the plant is found in Scandinavia and the Alps.

Orobanche caryophyllacea has been reported by Simpson (1982) as occurring in Suffolk in 1940, when it was recorded by C.C.T. Giles parasitic on *Galium verum*, but we have seen no specimens and suspect confusion with another species. A specimen exists in H. C. Watson's herbarium at **K**, labelled as "*O. leucorum*?" and said to have been gathered in Surrey in 1846. This herbarium also contains the specimens on which is based the single enigmatic record from the Scottish Highlands, with a duplicate in the main herbarium at **K**. Originally identified as "*O. major*?" or "*O. elatior*", these three specimens were collected in 1844 in the Loch Nell area by E. Harvey. This same collector had given H. C. Watson another specimen of *O. caryophyllacea* labelled as *O. rapum-genistae* from near Oakwood, Dumfries, and so considerable suspicion must be attached to the provenance of these specimens. Further Victorian specimens of this species from North Wales have been reported by Rumsey (1985), although it seems most likely that these resulted from confusion of labels or mixing of specimens during mounting.

The decline of this always rare species can be explained partly through habitat destruction, but over-collecting must in this case have had some effect for there are over 115 plants gathered from Kent in **BM** alone! Other than the preservation of localities and the maintaining of conditions for the host plant, it seems difficult to see how this usually annual species may be conserved effectively.

8. **O. elatior** Sutton in *Trans. Linn. Soc. Lond.* **4**: 178 (1797).
O. major L., pro parte.

English name: Tall Broomrape.

Illustrations: Figs 2A, 5C. Photographs in Strid (1980: pl. 63), Petch & Swann (1968: pl. 73); drawings in Garrard & Streeter (1983: 150), Ross-Craig (1966: pl. 25), Butcher (1961: 287), Martin (1965: pl. 66).

Flowering stem simple, (15–)25–70 cm, usually stout, yellowish to orange, often with a rather bulbous base, usually glandular pubescent. Flowers numerous, usually densely packed, often confined to the top third of the stem. Bracts 15–25 mm, lanceolate, acuminate. Calyx (6–)9–11 mm, segments connate at base, usually unequally bidentate. Corolla 18–25 mm, yellow or orange with reddish-brown veins; uniformly curved throughout, widely tubular, glandular-pubescent, sub-erect to erecto-patent, sometimes patent; upper lip ± entire, or more often two-lobed, usually spreading; lower lip three-lobed, the lobes nearly equal, crisped, denticulate. Stamens inserted 3–6 mm above the base of the corolla tube; filaments hairy below, glandular throughout. Stigma lobes yellow. Flowering period mid-June to August. 2n=38. Native, usually parasitic on *Centaurea*.

This plant was described by Sutton (1797), but has been the centre of a taxonomic wrangle causing a great deal of confusion. This stems from the inadequate description of *O. major*, together with a confusing array of synonyms. *Orobanche major* has been interpreted to include *O. elatior*, *O. rapum-genistae* and larger specimens of *O. minor*! British and French botanists used the name *O. major* for *Orobanche rapum-genistae*, while Beck-Mannagetta (1930) assigned *Orobanche elatior* to this, citing Linnaeus's *Flora Suecica* of 1755; *O. elatior* is a Swedish plant, while *O. rapum-genistae* is not. However, in the second edition of his *Species Plantarum*, Linnaeus (1763) states clearly that the plant grows on the roots of Leguminosae. Linnaeus did not understand *Orobanche* at all well! There is a sheet in **LINN** on which two specimens are mounted, these having been sent to Linnaeus by Loefling, and were inscribed "*Orobanche major*" by Linnaeus. Sir James Smith saw these and annotated the sheet "*minor* Mr. Sutton". Later, Hooker was to claim no sheet of *Orobanche major* existed in the herbarium. Pugsley examined the sheet and considered the plants most like *Orobanche picridis*. He hoped that the specific identity of the plants could be established, so that *O. major* L. could be validated. We have examined the sheet and believe the two specimens belong to different species. The left, which has been attacked by beetles, does indeed look quite like *O. picridis*; however, we do not believe it is. We consider it is probably a pale form of *Orobanche crenata* Forskål, a plant which would be found in the area Loefling collected from. The flowers are 20–25 mm with straight backs and erect upper lips. The right hand plant suggests *O. elatior*, but examination of an opened corolla of this plant showed a stamen insertion of 2–4 mm and glabrous filaments. Such a combination of characters seems to rule out *Orobanche elatior*. Because of this, and the overall confusion, it would seem necessary to reject the name *O. major* L.

In Britain, *Orobanche elatior* grows almost exclusively on *Centaurea scabiosa* L., but it has been reported on *Centaurea nigra* L. The habitat preference of the host largely determines the parasite's distribution but *O. elatior* is more restricted to chalk and Jurassic limestones. Early authors stated that this plant grows on *Trifolium pratense* L. Confusion with large states of *O. minor* is probable in many cases. Where the plant is correctly identified, it is probable that the wrong host was given as it is often difficult to trace the root systems.

The plant grows on chalk downs, in disused chalk pits, on roadsides, etc. It is a perennial and may throw up a large clump of flower spikes from a single host. The previous year's flower spikes often persist and may be found next to the new spikes. The plant is of a characteristic colour with a yellowish stem, and usually pinkish- to yellowish-brown flowers; however, f. *citrina* (Druce) Pugsley has the whole plant citron yellow. The plant may be confused when small with *O. minor*, but only var. *compositarum* has the suberect corollas so often found in *O. elatior*. The flowers are broader in *O. elatior*, have conspicuous brown veins and are more glandular, while the whole plant has a distinctly different look about it, difficult to describe. This species is somewhat local and many of its sites would be threatened by land-use changes. It is still tolerably plentiful, especially in Wiltshire and northern Essex/Cambridgeshire. However, it is decreasing towards the western and northern extremities of its range, possibly for climatic reasons. A summary of its distribution is given in Fig. 14.

9. **O. loricata** Reichenb., *Pl. Crit.* **7**: 41 (1829).
O. picridis F. W. Schultz ex Koch, *Fl Deutsch.* **4**: 453 (1833).

English names: Oxtongue Broomrape, Picris Broomrape.

Illustrations: Figs 3A, 6A. Drawings in Ross-Craig (1966: pl. 30 as *O. picridis*), Garrard & Streeter (1983: 149), Butcher (1961: 290 as *O. picridis*). The illustration in Sitwell (1984) purporting to be this species is in fact *O. minor* var. *maritima*.

Flowering stems simple, (10–)20–60 cm, glandular-pubescent to subglabrous, pale yellowish, often with a purple tinge. Inflorescence rather dense, flowers usually restricted to top half of stem. Bracts 12–20 mm, narrowly ovate-acuminate, equalling to just exceeding the flowers. Calyx 10–15 mm, segments unequally bifid, rarely entire; the segments slender, acuminate, 1-veined or 3-veined, the outer veins very indistinct. Corolla 14–22 mm, very pale, ivory to yellowish, veined purple-lilac distally, glandular-pubescent to subglabrous, upper lip emarginate to bifid, porrect to erect, ± forming a standard; lobes of lower lip subequal, or the middle the largest, squarish in shape; all lobes crisped and denticulate; back of corolla curved at base, then ± straight. Stamens inserted (2–) 3–5 mm above the base of corolla; filaments with conspicuous white hairs below. Stigma purple, lobes just touching. Flowering period June to July. 2n = c. 38* & 38. Native and introduced, often parasitic on Compositae but not exclusively.

This species is very clearly related to the widespread *O. minor*, and all the diagnostic characters overlap with the extremes found in that species. Seeds identical to those of *Orobanche minor*. Intermediates are not uncommon and may represent hybrids. Some herbarium specimens cannot be assigned to either species with certainty. The distinctions are much clearer in fresh material. In typical material the very pale colour is distinctive. This paleness is also apparent in herbarium specimens, which often have a characteristic orange-brown colour. The calyx lobes are long and thin, the upper segment with one conspicuous vein only. The bracts more or less exceed the flowers and may be very apparent at the top of the spike. The stigma lobes become very dark on drying, contrasting very strongly with the pale corollas. The bracts and stem of *O. loricata* are more pubescent than is usual in *O. minor* and the filaments, which are inserted rather higher, are covered below in long white hairs. The porrect to suberect upper lip of the corolla is also a useful taxonomic character, but is not always present.

We have seen specimens of this species from seven vice-counties: Wight, Kent, Surrey, Bucks., Cambs., Gloucs. and Pembs. A summary of its distribution, based on material we have seen, is given in Fig. 15. D. J. Hambler has determined an 1892 specimen from Guernsey as this species, and also a more recent record from Brean Down, Somerset. We have examined the voucher material for this latter record and believe it to be slightly atypical material of *O. hederae*, which is abundant in this area.

An earlier Somerset record, determined by Beck, has also been queried (Roe 1981). The specimens from Surrey, Buckinghamshire and Gloucestershire more closely approach *O. minor* in stature and pigmentation. *O. loricata* was first recognised as British in 1848 by C. C. Babington who discovered it growing in the Comberton area of Cambridgeshire. It was last seen in this general vicinity, at Haslingfield in 1935. Babington was also to discover the plant later the same year in a quarry on Giltar Point, Pembrokeshire, where it was still present in 1851 but has not been seen since. Earlier specimens exist from the two best known and still extant locations: near Freshwater, Isle of Wight and St Margarets, Kent. The former had become completely inaccessible through coastal erosion and had not been seen for many years (Bevis, Kettell & Shepard 1978), but a small colony has appeared on the cliff top in recent years and plants can be seen on the ledges below. Similarly the St Margarets site is largely inaccessible, with plants scattered on cliff ledges and unstable chalky debris. *O. loricata* also sporadically occurs at a second Kent locality, near Dover, where less than five spikes are to be found in most years. These sites are all on unstable steep chalk cliffs where the usual host is *Picris hieracioides*, but at St Margarets, *Pilosella officinarum* is also parasitized. A further site was discovered by chance when photographs of an unnamed broomrape were exhibited at the 1984 B.S.B.I. exhibition meeting by Mr V. Johnstone. These were of a group of *O. loricata* parasitizing a *Crepis* sp. on the R. Adur flood plain in W. Sussex. However, a subsequent visit by D. C. Lang revealed only *O. minor* at the site.

O. loricata is probably Britain's least understood and rarest, in terms of plant numbers, broomrape and this has been recognised by its inclusion in the 1981 Wildlife and Countryside Act. Inaccessibility accords it some protection though population sizes fluctuate due to natural changes in its unstable habitat.

10. **O. minor** Sm., *Eng. Bot.* **6**: 422 (1797).
O. minor Sutton in *Trans. Linn. Soc. Lond.* **4**: 179 (1797).

English names: Common Broomrape, Lesser Broomrape.

Illustrations: Figs 3B–E, 6G, D, 7A–B. Photographs in Polunin (1969: pl. 131), Gilmour & Walters (1954: pl. 22), Philp (1982: 196 as *O. amethystea*); drawings in Martin (1965: pl. 66), Garrard & Streeter (1983: 149), Butcher (1961, **2**: 289).

Flowering stems simple, (5–)10–60 cm, glandular-puberulent to hairy, yellow or reddish-brown variously tinged purple. Spike lax to dense. Bracts 6–22 mm ovate-lanceolate to lanceolate-subulate, acuminate, ± equalling to just exceeding the corolla. Calyx 6–14 mm long equally to unequally bifid or entire. Corolla 10–18 mm, creamy-yellow, curved regularly throughout or sharply inflected at the base then curved, purplish suffused to a variable extent, glandular- pubescent to ± glabrous, upper lip emarginate or slightly bilobed with the lobes directed forwards; lobes of lower lip sub-equal or with the central the largest, all lobes crisped and denticulate. Stamens inserted 2–3.5 mm above the corolla base; filaments glabrous to sparsely hairy below. Stigma lobes yellow or reddish-purple, just touching at base to partially united. Flowering period late May to mid September. n = 19, 2n = 38. Probably native but frequently introduced, a parasite of many families.

Undoubtedly our most common broomrape, which makes its date of description all the more remarkable. It is likely that the early English botanists confused this species with many of the other members of the genus but even allowing for such confusion it would seem to have greatly increased in this country, probably through repeated introduction with fodder crops. Cleaner seed and changes in agricultural practice would seem to have caused some decline. Webb (1985) has questioned the native status of this species in the British Isles; it is unquestionably an introduction in Ireland where it occupies similar habitats. Its indigenous range is now unclear through man's activities. *O. minor* exemplifies the taxonomic difficulties posed by the genus. As with many parasitic groups, morphological reduction has deprived the taxonomist of diagnostic characters. This, when combined with the largely unknown host-determined effects on parasitic morphology and phenology, makes classification problematic. Seeds similar to those of *O. elatior*, with few 'cells' on the surface. Seed size and shape are very variable and are not of use in distinguishing the infraspecific taxa in the *O. minor* agg. Of all the *Orobanche* species *O. minor* has the most catholic tastes with regard to hosts, hundreds of species in families from the Ranunculaceae to the Gramineae are attacked but a clear preference is shown for the Leguminosae and Compositae. Cultivation experiments which could determine the influence of the host and degree of host specificity are difficult to perform. Musselmann & Parker (1982) have shown that races of *O. minor* physiologically adapted to certain hosts exist and it is easy to visualise speciation progressing along these lines. *O. minor* has efficient seed dispersal and is largely inbreeding; accordingly populations preferentially parasitizing a species which has its own distinct ecological preferences may become effectively isolated and ultimately give rise to distinct taxa. Recognition of these by traditional means is only possible where subtle morphological differences have paralleled the more profound but invisible physiological changes; such morphological characters may be of lesser selective importance. As so little is known of the cytology and physiology of *O. minor* sensu lato, the following treatment is perhaps best regarded as provisional. We conclude it best to regard *O. minor* in Britain and Ireland as consisting of four varieties which can be distinguished as follows.

