Short Notes

SARRACENIA IN THE NEW FOREST

Members of the genus *Sarracenia* (pitcher plants) are native to the eastern seaboard of North America. One species, *S. purpurea*, is known to have been introduced to Europe: in particular it has naturalized from plantings in western Switzerland and central Ireland (Webb 1964). It has also been recorded during the past 20 years from three localities in northern England.

On 16th July 1984, the authors found a clump of a *Sarracenia* species in the New Forest, S. Hants., v.c. 11. This plant had erect, slender, trumpet-shaped pitchers which were yellow-green and broadened gradually from their bases to their orifices. It was not *S. purpurea*, which has decumbent, inflated pitchers that vary from green, suffused with red or purple, to almost completely red. Up the front of each pitcher was a distinct wing which was broadest at the base and became progressively narrower as the trumpet itself became wider. No flowers were present, but reference to Godfrey & Wooten (1979) led to the conclusion that the plant was *S. flava* L., a species of seepage zones, cypress swamps and bogs in the coastal plain area of south-eastern North America. With assistance from Miss C. Whitefoord, subsequent comparison with herbarium material held at **BM** confirmed the identification. North American populations of this species are variable: wings are usually narrow, but may be up to 3 cm wide towards the pitcher base and the pitchers themselves vary from yellow-green to almost entirely red, with a range of venation patterns (Schnell 1978). In the New Forest, the clump of pitchers (which appeared to originate from a single rootstock and was about 15 cm in diameter) was growing between tussocks of *Molinia caerulea* (L.) Moench on a seepage terrace at the side of a valley mire. Associated species were: *Myrica gale* L., *Calluna vulgaris* (L.) Hull, *Erica tetralix* L., *Juncus acutiflorus* Ehrh. ex Hoffm., *Carex echinata* Murr., *Eriophorum angustifolium* Honck., *Equisetum palustre* L. and *Sphagnum palustre* L. The area was well-frequented by ponies, as evidenced by the extent of trampling and grazing and by the quantity of dung in the vicinity.

At the time of the first visit, the clump consisted of three grazed leaves, six mature but ungrazed pitchers and six smaller leaves, either immature pitchers or phyllodia. Phyllodia are small, sword-shaped leaves, not growing to more than about one third the length of mature pitchers, which do not develop into pitchers. In *S. flava* they develop during the latter half of the growing season and persist through the winter, though in other species they may grow in the spring before pitchers are produced. On a second visit (24th August 1984), there were 19 grazed leaves, six mature pitchers and five small leaves (phyllodia or young pitchers). Mature pitchers were 34–36 cm tall, compared with maximum lengths of c. 90 cm found in material from North America.

There is a long history of cultivation of *S. flava* in Britain and different variants have been recognized (Masters 1881). The New Forest clump undoubtedly originated from introduced, cultivated stock, though it is not possible to determine how it arrived at this locality. The site is at least 200 m from the nearest road or track, although it is close to a walkway used by ponies. Apart from damage caused by these animals, there are no signs of recent disturbance; associated plants are well-grown and the vegetation cover is complete. Thus it would seem that direct planting in the recent past is unlikely. The plant appears to be selectively grazed and, on a third visit to the site in October 1984, no mature pitchers remained ungrazed. On 30th July 1985 the clump contained five mature pitchers, five developing pitchers or phyllodia, and 13 grazed leaves. Grazing pressure may be responsible for keeping the size of the clump in check and it is possible that it has existed in this area for a considerable time.

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CAREX MURICATA L. SUBSP. *MURICATA* NOT IN DEVON

Ivimey-Cook (1984) has reported that *Carex muricata* L. subsp. *muricata* "is thought to occur on the chalk in the vicinity of Branscombe and has also been recorded for Bideford". This is a sedge of northern and eastern Europe, largely replaced in the west by its close ally, the subspecies *lamprocarpa* Čelak. (= *C. pairaei* F. W. Schultz). Its presence in Britain was established by Nelmes (1947) who found herbarium specimens from four widely separated stations. To these only one more has since been added.