Key to the varieties of *Orobanche minor*:

1. Plant yellow*, to 25 cm, rarely more, spike dense almost sub-globose. Stigma lobes yellow. Host usually *Hypochaeris radicata* ..... 10c. var. *flava*
1. Plant purple*, to 60 cm, spike lax to dense above. Stigma lobes reddish brown to purple. Hosts various 2
2. Flowers sub-erect at anthesis, slender, ca 3.5–5.0 mm diameter, pale, sub-glabrous. Hosts usually *Crepis* spp. and other Compositae ..... 10b. var. *compositarum*
2. Flowers patent to erecto-patent, ca 5.0–8.0 mm diameter, ± suffused purple, glandular

pubescent to sub-glabrous. Hosts various 3

3. Plant with bulbous base, stem glandular-puberulent, to 35 cm. Bracts not exceeding corolla. Calyx short, 6–10 mm, usually entire. Lower lip with middle lobe the largest, reniform. Stigma lobes partially fused. Host almost exclusively *Daucus carota* subsp. *gummifer* .... 10d. var. *maritima*

Plant usually without 'bulb' at base, stem sub-glabrous to glandular-pubescent to 60 cm. Bracts equalling to exceeding corolla. Calyx ca 7.5–16 mm, bifid or entire. Lower lip with sub-equal broadly rounded lobes. Stigma lobes scarcely fused becoming distant with age. Hosts various ..... 10a. var. *minor*

* Rarely individuals without purple pigmentation but otherwise identical to var. *minor* occur, to which they are best referred. Similar pigment-less variants exist in other *Orobanche* species, e.g. *O. hederae*, *O. elatior* and *O. crenata*.

10a. var. **minor**

Illustrations: Figs 3B, 6C.

Flowering stems (5–)10–60 cm, glandular-pubescent, reddish-brown tinged purple, rarely yellow. Spike usually lax below ± dense above. Bracts 7–22 mm ovate-lanceolate equalling or exceeding the corollas. Calyx 7–14 mm equally or unequally bifid or entire. Corolla 10–18 mm glandular pubescent to sub-glabrous, back ± regularly curved; upper lip emarginate to bilobed, forwardly directed rarely ± sub-erect; lower lip with sub-equal lobes, all crisped and denticulate. Filaments glabrous to sparsely hairy below inserted 2–3.5 mm above corolla base. Stigma lobes purplish, touching at base becoming more distant with age. Flowering period late May to mid September. 2n = 38*.

A highly variable and widespread plant, possibly not native. Its appearances are often casual or sporadic. Most commonly encountered on roadsides, in disused chalk and gravel pits and on 'grey' dunes in coastal areas. It is becoming increasingly common as a weed in flowerbeds where the usual hosts are shrubby *Senecio* spp. A summary of its distribution (based on all records of the species, other than those attributed to the rarer varieties) is given in Fig. 16.

We include in this taxon the plants referred to the Mediterranean species *O. amethystea* Thuill. by Philp (1982). Some of the Kent plants do approach this in some respects but *O. amethystea* has larger flowers with a distinctly bilobed, sub-erect upper lip and a higher filament insertion. The population at Sandwich consists of plants parasitic on a wide range of hosts, including *Eryngium maritimum*, *Ononis repens*, *Calystegia soldanella*, *Honkenya peploides* and *Elymus farctus*. The host influence on stature and pigmentation is apparent and a full range of intermediates between *O. amethystea sensu* Philp and typical *O. minor* can readily be found.

Occasional pigment-less variants are found, indeed the type sheet at **LINN** contains just such, as well as pigmented, material. We prefer not to treat the albino variant at varietal rank as it differs only in this respect and lacks the distinct morphological features, ecology and distribution shown by var. *flava* E. Regel.

10b. var. **compositarum** Pugsley in *J. Bot., Lond.* **78**: 111 (1940).

Illustrations: Figs 3C, 6D.

Flowering stems 10–50 cm glandular pubescent to sub-glabrous, usually pale reddish-brown. Spike ± lax throughout. Bracts and calyx as in var. *minor*. Corolla 10–18 mm slenderer than in var. *minor*, sub-glabrous, sub-erect not horizontal at anthesis, less heavily pigmented. Other characters as var. *minor*.

A distinctive looking variant distinguished by its narrower, paler, sub-erect corollas. Pugsley (1940) claimed that the filament bases were hairier than usual for var. *minor*. This variety would appear to be thinly scattered throughout the British range of *O. minor* sensu stricto but is probably under-recorded. It would seem to be most frequent on sandy soils in Surrey, East Anglia and in coastal

areas elsewhere. Extra-British distribution is unknown. Host plants are, as the name would suggest, usually Compositae, *Crepis virens* being the most frequently recorded. Other hosts include *Hypochaeris radicata*, *Tripleurospermum inodorum*, *Carduus nutans*, *Senecio greyii* and exceptionally *Smyrnium olusatrum*. Specimens from Nob End, South Lancs., parasitic on *Trifolium pratense* are also probably best referred to this variety. Care should be taken when naming fruiting specimens as the corollas in var. *minor* may become increasingly erect with age.

10c. var. **flava** E. Regel, in Otto & Dietrich, *Allg. Gartenzeit.* 284 (1842).
O. minor Sm. var. *lutea* Tourlet in *Bull. Soc. Bot. Fr.* **1**: 421 (1903).
O. ritro Gren. & Godron f. *hypochaeroides* Beck ex Druce in *J. Bot., Lond.* **45**: 425 (1907).

Illustrations: Figs 3D, 7A.

Flowering stem 8–18(–25) cm, glandular-pubescent, yellow. Spike dense sometimes sub-globose. Bracts 6–14 mm, ovate lanceolate, equalling corollas. Calyx 6–10 mm, entire almost filiform. Corolla 10–14 mm, sparsely glandular, curved throughout but most sharply inflected at the base. Upper lip emarginate, lobes forwardly directed; lower lip with ± subequal lobes, all crisped and denticulate. Filaments sub-glabrous, inserted 3–3.5 mm above corolla base. Stigma lobes yellow touching at base. Flowering period early June to mid July.

Plants referable to this taxon were first collected in the British Isles in 1866 by Syme at St Ouens, Jersey. It has subsequently been gathered here by many botanists under a confusing array of names (Pugsley 1940). Le Sueur (1984) incorrectly treated this taxon under *O. elatior* and suggested that it was destroyed by building during the Second World War. However, there is a specimen at **LIV** dated 1951. Other sites include Braye Bay, Alderney (Pugsley 1940) and Newport Docks, Glamorgan. Similar plants were reported as growing at Grand Havre, Guernsey by Syme in Sowerby (1866).

Unfortunately we have not been able to examine the types of var. *flava* E. Regel or var. *lutea* Tourlet and it is possible that they may be based on pigment-less variants of var. *minor* and therefore not be conspecific with the distinctive Channel Islands taxon. Similar plants have not been found elsewhere on coastal dune systems, suggesting the morphological features are not an environmental modification. This taxon would appear to us to be more closely related to var. *maritima* than to var. *minor*. Its continued existence in this country is somewhat precarious, the sole extant site being by a railway line in an area of dockland.

10d. var. **maritima** (Pugsley) Rumsey & Jury in *Watsonia* **17**: 442 (1989).
O. maritima Pugsley in *J. Bot., Lond.* **78**: 110 (1940).

English name: Carrot Broomrape.

Illustrations: Figs 3E, 7B. Photograph in Sitwell (1984: 36, as *O. loricata*); drawings in Garrard & Streeter (1983: 149), Butcher (1961, **2**: 291).

Flowering stem 10–30(–40) cm, heavily pigmented with purple, glandular-puberulent, usually with a pronounced bulbous base from which several stems may arise. Flowers few to many in a dense spike. Bracts 8–16 mm, lanceolate from a broad base, usually not exceeding the corollas. Calyx 6–10 mm, entire or unequally bifid. Corolla 10–17 mm, sparsely glandular, sharply inflected at base; upper lip entire to emarginate; lower lip with middle lobe the largest, reniform, with pronounced yellowish bosses; all lobes crisped and denticulate. Filaments glabrous to sparsely hairy below, inserted 2–3 mm above the corolla base. Stigma lobes partially united, purple. Flowering period late May to early August.

This interesting variant can usually be distinguished from the widespread var. *minor* by the characters stressed in the key but these are not always easily seen in herbarium material. The squatter corollas densely packed in the top third of the spike is, however, a good indication of this exclusively maritime taxon.

O minor var. *maritima* appears to be largely restricted to steep calcareous sea cliffs, where it almost exclusively parasitizes *Daucus carota* subsp. *gummifer*, but it is occasionally found in dune grasslands.

Plants referrable to this taxon were first reported in Britain in 1845 by Rev. W. S. Hore. He collected it on the cliffs at Whitsand Bay, Cornwall and identified it as *O. amethystea* Thuill. presumably misled by its deep 'amethyst' colour. His identification was disputed and doubted by many yet the name persisted until Pugsley (1940) showed that the continental *O. amethystea* Thuill. was distinct and that our plant was of an undescribed taxon. Material sent to Beck von Mannagetta had been returned with various unsatisfactory names; Pugsley thus named the plant. Many British botanists since have questioned the distinctness of this taxon. Webb & Chater (1972) sink it completely in *O. minor* but note that it may have affinities with *O. loricata* Reichenb. We prefer to treat this taxon as a variety of *O. minor*. The morphological features distinguishing it are small and continuously variable to *O. minor* var. *minor*; this intergradation is most apparent at the eastern extremity of its range, however it has a distinct ecology and distribution and quite marked host specificity. Whereas *O. minor* var. *minor* is possibly not truly native, var. *maritima* would seem to be. Its distribution pattern (Fig. 17) closely reflects that of its chief host, the coastal ecotype of the carrot, *Daucus carota* subsp. *gummifer*, and is shared to varying degrees by a range of species including: *Lotus subbiflorus*, *L. angustissimus*, *Centaurium capitatum*, *Bromus hordeaceus* subsp. *ferronii*, *Polycarpon tetraphyllum* and *Brassica oleracea*, only the last named being of questionable status. The extra-British distribution of var. *maritima* is unclear. In his original description, Pugsley (1940) cited a specimen from Gibraltar but we know of no other records and have seen no material. This taxon, as *O. maritima*, was included in the Red Data Book (Perring & Farrell, 1983) but only over-collection can affect it and it is somewhat protected from this by the inaccessibility of its habitat.

11. **O. hederae** Duby, *Bot. Gall.* **1**: 350 (1828).
O. barbata Sm., *Engl. Bot.* **6**: t.2859 (1841), non Poir, in Lam., *Encyclop.* **4**: 621 (1797).

English name: Ivy Broomrape.

Illustrations: Figs 3F, 7C. Photographs in Lousley (1950: pl. 13), Bichard & McClintock (1975: pl. 49), Phillips (1977: 92, as *O. minor*); drawings in Martin (1965: pl. 66), Ross-Craig (1966, **23**: pl. 29), Garrard & Streeter (1983: 149).

Flowering stems simple, 10–60(–105) cm, strongly suffused purple, very rarely yellow, glandular-pubescent usually strongly swollen at the base. Spike dense to lax, flowers frequently from ground level, shoot often with conspicuous terminal 'bud'. Bracts 12–22 mm ovate-lanceolate to lanceolate, acuminate. Calyx 10–15 mm, bifid or entire. Corolla (10–)12–20(–22) mm, dull cream tinged reddish-purple; sparsely glandular to sub-glabrous, erecto-patent to patent tube slightly inflated below usually constricted distally; upper lip entire to emarginate, the lobes forwardly directed or spreading; lower lip with middle lobe just the largest, all sub-acute, crisped and denticulate. Stamens inserted 3–4 mm above corolla base; filaments ± glabrous below, occasionally sparsely glandular above. Stigma lobes partially united, yellow rarely pink tinged. Flowering period June to October. 2n=38*. Native, introduced or self sown in artificial habitats east of its native range; parasitic on Araliaceae.

Usually easily distinguished from the similar *O. minor* Sm. by its characteristically distally pinched corollas, the flower extending over most of the stem and the large terminal 'bud' of unopened flowers which give the spike a pointed top. In wild populations it is only parasitic on the Araliaceae but caution should be exercised as *O. minor* can also parasitize members of this family.

First discovered in the British Isles on Guernsey in 1726 and subsequently found along the south-western coast of England, Wales and in the Killarney area of Ireland (Fig. 18). This species was confused with *O. minor* and was included in it by Bentham & Hooker (1930) who considered the stigma colour and "other trifling characters" were not constant. Some populations of *O. hederae*

examined by us have pinkish stigmas but otherwise are typical. They may be distinguished from *O. minor* by the morphological features listed above.

O. hederae has been recorded as parasitizing *Hedera*, *Fatsia*, × *Fatshedera* and *Kaplopanax*. Plants on the latter at Royal Botanic Gardens, Kew were exceptionally robust, some over a metre tall! Jones (1987) succeeded in raising plants on *Trifolium pratense*. Records of hosts from other families have all proved to be based on misidentification of the parasite involved. The predominantly Atlantic coastal distribution of *O. hederae* suggests that it is primarily a parasite of *Hedera hibernica*. Inland stations may have arisen from wind borne seed but in most cases deliberate introduction is likely as many sites are in or near botanic gardens.

This species has a longer flowering period than any other British broomrape. Late-flowering plants will almost invariably be found in most populations when most spikes are dead. Populations of most *Orobanche* species flower simultaneously, the asynchronous appearance of *O. hederae* and its lengthy flowering period are presumably due to the evergreen nature of its host.

O. hederae is one of the commonest British broomrapes and certainly the most abundant in Ireland. It is not threatened and may be increasing slowly as it exploits cultivated *Hedera* outside its natural range.

12. **O. crenata** Forskål, *Fl. Aegypt. Arab.* 113 (1775).
O. speciosa DC., *Fl. Fr.* **6**: 393 (1815).
O. pruinosa Lapeyr., *Hist. Abr. Pl. Pyr. Suppl.* 87 (1818).

English names: Carnation-scented Broomrape.

Illustrations: Figs 2E, 6B. Photographs in Huxley & Taylor (1977: pl. 272), Polunin (1969: pl. 131), Polunin & Huxley (1965: pl. 181).

Flowering stem simple, 15–80(–120) cm, densely glandular-pubescent, somewhat bulbous at base. Inflorescence usually rather lax, with numerous flowers. Bracts 15–25 mm, ± villous, ovate-lanceolate to linear-lanceolate, acuminate. Calyx 10–20 mm, unequally bifid. Corolla (12–)20–30 mm, creamy white with purplish veination especially on the lips, yellow at the base, somewhat campanulate, erecto-patent to horizontal; lips divergent, upper strongly bi-lobed forming an ± erect standard, lower with large sub-orbicular lobes. Stamens inserted 2–4 mm above corolla base, filaments hairy at least below. Stigma lobes white, yellow or pink, rarely darker. With a powerful, pleasant carnation scent. Flowering period May to August. n=19. Introduced, rarely persistent. Usually parasitic on herbaceous legumes or Pelargoniums in this country but it has an extensive host range of similar magnitude to that of the other main agricultural weed in the genus, *O. ramosa*.

British material of this species is often smaller and less floriferous than Continental plants, such depauperate plants may be confused with *O. loricata* Reichenb., *O. minor* Sm. or perhaps *O. reticulata* Wallr. It has also been confused with *O. caryophyllacea* Sm. probably because of its large, somewhat campanulate flowers, and strong scent. Its pale stigma, divergent corolla lips and villous stems and bracts combined with the strong scent are characteristic.

This attractive pernicious Mediterranean weed has been reported as a casual only very rarely in Britain (Fig. 19). It was first discovered in a bean field near Charlton, Glos. in 1845 and then on peas near Stroud in 1863. Both were originally recorded as *O. caryophyllacea* Sm. (Riddlesdel *et al.* 1948). It had also been found amongst peas in a Bridgewater, Somerset garden in 1860 where it was reputedly 115 cm tall. *O. crenata* was next discovered at St Philips Marsh, Bristol in 1905; this area was rich in Mediterranean weeds at this time, *O. ramosa* being recorded twice. Bowen (1968) reports this species as occurring on a *Pelargonium* in a garden in Cholsey, Berks.

The majority of recent British records are from the Upminster/Cranham area of S. Essex. It was first found here in 1950 in a garden flowerbed at 13 New Place Gardens where it reappeared with greater vigour in 1951. It was next found in a garden in Peterborough Avenue, Upminster in August 1975. The following year Dr K. J. Adams was visiting a proposed nature reserve site at Cranham marsh when he detected a strong carnation scent. He tracked this down to a small but thriving population of *O. crenata* in the marshy corner of a partially ploughed field. This was less than 1 km

from the previous garden finds. *O. crenata* continued to increase in this site and when visited in 1982 the population was of about 200 plants parasitizing *Vicia hirsuta* and *V. tetrasperma*. Regrettably, the field was ploughed up in 1983 and fewer than ten plants were reported on a visit by the Thurrock Natural History Society (C. J. Studholme, pers. comm.). Since then the plant has not been refound and the original site looks unsuitable. It was thus feared that *O. crenata* was extinct in this area (Rumsey 1986). However, in 1986 three plants were found in a field of peas c. 1 km N.N.E. of the previous colony (Mrs. M. Smith, pers. comm.).

Adams (1984) speculated as to the status of the species in this area and considered it may be native. This is unlikely given the extra-British distribution of *O. crenata*. Although broomrapes often exhibit pronounced fluctuations in population size, the steady increase would also suggest it was not native. It is not certain whether the 1950/1 plants gave rise to the main colony or vice versa, whatever the sequence of events the original mode of introduction remains unclear.

Several other casual occurrences have been reported or are evidenced by herbarium specimens: a depauperate plant was collected on a potted *Daucus* at the Cambridge Botanic Garden, although initially misidentified as *O. picridis* var. *carotae* (*Graham*, **CGE**). Similarly, a record of *O. rapum-genistae* from Clehonger, Hereford in 1968 was probably *O. crenata*, as the plant was parasitic on *Vicia faba*. This is the preferred host for *O. crenata* in the Mediterranean region, whereas *O. rapum-genistae* exclusively parasitizes shrubby legumes, especially *Cytisus*, *Ulex* and *Genista*. A single plant parasitizing *Vicia bithynica* in the natural order beds at Kew may have been intentionally introduced. The only other record known to us is of a potful of parasites and *Pelargonium* brought to the 1984 B.S.B.I. Exhibition Meeting. Unlike most broomrape species, *O. crenata* is dependent on insect visitation for seed set. Damper, cooler climates result in later flowering and perhaps fewer pollinator visits. This may in turn result in inadequate seed bank establishment and effectively thus governs the northern limit of distribution. The copious seed production potential and efficient seed dispersal of just one plant combined with the lengthy period of sustainable seed dormancy (probably greater than ten years) could account for its prolonged survival in a marginally suitable habitat as in Essex. It is to be hoped that it will re-establish itself in the E.N.T. Nature Reserve where it can be more effectively conserved.

The climatic changes experienced recently, coupled with more frequent Faba bean crop cultivation, may result in the more frequent occurrence and establishment of this species in the British Isles. It could become a major and serious weed species in the 21st century.

13. **O. flava** C.F.P. Mart. ex F.W. Schultz, *Beitr. Kenntn. Deutsch. Orob.* 9 (1829).

English name: Butterbur Broomrape.

Illustrations: Fig. 2B.

Flowering stem simple, 20–65 cm, glandular-pubescent, scarcely swollen at base, yellowish. Inflorescence rather dense. Bracts 13–20 mm, oblong to lanceolate, acute to acuminate. Calyx 8–15 mm, unequally bidentate or entire. Corolla (12–)15–22 mm, yellow tinged with red, erecto-patent to patent, uniformly curved; upper lip ± bilobed, erect or recurved at maturity; lower lip minutely ciliate or glabrous, middle lobe the largest. Stamens inserted 4–6 mm above corolla base; filaments hairy. Stigma pale yellow, style becoming exserted and convolute. Flowering period June to August. 2n=38. Introduced, parasitic on Compositae.

Closely resembles *O. lucorum* A. Braun, with which it grows in the Oxford Botanic Garden, and could be confused with the native *O. elatior* from which it differs in the exserted style and the choice of host.

Known only as an introduction at the Oxford Botanic Garden where it parasitizes *Petasites*, *Adenostyles* and related genera in the natural order beds (*Bowen*, **RNG**). As suitable hosts are widespread in this country it may become established elsewhere.

14. **O. lucorum** A. Braun in Rohling, *Deutschl. Fl.*, 3rd ed., **4**: 456 (1833).

English name: Barberry Broomrape.

Illustration: Fig. 2C.

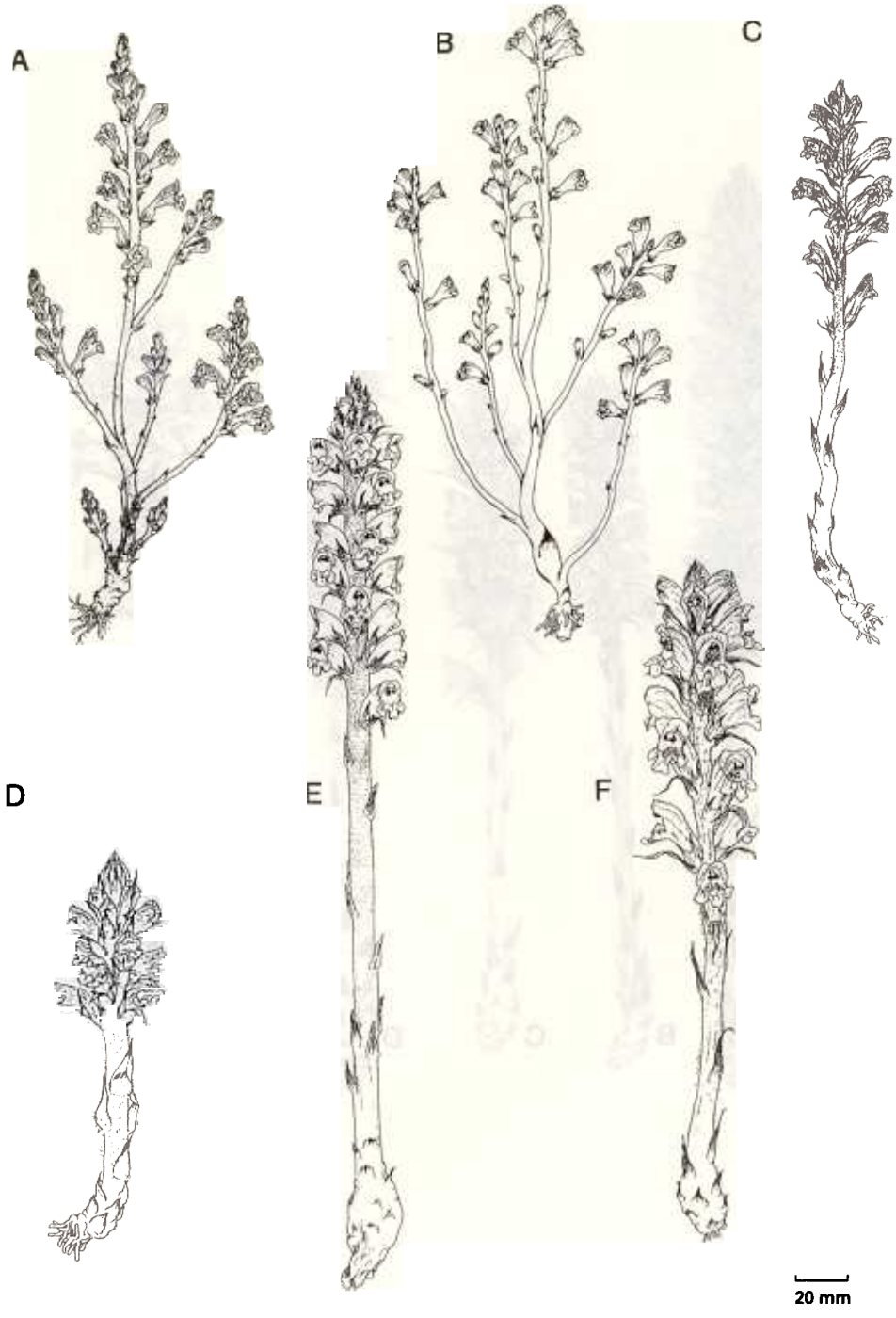

FIGURE 1. Morphology of British *Orobanche* species: A) *O. ramosa* L., B) *O. aegyptiaca* Pers., C) *O. purpurea* Jacq., D) *O. alba* Steph. ex Willd., E) *O. reticulata* Wallr., F) *O. caryophyllacea* Sm.

FIGURE 2. Morphology of British *Orobanche* species: A) *O. elatior* Sutton, B) *O. flava* C. F. P. Mart. ex F. W. Schultz, C) *O. lucorum* A. Braun, D) *O. rapum-genistae* Thuill., E) *O. crenata* Forskål

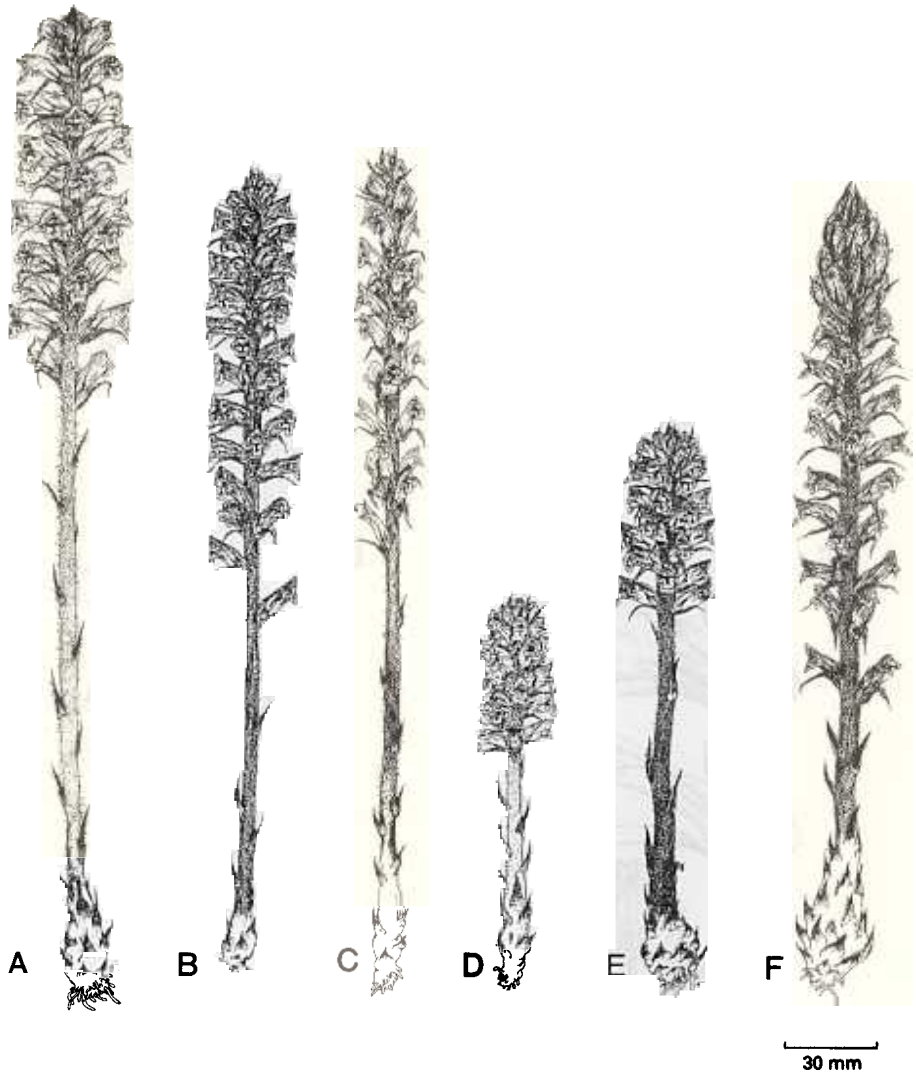

FIGURE 3. Morphology of British *Orobanche* species: A) *O. loricata* Reichenb., B) *O. minor* Sm. var. *minor*, C) *O. minor* Sm. var. *compositarum* Pugsley, D) *O. minor* Sm. var. *flava* E. Regel, E) *O. minor* Sm. var. *maritima* (Pugsley) Rumsey & Jury, F) *O. hederae* Duby