Although one of Nelmes' stations was in Gloucestershire (where the plant, though refound in 1973, now appears to be at least temporarily extinct), an occurrence in Devonshire is extremely improbable, for in Britain the habitat is closely restricted to very well drained limestone scree. Opportunities for error are, moreover, great: determination is not so very difficult – though the differences between the two subspecies are small they are quite definite (David 1979) – but the nomenclature has been very much confused.

L. J. Margetts has kindly and thoroughly investigated these Devonshire records. For 'Bideford' a specimen exists (now in **CGE**) and this turns out to be not a 'muricata' at all but *Carex otrubae* Podp. For 'Branscombe' no specimen has been preserved, but the finder was unaware that there are two subspecies of *C. muricata* proper and followed Jermy & Tutin (1968) in using the name merely to distinguish her plant from *C. muricata* subsp. *leersii* Aschers. & Graebn., now known (Chater 1980) as *C. divulsa* subsp. *leersii* (Kneucker) W. Koch. It is Margetts' opinion that the plant found was most probably *C. spicata* Huds., yet another member of the complex.

There is no reason, then, to suppose that *C. muricata* L. subsp. *muricata* is, or could be, in Devon. And I would beg all recorders not to publish records of this (in Britain) extremely rare plant before making the most thorough check of their authenticity.

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PETRORHAGIA NANTEULII (BURNAT) P. W. BALL & HEYWOOD IN MID-GLAMORGAN

In August 1985, *Petrorhagia nanteulii* (Burnat) P. W. Ball & Heywood (*Kohlrauschia prolifera* auct.) was discovered by the author in the Dare Valley Country Park, Aberdare, v.c. 41. It was found to be growing in a large established colony along with other grassland plants on a well drained embankment of a disused railway line.

P. nanteulii is a rare species found growing in sandy and gravelly places in south-eastern England and is also established as an alien. There are only two previous records for this species in Wales, both from Cardiff Docks (Ellis 1983). The most recent record was 1980, the previous record was 1926. Thus this site is the second in Wales so far discovered. Its presence on what was a busy railway line serving the coal mines and Gadlys Ironworks in the Dare Valley, ultimately connected with Cardiff Docks, gives a clue as to its possible origin. Coal mining operations ceased by the 1950s and the line fell into disuse. As the colony is well established it is conceivable that it has existed at this site for 30 years or more after being carried there, presumably on railway wagons loaded with imported iron ore.

ACKNOWLEDGMENTS

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DACTYLORHIZA MACULATA (L.) SOÓ × *D. TRAUNSTEINERI* (SAUTER) SOÓ IN N.E. YORKS.

In mid-June 1985, I examined what may possibly be a previously unrecorded colony of *Dactylorhiza traunsteineri* (Sauter) Soó at a site east of Pickering, N.E. Yorks., v.c. 62, (GR 44/8.8). The location is a very small, isolated calcareous flush (approx. 10 m diameter), where *D. traunsteineri* and its putative hybrid with *D. maculata* (L.) Soó grow along with such normal associates as *Primula farinosa*, *Pinguicula vulgaris* and *Schoenus nigricans*. *Dactylorhiza maculata* grows close by and certainly within 30 m. The hybrid, *D. maculata* × *D. traunsteineri*, for which this is a new vice-county record and second English record, is rare in the British Isles.

The typical hybrid shows many features intermediate between the parents and is a relatively robust and distinctive plant generally 20–26 cm tall (at this site typical *D. traunsteineri* is 6–12 cm), with broader leaves than *D. traunsteineri*, marked with well-spaced dark blotches. The stem is stouter than in *D. traunsteineri* and the upper stem and bracts are not so deeply stained red-brown with anthocyanin. The flower colour is a very distinctive pale bluish-red, intermediate between the parents, and the lateral sepals are not held erect but arched forward into a semi-hood. The labellum is large and is lightly flecked with dots and broken loops, with the lateral lobes reflexed and the central lobe smaller than the laterals but of similar length, although perhaps closer in shape to *D. maculata*. The spur is shorter and more conical than in *D. traunsteineri*.