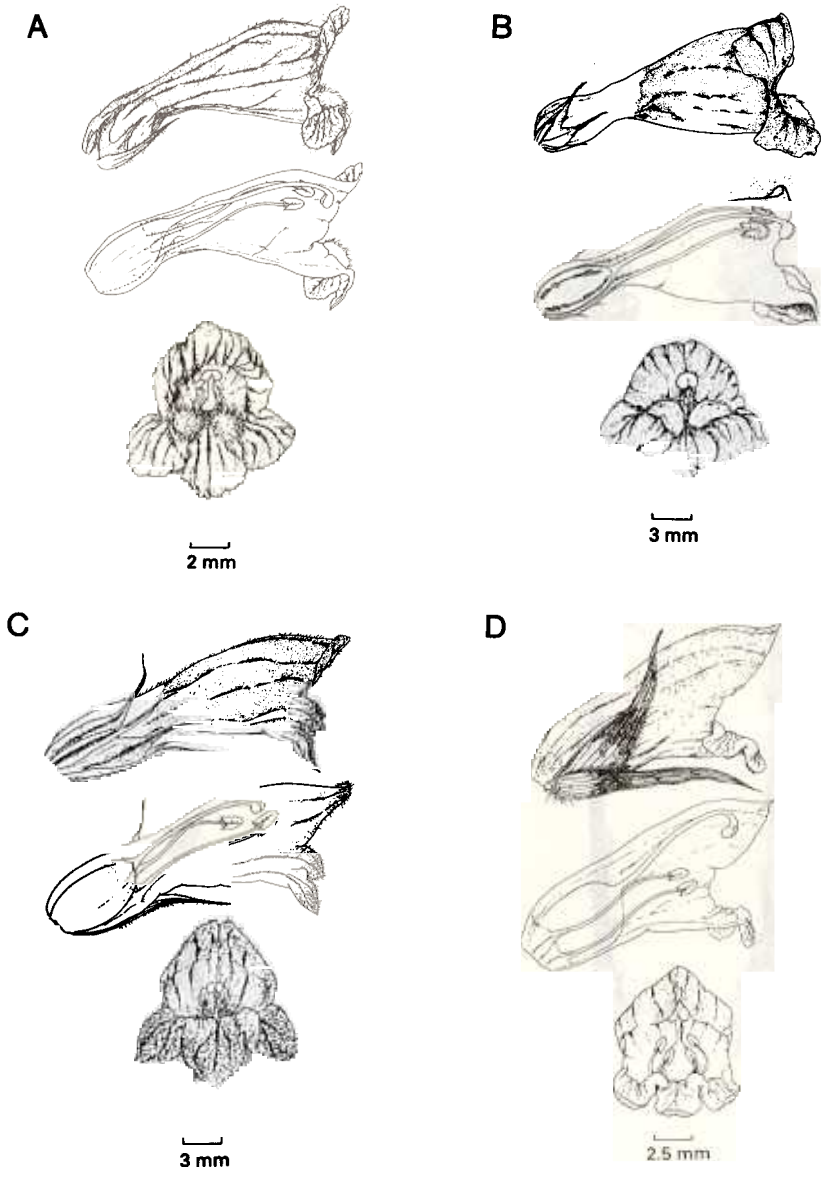

FIGURE 4. Corolla morphology of British *Orobanche* species: A) *O. ramosa* L., B) *O. aegyptiaca* Pers., C) *O. purpurea* Jacq., D) *O. alba* Steph. ex Willd.

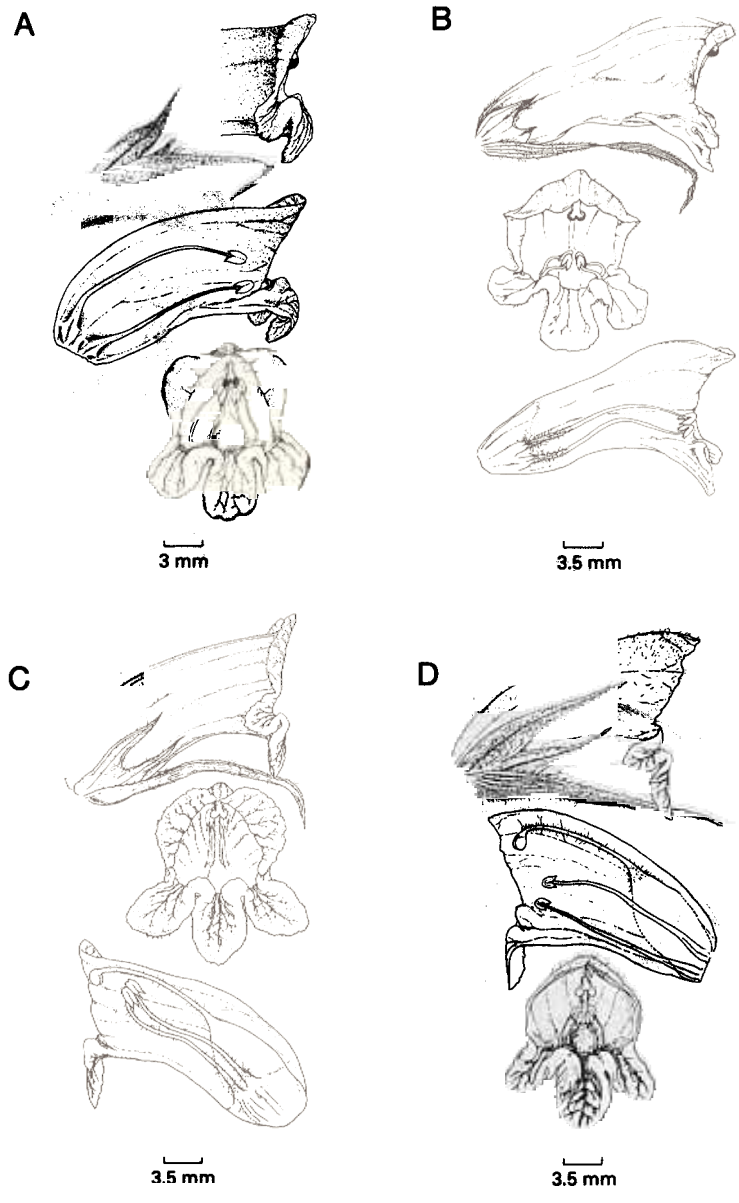

FIGURE 5. Corolla morphology of British *Orobanche* species: A) *O. reticulata* Wallr., B) *O. caryophyllacea* Sm. C) *O. elatior* Sutton, D) *O. rapum-genistae* Thuill.

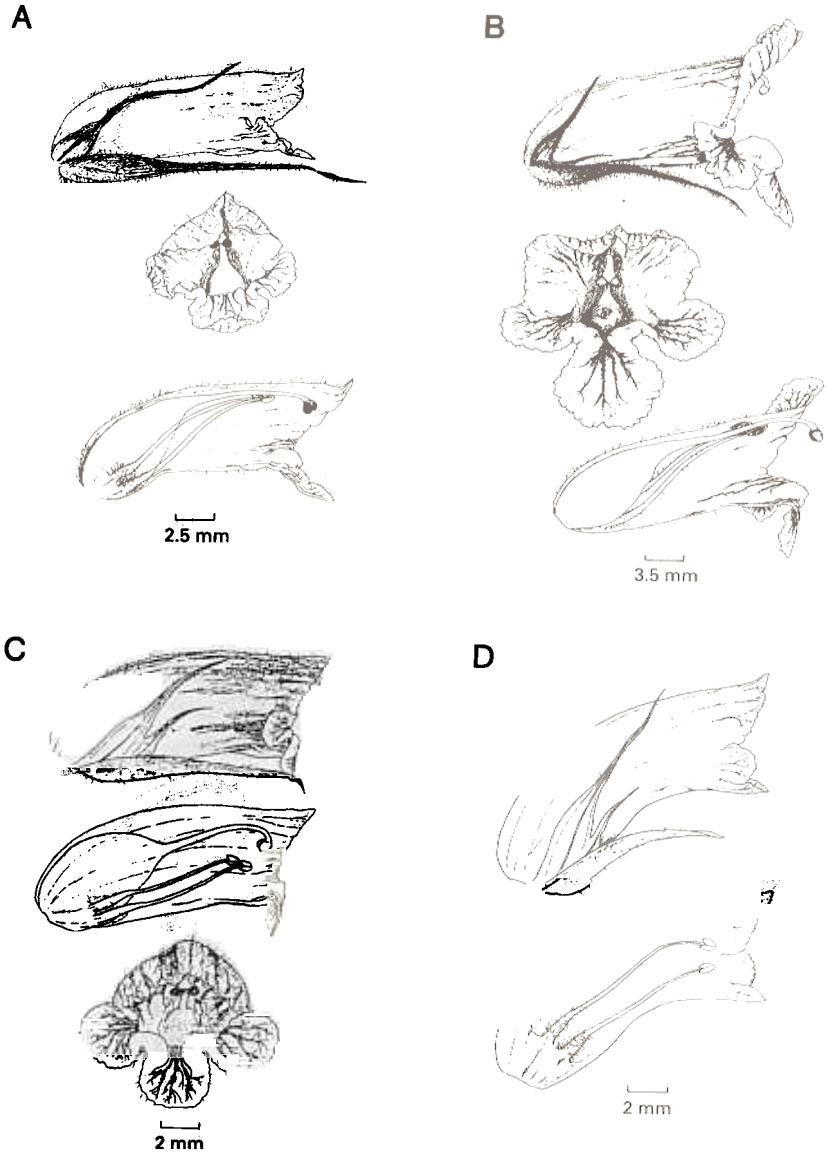

FIGURE 6. Corolla morphology of British *Orobanche* species: A) *O. loricata* Reichenb., B) *O. crenata* Forskål, C) *O. minor* Sm. var. *minor*, D) *O. minor* Sm. var. *compositarum* Pugsley

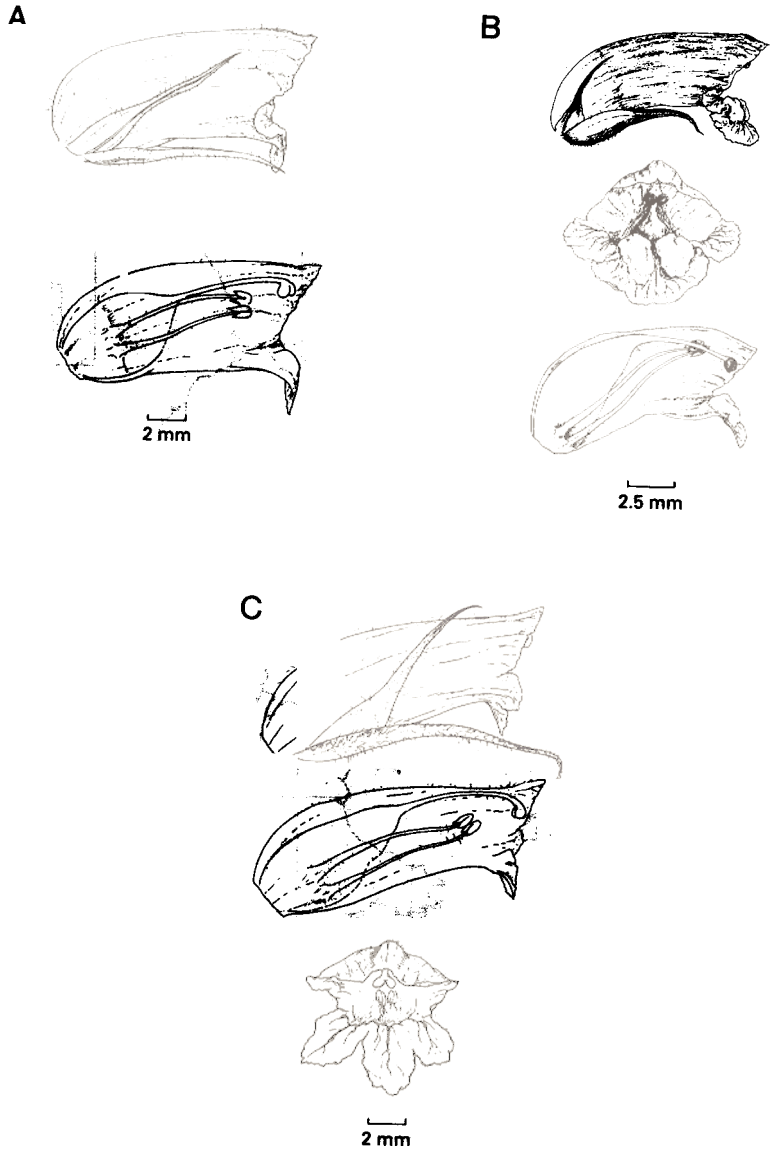

FIGURE 7. Corolla morphology of British *Orobanche* species: A) *O. minor* Sm. var. *flava* E. Regel, B) *O. minor* Sm. var. *maritima* (Pugsley) Rumsey & Jury, C) *O. hederae* Duby

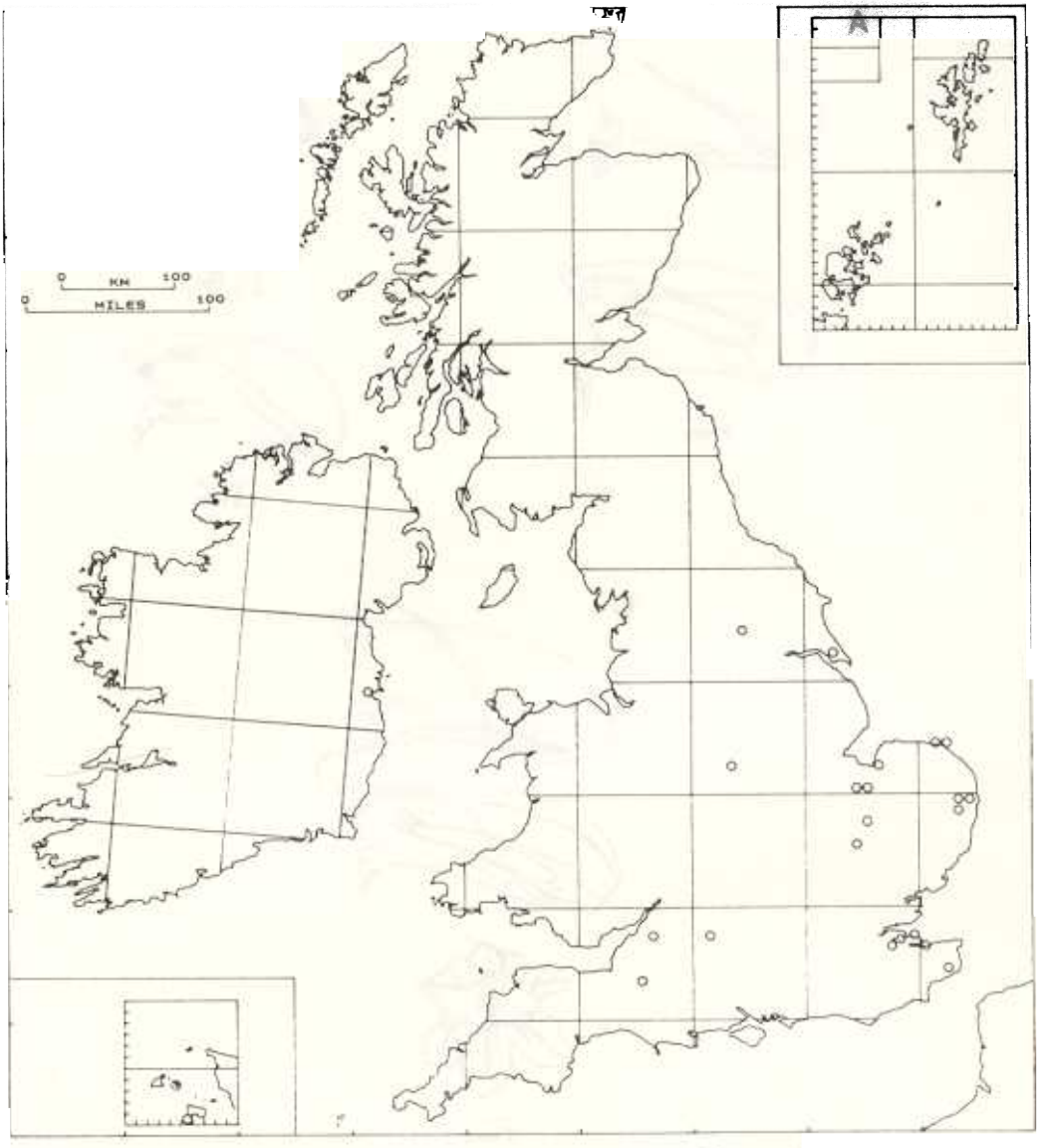

FIGURE 8. Distribution of *O. ramosa* L.; • = post-1950 record, ○ = pre-1950 record.

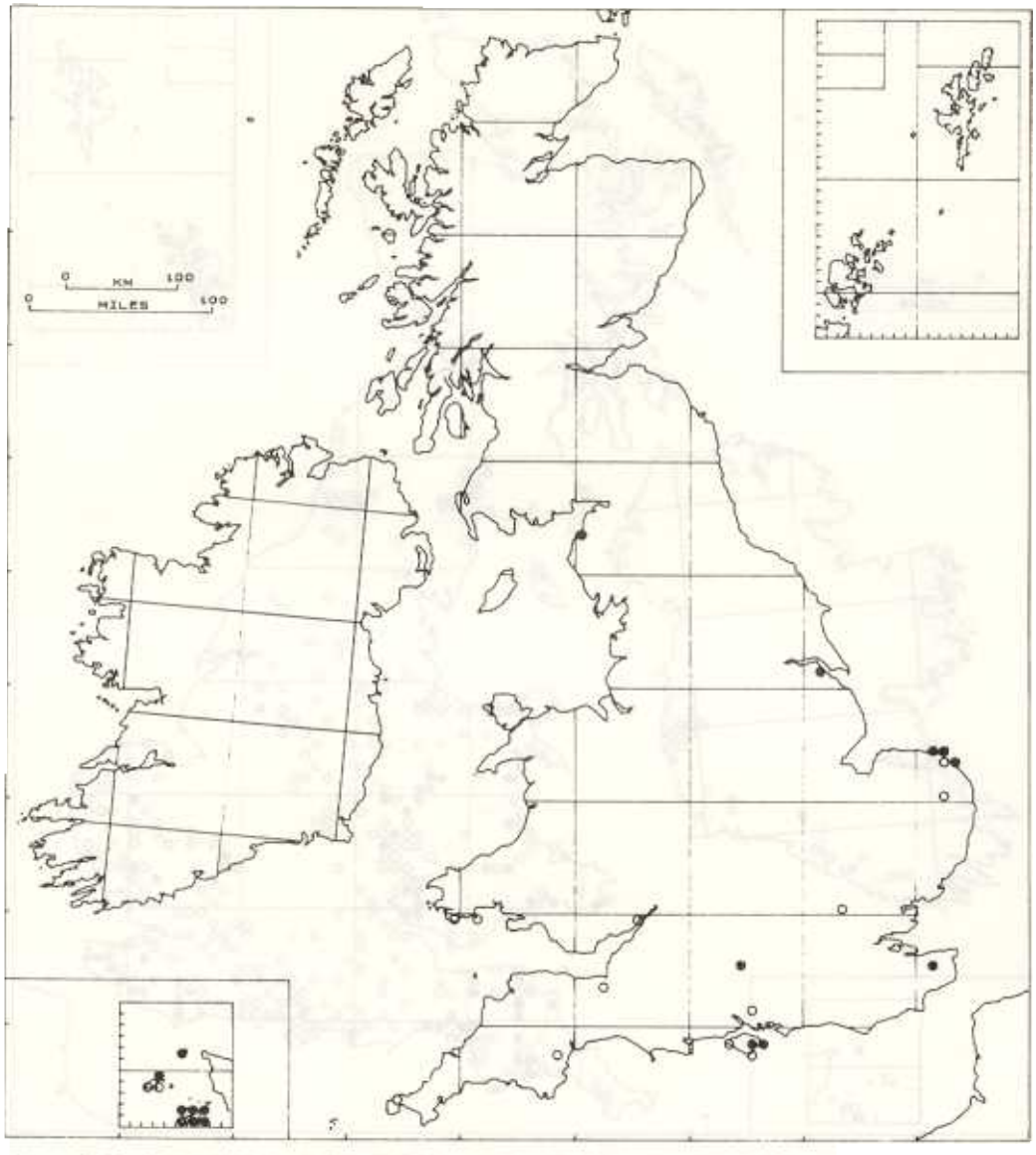

FIGURE 9. Distribution of *O. purpurea* Jacq.; • = post-1950 record, ○ = pre-1950 record

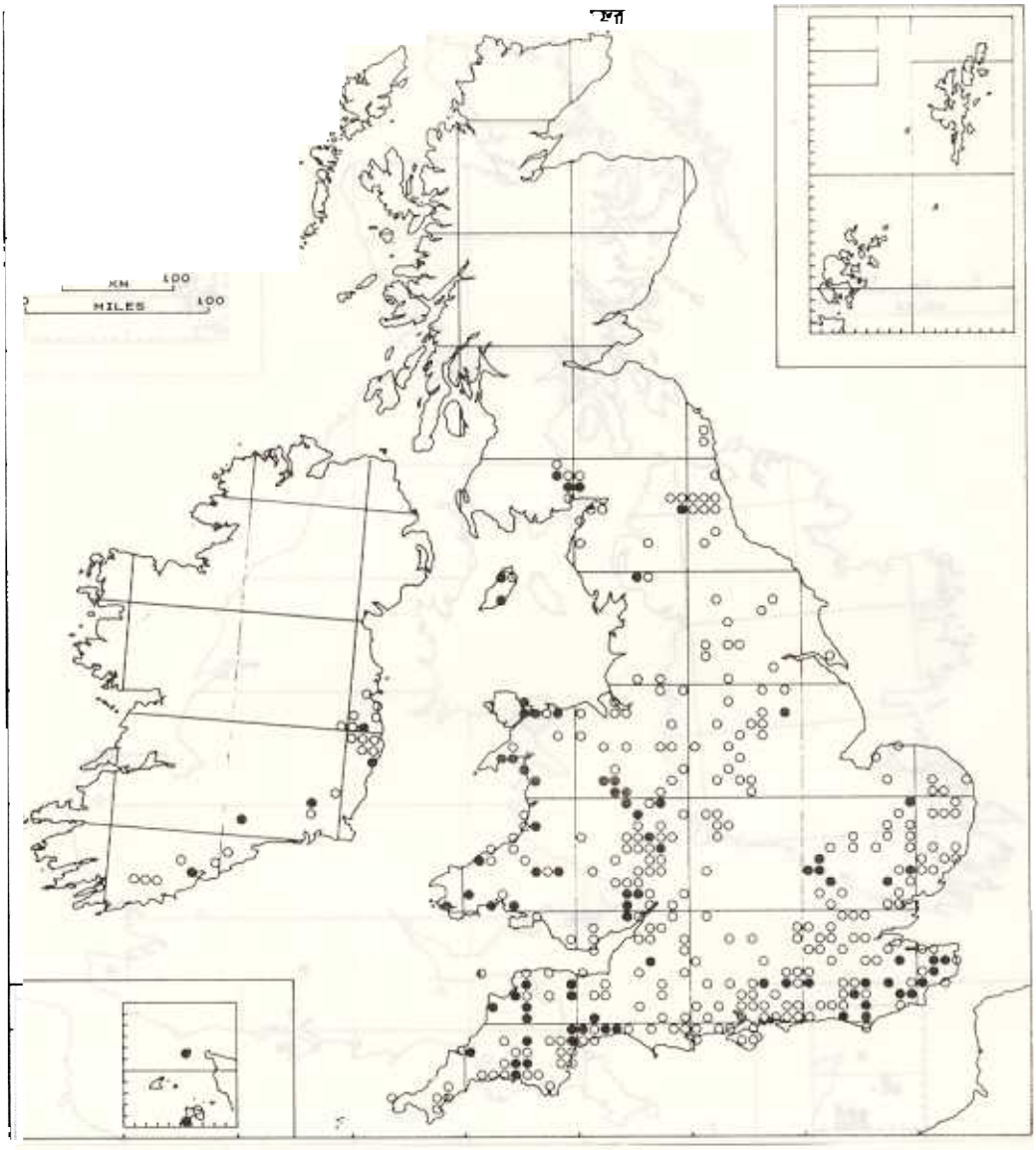

FIGURE 10. Distribution of *O. rapum-genistae* Thuill.; ● = post-1950 record, ○ = pre-1950 record.