Although the characteristics as outlined above are found to be in close accord with those given by Roberts (1962), it is interesting that some of the plants had unspotted (rather than spotted) leaves and, in some cases, the usual pronounced reflexing of the lateral lobes of the labella was absent or reduced and, often, the flower spike was distinctly less lax than is usual.

A detailed description and colour photographs were sent to R. H. Roberts, who noted in these plants a greater leaf width and wider spur opening than in examples of the hybrid which he had observed, but agreed that the arched forward position of the lateral sepals, the shape and colour of the labellum, and the reduced anthocyanin staining of the upper stem and bracts indicate the hybrid. It is in fact quite possible that a hybrid swarm is present, with back-crossing and/or segregation causing some degree of variability, but such swarms, whilst demonstrated to occur for instance between *D. fuchsii* and *D. majalis* subsp. *purpurella* (Lord & Richards 1977), appear not to have been recorded for *D. maculata* × *D. traunsteineri*.

Herbarium specimens were not gathered, but colour photographs and detailed field notes are retained by the author.

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I wish to thank Mr R. H. Roberts for his help with these plants.

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SEED MORPHOLOGY IN *ARUM MACULATUM* L.

A recent study of seed morphology in *Arum maculatum* L. has shown some interesting differences between hedgerow and woodland populations of this species. Seven discrete populations of *A. maculatum* were sampled from the Deeside area (GR 33/29.69) of north-eastern Flints., v.c. 51. Four were from woodland and three from hedgerow habitats. In all, 77 fruiting spikes were collected during August 1981. In each case, the ripe berries were removed from the spike and a random subsample of twelve berries per population was selected. The enclosed seeds were separated from the pulp of each berry and the largest seed was chosen for further examination. Seed length and width were measured across the widest points respectively. The total sample was therefore represented by 84 seeds, i.e. twelve seeds per population. To determine overall and habitat mean seed weights, each sample of twelve seeds per population was weighed. This provided a total of seven population weights on which to calculate means.

The results are shown in Table 1. The overall means for seed length and width are similar to those obtained by Sowter (1949), i.e. c. 6 × c. 5 mm. Both seed length and width show continuous variation and are strongly correlated ($r=0{\cdot}74$, $p=0{\cdot}001$); this indicates that seed shape is fairly constant irrespective of absolute size.

TABLE 1. SEED MORPHOLOGY IN WOODLAND AND HEDGEROW POPULATIONS OF *ARUM MACULATUM* L.

Population characters	Woodland	Hedgerow	Total
No. of populations	4	3	7
No. of spikes	52	25	77
No. of seeds sampled	48	36	84
Mean seed length (mm)	6·25±0·72	5·25±0·68	5·82±0·86
and S.D.	(n=48)	(n=36)	(n=84)
Mean seed width (mm)	5·02±0·66	4·36±0·54	4·74±0·69
and S.D.	(n=48)	(n=36)	(n=84)
Mean L/W ratio	1·3±0·1	1·2±0·1	1·2±0·2
and S.D.	(n=48)	(n=36)	(n=84)
Mean weight of 12 seeds (g)	0·44±0·07	0·33±0·02	0·39±0·08
and S.D.	(n=4)	(n=3)	(n=7)

There are, however, statistically significant differences between the mean values of woodland and hedgerow populations (Table 1). The differences involve (a) mean seed length ($t=6{\cdot}5$, $p\leqslant 0{\cdot}001$); (b) mean seed width ($t=5{\cdot}0$, $p\leqslant 0{\cdot}001$); (c) mean seed weight ($t=10{\cdot}3$, $p\leqslant 0{\cdot}001$); and (d) mean seed length/width ratio ($t=4{\cdot}5$, $p\leqslant 0{\cdot}001$).

I therefore conclude that there is a relationship between seed size and habitat in *A. maculatum*. Salisbury (1942) was able to demonstrate a broad correlation between the average seed weight of a species and its preferred habitat. In particular, species from closed, woodland communities have larger seeds than those of more open habitats such as hedgerows. This example of intraspecific variation in seed size was not discussed by Prime (1960) nor by other students of *Arum*, e.g. Sowter (1949).