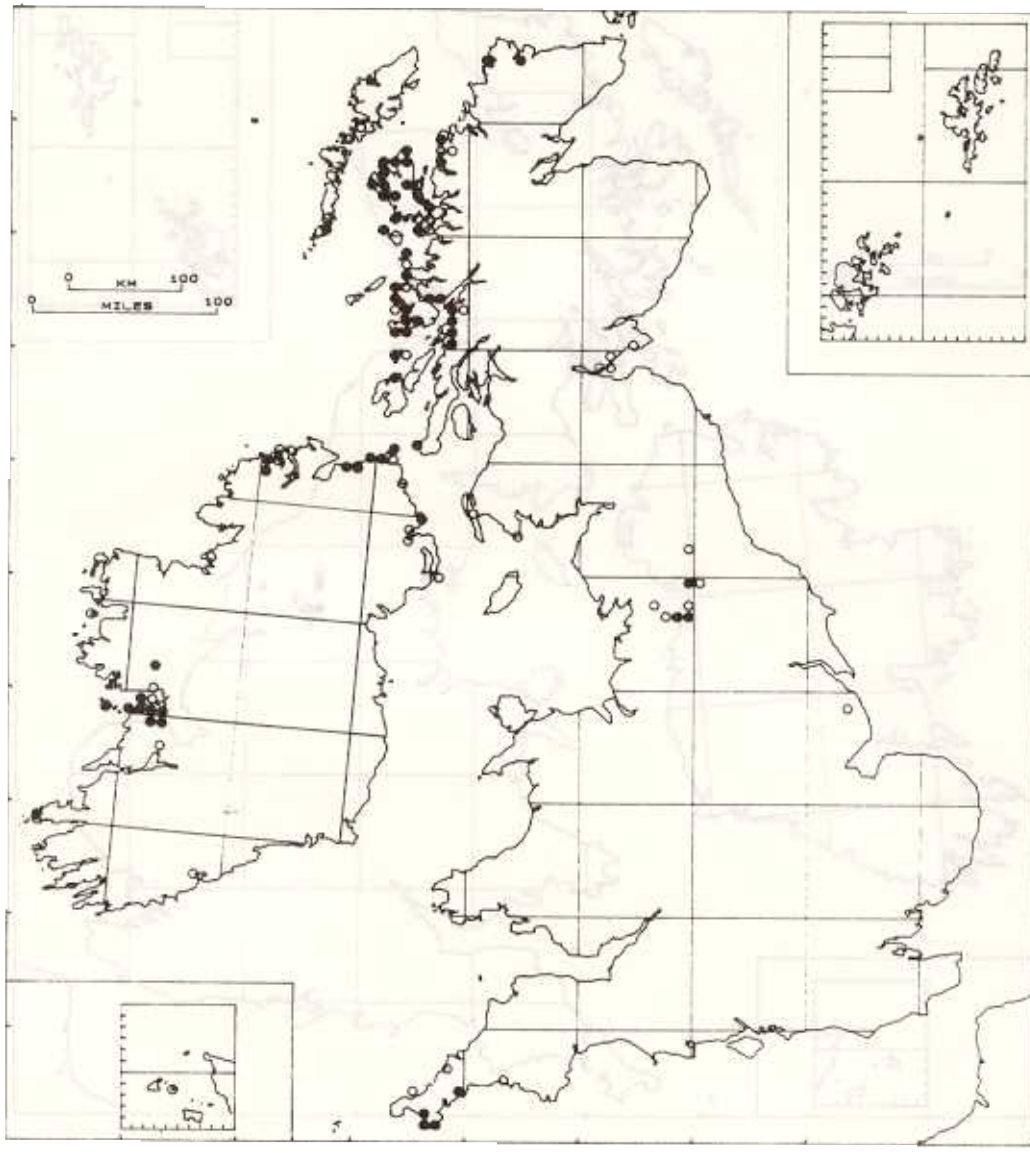

FIGURE 11. Distribution of *O. alba* Steph. ex Willd.; ● = post-1950 record. ○ = pre-1950 record.

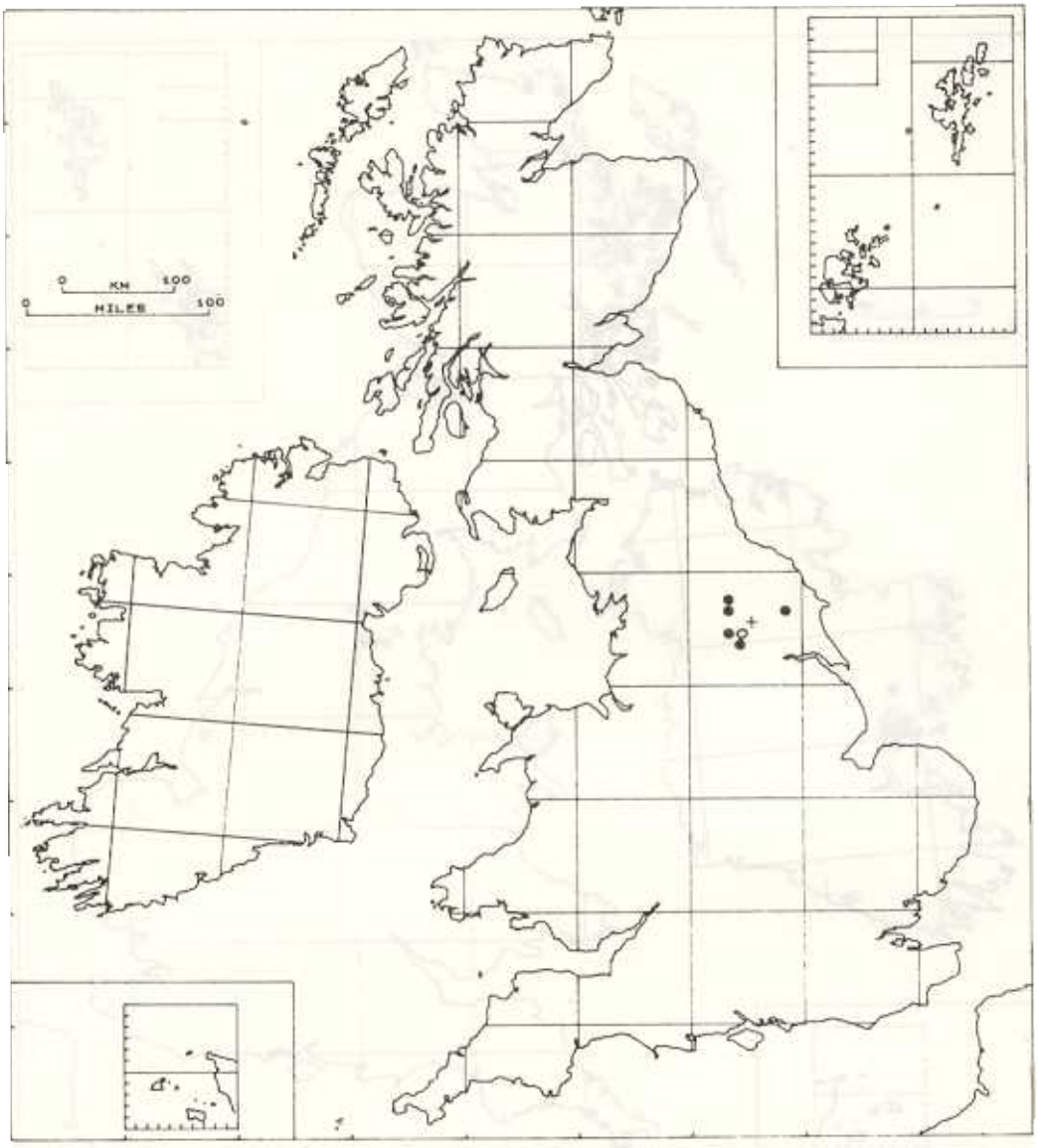

FIGURE 12. Distribution of *O. reticulata* Wallr.; • = post-1950 record, ○ = pre-1950 record, + = introduction or casual.

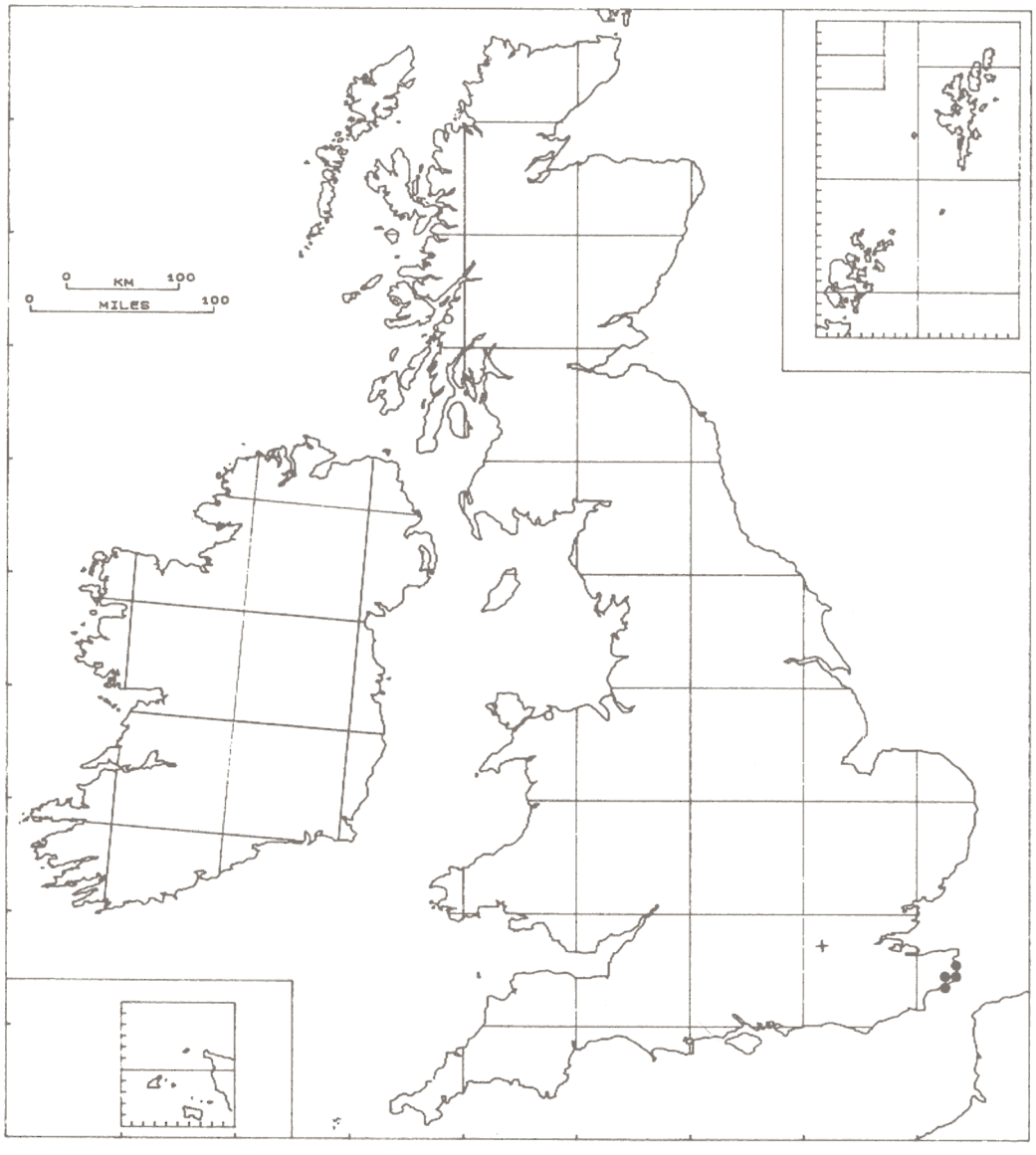

FIGURE 13. Distribution of *O. caryophyllacea* Sm.; ● = post-1950 record, ○ = pre-1950 record, + = introduction or casual.

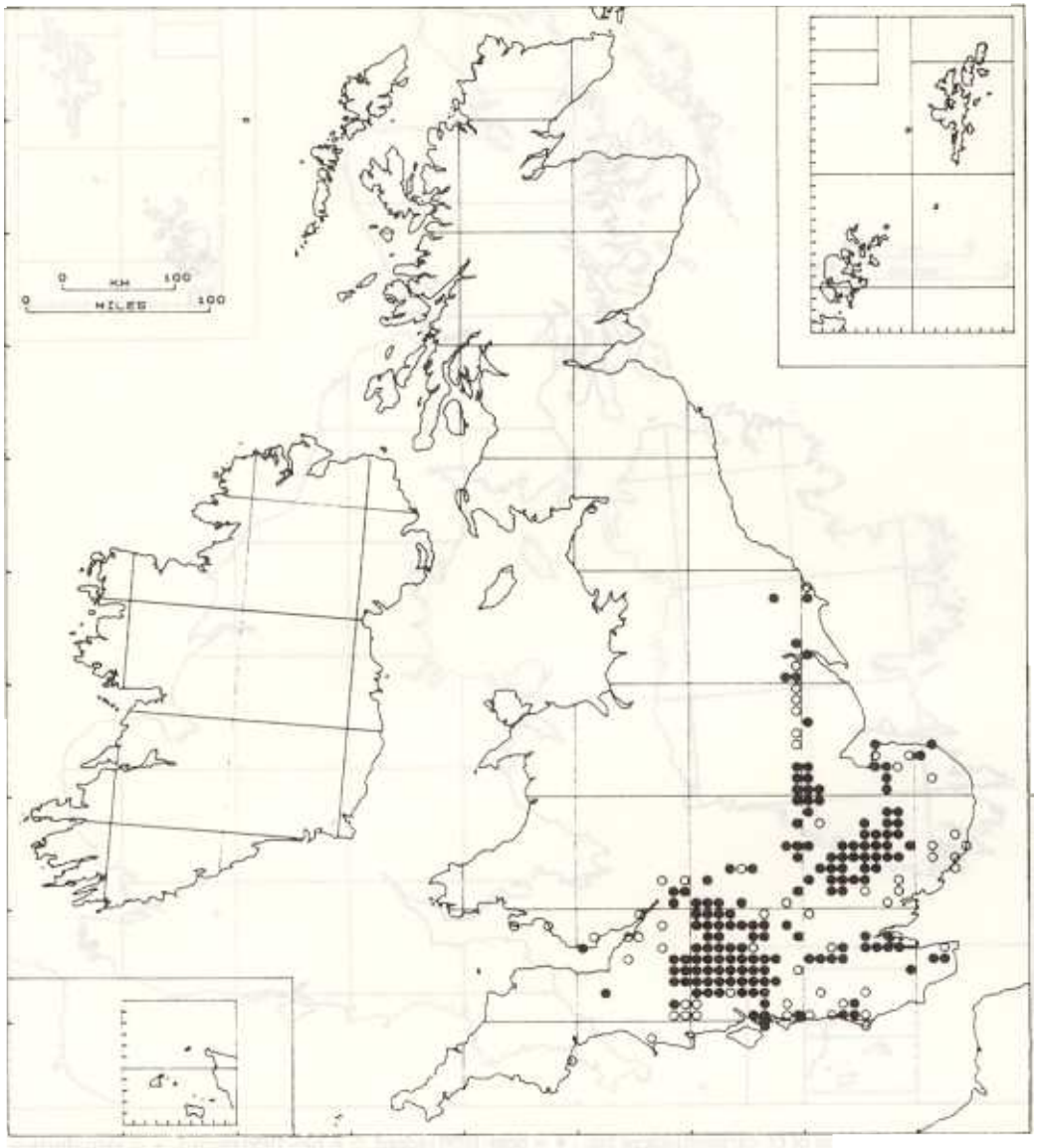

FIGURE 14. Distribution of *O. elatior* Sutton; ● = post-1950 record, ○ = pre-1950 record

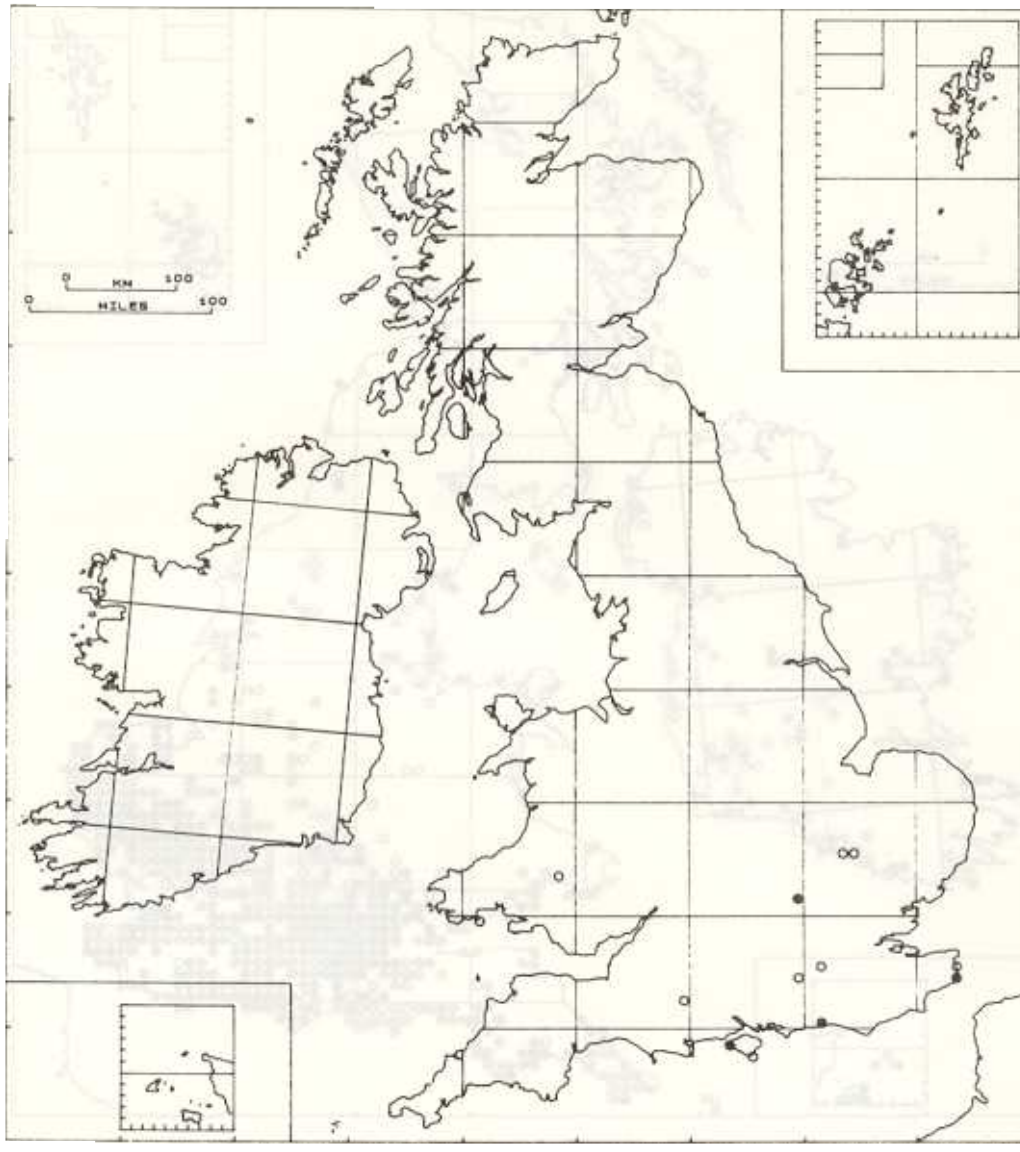

FIGURE 15. Distribution of *O. loricata* Reichenb.; ● = post-1950 record, ○ = pre-1950 record.

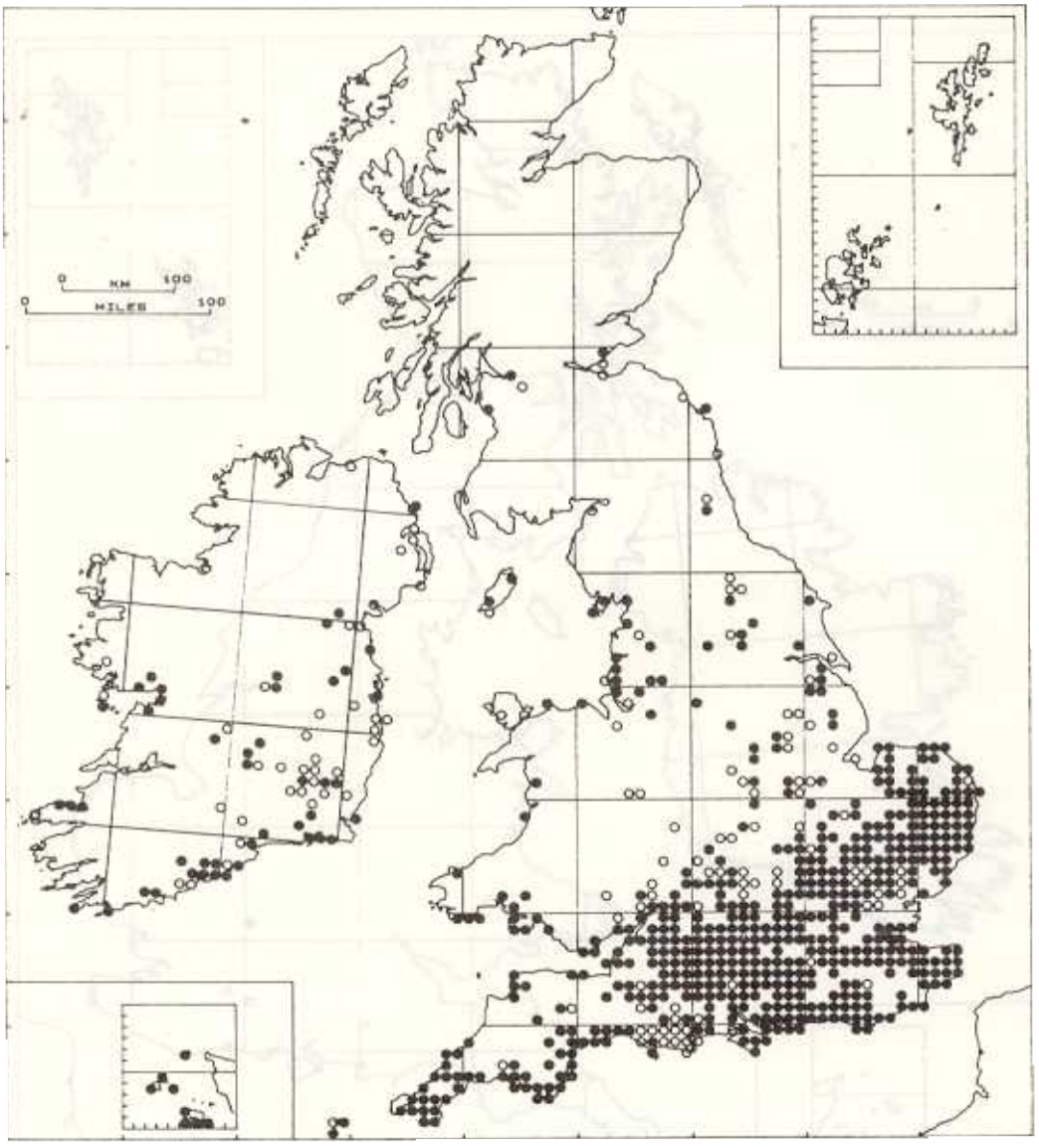

FIGURE 16. Distribution of *O. minor* var. *minor*; ● = post-1950 record, ○ = pre-1950 record. The map includes all records of the species other than those attributed to the rarer varieties.

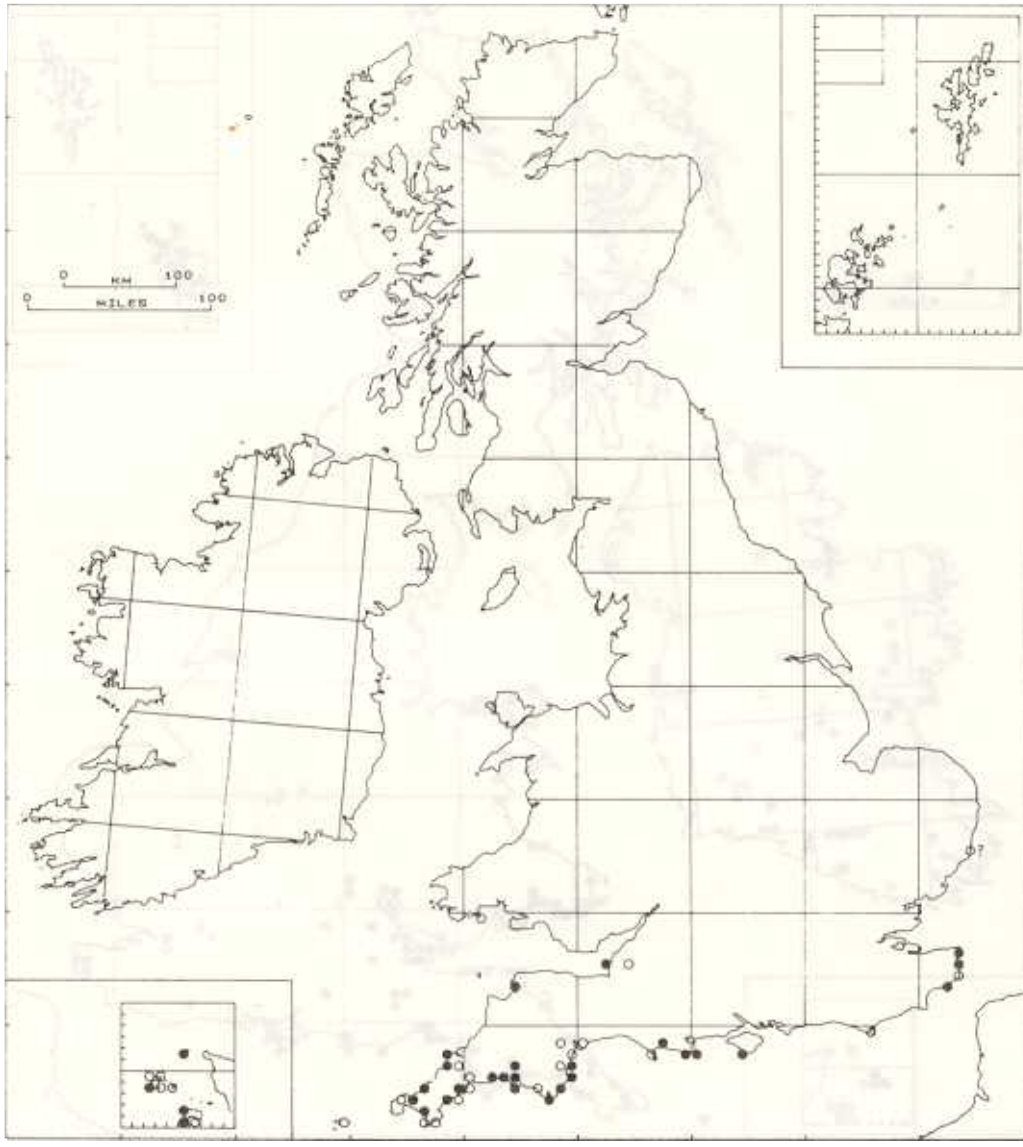

FIGURE 17. Distribution of *O. minor* var. *maritima* (Pugsley) Rumsey & Jury; ● = post-1950 record, ○ = pre-1950 record.