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OPHRYS APIFERA HUDSON SUBSP. *JURANA* RUPPERT FOUND IN BRITAIN

Every year since 1980, I have visited a site on the Wiltshire downs (v.c. 8) and, among a range of plants typical of chalk downland, I have recorded five species of orchid, *Listera ovata*, *Orchis mascula*, *Ophrys insectifera*, *O apifera* and *Dactylorhiza fuchsii*. *O. apifera* first appeared in June 1983, but the single specimen was not closely examined.

On 17th June 1984, a single spike of *O. apifera* was again found, in approximately the same position as the 1983 plant, and close examination of the flowers revealed that the two upper, inner perianth segments were of similar form and colour to the three outer perianth segments. Photographs were taken on 21st June and again on 23rd June, by which time four flowers had opened fully. These agreed in all details with the descriptions of *Ophrys apifera* Hudson subsp. *jurana* Ruppert given by Lang (1980) and Soó (1980) and also the descriptions and illustrations of this plant found in Duperrex (1961), Williams *et al.* (1978), Kohlhaupt (1981), Baumann & Künkele (1982) and Davies *et al.* (1983). Six flowers ultimately opened, and the spike reached a height of 28 cm. Photographs were sent to D.C. Lang, who agreed with the identification, and copies have been placed in **LTR**.

A visit to the site on 16th May 1985 revealed a developing rosette of leaves. Additional visits on 23rd June and 2nd July were made by D. C. Lang and myself, flowering being delayed to the latter date due to the late season.

The site is on an east-facing bank above a sunken track on the north side of a chalk hill. The flora is typical of chalk downland, and species recorded within 3 m of the plant include *Lotus corniculatus*, *Polygala vulgaris*, *P. calcarea*, *Helianthemum nummularium*, *Linum catharticum*, *Poterium sanguisorba*, *Thymus praecox*, *Asperula cynanchica*, *Cirsium acaule*, *Leontodon hispidus*, *Listera ovata* and *Dactylorhiza fuchsii*.

The plant had three basal leaves and two stem leaves, and reached a height of 26·5 cm with four mature flowers. Individual flowers varied slightly in size, the outer perianth segments averaged 13 mm long by 6 mm wide at the widest point, and the upper, inner perianth segments 10 mm long by 4 mm wide. The labellum was, on average, 8 mm wide. The upper, inner perianth segments were pink, with a green central rib, blunt and noticeably hairy on the margins. They tended to curl forward at the tips. The labellum pattern differed from that of the normal variant of *O. apifera*. The typical U-shaped pattern at the base was missing and, halfway down the labellum, an irregular horizontal yellow bar stretched across the entire breadth.

Seed-set was not observed in 1984. In 1985, self-pollination was evident in two of the flowers

and, on 30th August, three well-developed seed capsules were present. All known sites for *O. apifera* within 6 km have been searched, but no specimens resembling subsp. *jurana* have been found.

The distribution of subsp. *jurana* is described generally as western-central and southern Europe (Williams *et al.* 1978; Soó 1980; Davies *et al.* 1983), but more specifically it has been found in parts of south-eastern France (Duperrex 1961) and south-western Germany (Baumann & Künkele 1982). Although no previous record of this subspecies in Britain appears to exist, it has recently been discovered in northern Germany and Holland by M. Ebbens (D. C. Lang pers. comm.). Careful examination of *O. apifera* flowers might reveal that this subspecies is more widely spread than appears at present.

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I am indebted to D. C. Lang for help in identification, and for encouragement and suggestions in writing this note.

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THE STATUS OF *ORCHIS FRANCIS-DRUCEI* WILMOTT

Wilmott (1936) described a new species of orchid, *Orchis francis-drucei*, following its discovery whilst he was on an excursion with Francis Druce in north-western Scotland. This new species was described as being slender in habit, with few narrow leaves, and a short, lax-flowered inflorescence, with a long, projecting, median lobe of the labellum. Wilmott recognized that these characters were shared by a species then known as *O. traunsteineri* Sauter, which at that time had not been recognized from the British Isles; he distinguished the Scottish plants as being smaller and having a very long median labellum lobe, which also had intense reddish-purple markings on a white background.