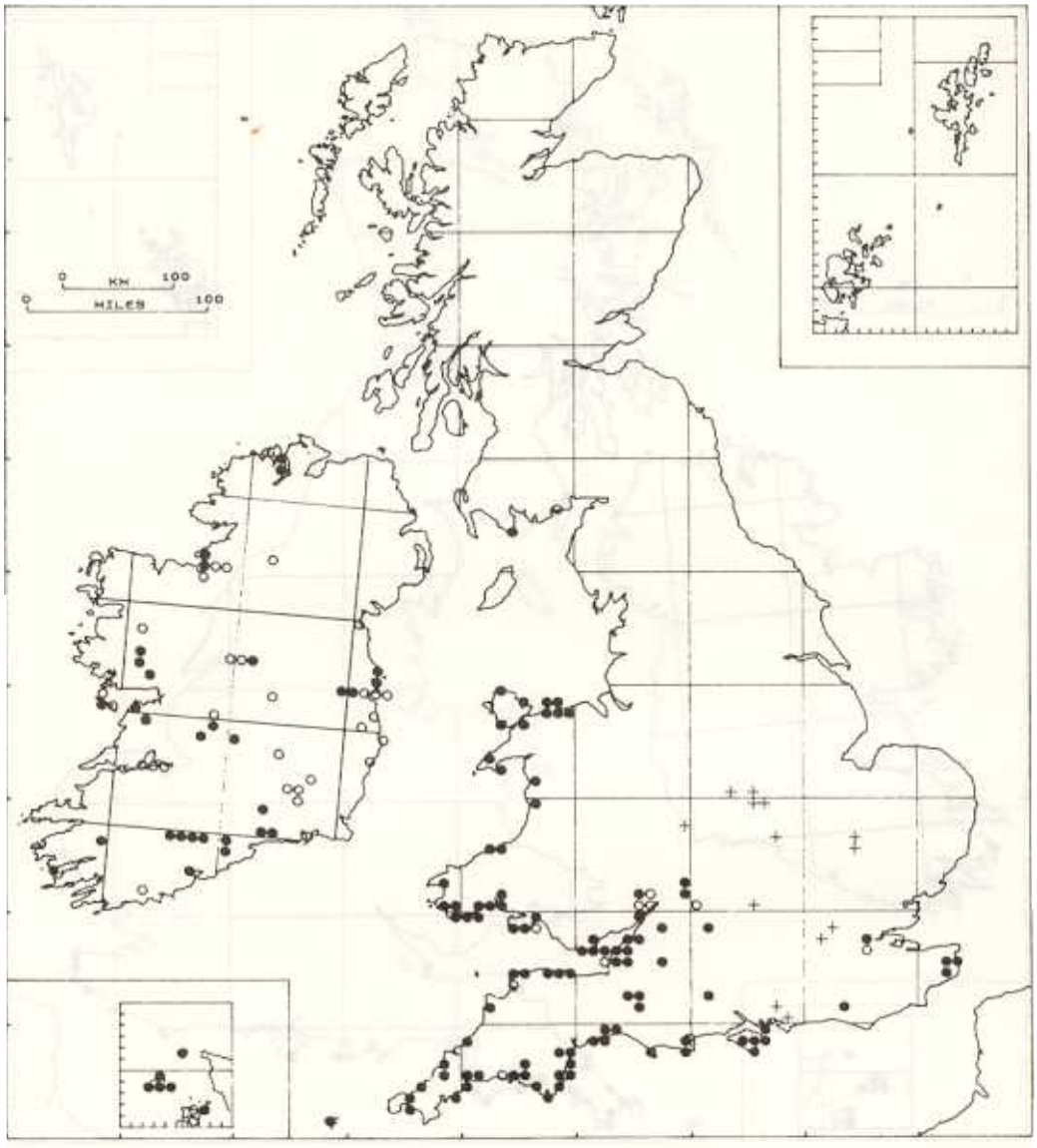

FIGURE 18. Distribution of *O. hederae* Duby; • = post-1950 record, ○ = pre-1950 record, + = introduction or casual.

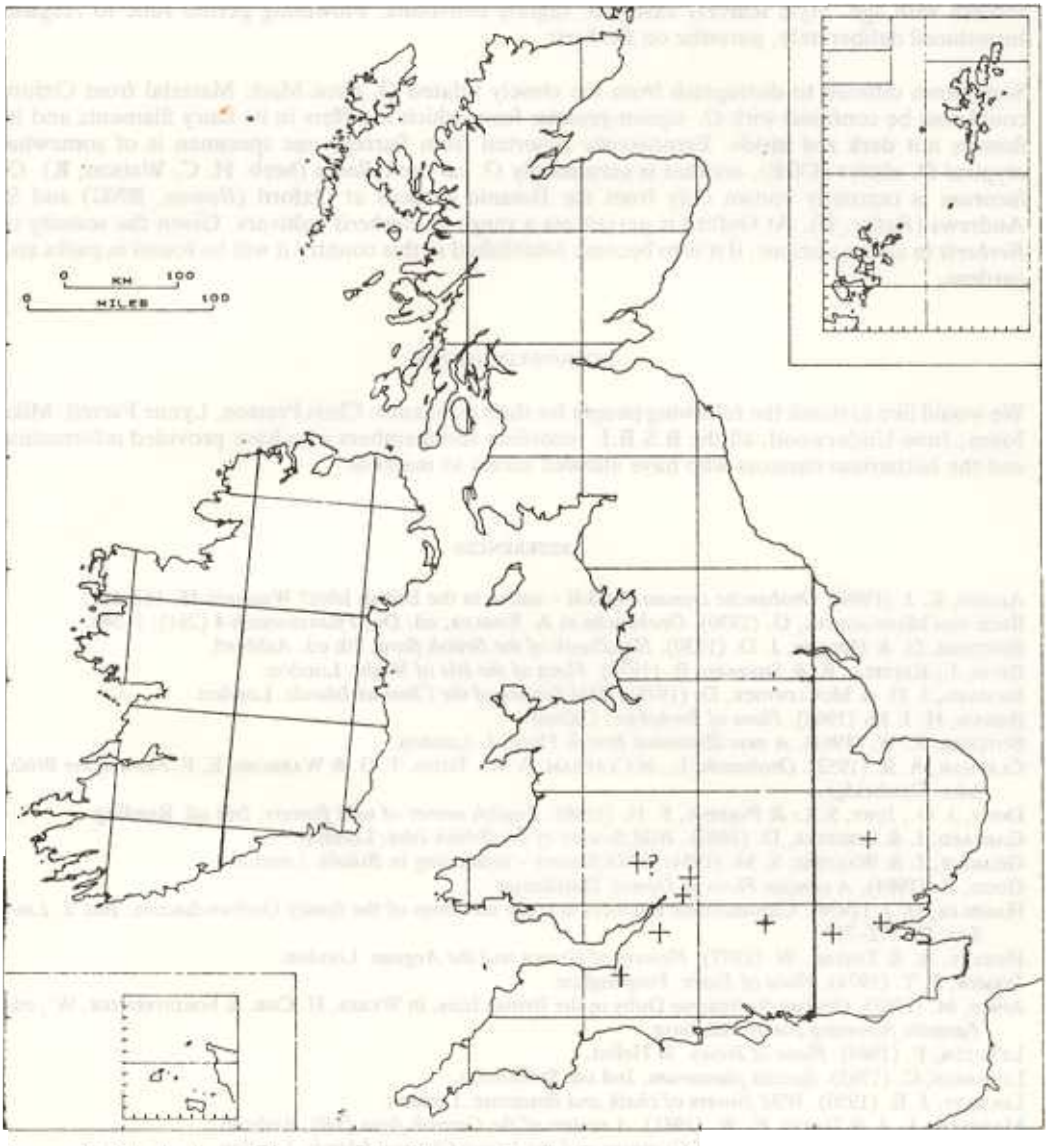

FIGURE 19. Distribution of *O. crenata* Forskål; + = introduction or casual

Flowering stem simple, 15–50 cm, glandular-pubescent, scarcely swollen at the base, yellowish. Inflorescence rather dense. Bracts 13–25 mm, oblong to lanceolate, acute to acuminate. Calyx 8–15 mm, unequally bidentate or entire. Corolla 15–22 mm, yellow tinged with red, erecto-patent to patent; upper lip ± emarginate, porrect; lower lip with conspicuously ciliate sub equal lobes. Stamens inserted 2–3 mm above the corolla base; filaments hairy. Stigma lobes yellow becoming reddish with age. Style scarcely exserted, slightly convolute. Flowering period June to August. Introduced deliberately, parasitic on *Berberis*.

Sometimes difficult to distinguish from the closely related *O. flava* Mart. Material from Oxford could also be confused with *O. rapum-genistae* from which it differs in its hairy filaments and its flowers not dark red inside. Erroneously reported from Surrey, one specimen is of somewhat atypical *O. elatior* (**CGE**), another is surprisingly *O. caryophyllacea* (herb. H. C. Watson, **K**). *O. lucorum* is currently known only from the Botanic gardens at Oxford (*Bowen*, **RNG**) and St Andrews (*Ratter*, **E**). At Oxford it parasitizes a range of *Berberis* cultivars. Given the scarcity of *Berberis* in native stations, if it is to become established in this country it will be found in parks and gardens.

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REFERENCES

ADAMS, K. J. (1984). *Orobanche crenata* Forskål – native in the British Isles? *Watsonia* **15**: 161–162.
BECK VON MANNAGETTA, G. (1930). *Orobanche* in A. ENGLER, ed. *Das Pflanzenreich* **4** (261): 1–348.
BENTHAM, G. & HOOKER, J. D. (1930). *Handbook of the British flora*, 7th ed. Ashford.
BEVIS, J., KETTELL, R. & SHEPARD, B. (1978). *Flora of the Isle of Wight*. London.
BICHARD, J. D. & MCCLINTOCK, D. (1975). *Wild flowers of the Channel Islands*. London.
BOWEN, H. J. M. (1968). *Flora of Berkshire*. Oxford.
BUTCHER, R. W. (1961). *A new illustrated British Flora*, **2**. London.
CLAPHAM, A. R. (1952). *Orobanche* L., in CLAPHAM, A. R., TUTIN, T. G. & WARBURG, E. F. *Flora of the British Isles*. Cambridge.
DONY, J. G., JURY, S. L. & PERRING, F. H. (1986). *English names of wild flowers*, 2nd ed. Reading.
GARRARD, I. & STREETER, D. (1983). *Wild flowers of the British Isles*. London.
GILMOUR, J. & WALTERS, S. M. (1954). *Wild flowers – botanizing in Britain*. London.
GOOD, R. (1984). *A concise Flora of Dorset*. Dorchester.
HAMBLER, D. J. (1958). Chromosome numbers in some members of the family Orobanchaceae. *Bot. J. Linn. Soc.* **55**: 772–777.
HUXLEY, A. & TAYLOR, W. (1977). *Flowers of Greece and the Aegean*. London.
JERMYN, S. T. (1974). *Flora of Essex*. Fingringhoe.
JONES, M. (1987). *Orobanche hederae* Duby in the British Isles, in WEBER, H. CHR. & FORTSTREUTER, W., eds. *Parasitic flowering plants*. Marburg.
LESUEUR, F. (1984). *Flora of Jersey*. St Helier.
LINNAEUS, C. (1763). *Species plantarum*, 2nd ed. Stockholm.
LOUSLEY, J. E. (1950). *Wild flowers of chalk and limestone*. London.
MARGETTS, L. J. & DAVID, R. W. (1981). *A review of the Cornish flora 1980*. Redruth.
MARQUAND, E. D. (1901). *Flora of Guernsey and the Lesser Channel Islands*. London.
MARTIN, W. K. (1965). *The concise British flora in colour*. London.
MILNE, M. (1986). Plant records. *Watsonia* **16**: 183–198.
MILNE-REDHEAD, E. (1985). More hosts of *Orobanche*. *B.S.B.I. News* **41**: 29.
MOORE, D. M. (1982). *Flora Europaea checklist and chromosome index*. Cambridge.
MUSSELMANN, L. J. & PARKER, C. (1982). Preliminary host ranges of some strains of economically important broomrapes (*Orobanche*). *Economic Botany* **36**: 270–273.
PERRING, F. H. & FARRELL, L. (1983). *British red data books*: *1. Vascular plants*, 2nd ed. Lincoln.
PETCH, C. P. & SWANN, E. L. (1968). *Flora of Norfolk*. Norwich.

PHILLIPS, R. (1977). *Wild flowers of Britain*. London.
PHILP, E. G. (1982). *Atlas of the Kent flora*. Maidstone.
POLUNIN, O. (1969). *Flowers of Greece and the Balkans*. Oxford.
POLUNIN, O. & HUXLEY, A. (1965). *Flowers of the Mediterranean*. London.
PUGSLEY, H. W. (1940). Notes on *Orobanche* L. *J. Bot., Lond.* **78**: 105–116.
RAY, J. (1690). *Synopsis methodica stirpium Britannicarum*. London.
RAY, J. (1724). *Synopsis methodica stirpium Britannicarum*, 3rd ed. London.
RIDDELSDELL, H. J., HEDLEY, G. W. & PRICE, W. R. (1948). *Flora of Gloucestershire*. Bristol.
ROE, R. G. B. (1981). *Flora of Somerset*. Bridgewater.
ROSS-CRAIG, S. (1966). *Drawings of British plants*, **23**. London.
ROSVALL, A. (1979a). Snyltrotslaktet i Sverige. *Svensk Bot. Tidskr.* **73**: 27–37.
ROSVALL, A. (1979b). *Orobanche alba*, Timjansnyltrot pa Gotland. *Svensk Bot. Tidskr.* **73**: 1–6.
RUMSEY, F. J. (1985). *Orobanche caryophyllacea* Sm. in North Wales. *Watsonia* **15**: 277.
RUMSEY, F. J. (1986). *Orobanche crenata* Forskål. *B.S.B.I. News* **43**: 18–19.
SIMPSON, F. W. (1982). *Simpson's Flora of Suffolk*. Ipswich.
SITWELL, N. (1984). *Shell guides to Britain's threatened wildlife*. London.
SOWERBY, J. (1794). *English Botany*, **3**. London.
SOWERBY, J. (1797). *English Botany*, **6**. London.
SOWERBY, J. (1799). *English Botany*, **8**. London.
SOWERBY, J. (1807). *English Botany*, **25**. London.
SOWERBY, J. (1866). *English Botany*, 3rd ed. (Ed. J.T.B. Syme). London.
STRID, A. (1980). *Wild flowers of Mount Olympus*. Kifissia.
SUTTON, G. (1797). A description of five British species of *Orobanche*. *Trans. Linn. Soc. Lond.* **4**: 173–188.
WEBB, D. A. (1985). What are the criteria for presuming native status? *Watsonia* **15**: 231–236.
WEBB, D. A. & CHATER, A. O. (1972). *Orobanche* L., in TUTIN, T. G. *et al.*, eds. *Flora Europaea* **3**: 286–293. Cambridge.

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