O. francis-drucei was originally described from a single colony found on a hill slope above Loch Maree, W. Ross, v.c. 105. Since its discovery on 23rd June 1935, the plant has apparently remained undetected until a colony of similar plants was found by M.R.L. in June 1983 near Loch Maree. A study of this colony of some 40 plants was undertaken by the authors the following year, and specimens sent to Mr R. H. Roberts were confirmed beyond any doubt as *Dactylorhiza traunsteineri* (Sauter) Soó.

The detailed description, illustrations and plates published by Wilmott (1936) enable a comparison of the 1935 and 1984 populations with each other and with a generalized description of *D. traunsteineri* (Table 1). In spite of the differences, the 1984 plants are clearly conspecific both with the 1935 plants described as *O. francis-drucei* and with *D. traunsteineri*. It is assumed that the variation between the two collections is either because the 1984 population was a different one or that the 1935 population is the same but consisted of variants which are no longer dominant in this population.

It has been demonstrated by Roberts & Gilbert (1963) that small isolated populations of *D.*

TABLE 1. COMPARISON OF *O. FRANCIS-DRUCEI* WITH *D. TRAUNSTEINERI*
Figures in brackets show mean values

Character	*O. francis-drucei*[a]	*D. traunsteineri*[b] West Ross	*D. traunsteineri*[c] Generalized
Height (cm)	11–13	10–18 (14·2)	10–32
Total no. leaves	4	3–5 (3·7)	3–5
No. non-sheathing leaves	0	0–1 (0·8)	0–1 (0·7)
Length of longest leaf (cm)	4	4–10 (7·6)	6–12
Max. width of longest leaf (cm)	0·4–0·5	0·8–1·3 (1·1)	0·6–1·5
Leaf spotting	unspotted	mainly lightly spotted with small dots or bars	markings light or absent
Leaf colour	pale green	pale green	pale green
Bracts	deeply suffused purple	deeply suffused purple	usually deeply suffused purple
Floral spike	sub-secund with 5–8 flowers	secund with 4–11 flowers	frequently secund with 2–20 flowers
Labellum length × width (mm)	7 × 6	(7·2) × (8·5)	6·5–8·5 × 0·7–1
Labellum shape and colour	sub-deltoid obtriangular with a long projecting mid-lobe, intense reddish purple markings on a white ground	more or less deltoid with a prominent mid-lobe, intense markings on a background of magenta to pale pink	more or less deltoid with less distinct mid-lobe than column (b), colour as column (b)
Spur length × width (mm)	6 × 2·3	(7·7) × (2·4)	8–9 × 3·0–3·5
Length of peripheral bract cells (μm)	—	(c. 110)	(c. 110)

[a] Wilmott (1936).
[b] Field measurements on 20 plants by the authors in 1984 near Loch Maree.
[c] Heslop-Harrison (1953), Roberts & Gilbert (1963) & R. H. Roberts (pers. comm.)

traunsteineri may be uniform but possess features at variance with other populations in the British Isles. Such local variation, when considered with Heslop-Harrison's (1953) concept of 'anthocyanin high' and 'anthocyanin low' modes for flower colour and leaf markings, offers an explanation for the differences between Wilmott's *O. francis-drucei* and *D. traunsteineri* in the British Isles. The only character which distinguishes both the 1935 and 1984 W. Ross plants from typical *D. traunsteineri* is the somewhat narrower spur (Table 1), which is not thought to be of high significance. We therefore consider that *O. francis-drucei* Wilmott should be regarded as wholly synonymous with *D. traunsteineri* and not be given even infra-specific status.

In 1983, *D. traunsteineri* was removed as a species known with certainty to occur in Scotland (Tennant & Kenneth 1983). The 1984 Loch Maree record therefore re-establishes *D. traunsteineri* as a Scottish plant beyond doubt. Moreover, a population has recently been recognized from Westerness, v.c. 97, (Mr D. C. Lang and Miss L. M. Watson, pers. comm.) that should be referred to *D. traunsteineri*, and a solitary plant found by the authors in 1984 in Knapdale, Kintyre, v.c. 101, is also this species; there is little doubt that further fieldwork will reveal it elsewhere in Scotland. Specimens and photographs of the 1984 Loch Maree dactylorchids have been placed in **E**.

The 1984 population occurred in a series of open flushes dominated by *Molinia caerulea* and *Schoenus nigricans* with penetration of *Erica tetralix*, *Salix aurita* and *Myrica gale* from the surrounding heath community. A full list of the species recorded showed the vegetation to be referable to the *Pinguiculo-Caricetum* Jones described by Wheeler (1980). (This unit includes the *Cariceto-Saxifragetum* and *Carex panicea-Campylium stellatum* syntaxa of McVean & Ratcliffe (1962), both widespread in base-rich flushes in Scotland). The vegetation is also similar to the W. Ross site for *D. incarnata* subsp. *cruenta* (Kenneth & Tennant 1984). *D. incarnata* subsp. *incarnata* and subsp. *pulchella* were both present at the 1984 Loch Maree site, and *D. maculata* subsp. *ericetorum* occurred in more acid parts nearby. Several rather robust dactylorchids were also noted

near the periphery of this site and were initially suspected to be the hybrid *D. incarnata* × *D. traunsteineri*, although this could not be confirmed; no other dactylorchids were found in the immediate vicinity.

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CROSS-POLLINATION BY WASPS IN *EPIPACTIS LEPTOCHILA* (GODF.) GODF. S.L.

This note describes what I believe to be the first published observation of cross-pollination in those species of *Epipactis* which are generally regarded as being autogamous, i.e. automatically self-pollinated. In the flora of the British Isles, these comprise *E. leptochila* (Godf.) Godf., its very close relative *E. dunensis* (T. & T. A. Stephens.) Godf., *E. phyllanthes* Sm. and *E. youngiana* Richards & Porter.

In the other species of *Epipactis* in the British Isles, it is believed that within-flower pollination rarely occurs and that pollen transfer is usually between flowers (allogamy), either on the same (geitonogamy) or different (xenogamy) genets. It was Darwin (1862) who first showed that the allogamous species (*E. helleborine* (L.) Crantz, *E. purpurata* Sm., *E. atrorubens* (Hoffm.) Schult.) are usually pollinated by wasps (*Vespa* spp.); *E. palustris* (L.) Crantz is also allogamous but is usually visited by bees. These species are, however, self-compatible, so geitonogamous selfing is possible. Wasps visit the flowers to drink nectar, which is located in the proximal, hemispherical and usually purplish segment of the labellum (hypochile). To reach the hypochile, the head or top of the thorax of the wasp rubs against the projection on the outer end of the stigma (rostellum), which is covered by a sticky, whitish membrane (viscidium). The two pollinia drop from the anther into grooves (clinandria) shortly after the flower opens, in which position they adhere apically to the viscidium. When a wasp leaves a flower, the viscidium together with one or both pollinia adhere to the wasp. When a subsequent flower is visited, part or all of one or both pollinia may be deposited in the wet secretion of the stigma surface (just inside the position of the rostellum), thereby achieving allogamous pollination. However, Hagerup (1952) noted that when pollinia are not removed, some self-pollination occurs within the flower (autogamy) as the viscidium ages and flows onto the stigma surface, carrying the pollinia with it.

In contrast, in the autogamous species, the rostellum is small (except in *E. youngiana*) and the viscidium is missing, or is present in bud but disappears before or shortly after the flower opens. The flower is usually greenish, inclined, and less fully open than in the allogamous species. The

pollinia rest uneasily in the shallow clinandria, and rapidly break up and fall onto the stigma unimpeded because the viscidium is absent. It is usually considered that such plants are invariably self-pollinated, and this must certainly be so for cleistogamous variants, in which the flower never opens, and is probably so for the variants of *E. phyllanthes* in which self-pollination occurs before the flower opens. However, Proctor & Yeo (1973) and Richards (1982) have speculated that some casual allogamy in the supposedly autogamous *E. leptochila*, *E. dunensis* and *E. youngiana* might be caused by insect visitors, to which parts of disintegrating pollinia might adhere. The biological importance of the allogamous and autogamous breeding systems has been illustrated by Richards (1982), who showed that four populations of three allogamous species are more variable than five populations of four autogamous species for each of ten metric characters.

On 10th August 1985 at 16.00 hrs, I visited a population of the inland Northumberland variant of *E. leptochila* (Richards & Swan 1976), many individuals of which closely resemble *E. dunensis*. This population grows on lead-mine spoil under birch trees beside a road leading into a caravan site. Some 30 individuals were flowering, with 5–35 flowers per spike, approximately half of which were open and not withered. Within an area of 1 m^2 were seven spikes next to the road in filtered sunlight, where the shade temperature was approximately 20°C. For at least 30 minutes, these received the intermittent but urgent attention of at least five workers of the wasp *Vespa germanica* Fab. The wasps were drinking nectar from the hypochile for periods of 5–60 seconds per flower. For twelve recorded spike visits, from three to five flowers were visited; these were usually adjacent to each other and in the middle of the region of the open flowers on a spike. Some feeding took place at every flower which the wasp visited, and the wasps alighted on every flower that was approached; however, wasps usually visited adjacent flowers by crawling.

Although viscidia were present within large buds (determined by dissection), almost all open flowers lacked a viscidium, and the rostellum was poorly marked, the outer edge of the stigma being rather straight with only a slight rostellar peak. For three spikes, only the topmost open flower had a detectable viscidium. Pollinia remained in the anther or on the clinandria in 15 out of a sample of 61 open flowers in which the stigma was greenish (and therefore presumed to be receptive) rather than brownish. On six occasions, a wasp was observed to visit a flower with pollinia in situ. On each occasion, all or most of both pollinia adhered to the head or to the front of the top of the thorax of the wasp when it left the flower, despite the apparent absence of a visible viscidium of the type found in allogamous species. When a wasp visit was simulated using the sharpened end of a pencil, the pollinia adhered to the bare wood surface of the pencil. All the five wasps that were closely observed were carrying pollinia on, or just behind, the head; a minimum of three and a maximum of at least eight pollinia were observed on different wasps at various times. In some cases, pollinia had adhered on the top of other pollinia, making an accurate estimation difficult.

Wasps carrying pollinia were observed visiting about 30 flowers with apparently receptive stigmas. In no cases were whole pollinia or parts of pollinia large enough to be detected by the naked eye on stigmas, although in every case that was closely observed, the pollinia on the wasp were clearly brought into contact with the stigma as the wasp drank. It seems very likely however that some pollen was deposited on stigmas, either as individual tetrads or as very small fragments. In between flower visits, wasps tried vigorously to remove pollinia from their heads using their front legs, but in this they were apparently unsuccessful. However, it is likely that such efforts would loosen tetrads and massulae from the pollinium, making them available for pollination.

From the same sample of 61 flowers with apparently receptive stigmas, whole pollinia or parts of pollinia large enough to be observed with the naked eye were seen in 19 flowers. It is assumed that these resulted from within-flower pollination, because between-flower visits by wasps apparently did not leave large pollinium fragments on stigmas. It follows that for 42 of 61 flowers in this 'autogamous' population, within-flower pollination had not occurred; in most the pollinia were missing.

Within the 1 m^2 that was intensively studied, the minimum distances between spikes were 5, 10, 15, 20 and 50 cm respectively. Nine out of 30 between-flower transfers by wasps were between spikes and should therefore have resulted in at least some cross-pollination. As pollinia

apparently adhere to wasps for some time, releasing pollen slowly, pollen carry-over should be large, and the potential for cross-pollination should be considerable.

It is concluded that in apparently autogamous populations of *Epipactis* in which the viscidium is absent in open flowers and large parts of pollinia fall onto the stigma of the same flower at an early stage, substantial amounts of cross-pollination may occur. The high level of pollinator activity (observed fortuitously and briefly on this occasion) might be ascribed to a pleasantly warm, sunny, still interlude in a dismal summer. Out of many observations of populations of *E. leptochila* s.l. in different years, I have seen wasps visiting the flowers only on rare occasions, and then casual visiting by single individuals seemed to be occurring.

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