Dactylorhiza lapponica (Laest. ex Hartman) Soó in Scotland

A. G. KENNETH

Stronachullin, Ardrishaig, Argyll, PA30 8ET

M. R. LOWE

Botany Department, The University, South Road, Durham, DH1 3LE

and

D. J. TENNANT

Marhead Grange, Arkendale, Knaresborough, North Yorks., HG5 0RG

ABSTRACT

Observations on tetraploid marsh-orchid populations in Scotland have revealed the presence of *Dactylorhiza lapponica* (Laest. ex Hartman) Soó, new to the British Isles. A description of this species is given and its distribution and habitat in Scotland are discussed.

INTRODUCTION

In 1967, a population of marsh-orchids was discovered by one of the authors (A.G.K.) in Knapdale, Kintyre, v.c. 101. After considerable hesitation these plants were identified as *Dactylorhiza traunsteineri* (Sauter) Soó (Cunningham & Kenneth 1979) and until 1983 this remained as the only confirmed Scottish record of this species. However, following examination of photographs of these Knapdale plants by another of the authors (D.J.T.), it was realized that they did not closely match any known variant of *D. traunsteineri* from British localities and, after discussion with R. H. Roberts, they were transferred to *D. majalis* (Reichb. f.) Hunt & Summerh. subsp. *occidentalis* (Pugsley) Sell (Tennant & Kenneth 1983), although at the same time it was realized that they possessed many features which were atypical of even this taxon. The possibility that the Knapdale dactylorchids might be referable to a Continental species or subspecies not hitherto recognized in the British Isles had been considered, but none of the descriptions of potential taxa available at that time seemed to match those of the Scottish plants. However, as a consequence of extended field-work which is described below, the authors now suggest that the Knapdale plants, and similar dactylorchids found in other localities in western Scotland and in the Outer Hebrides, should in fact be referred to *D. lapponica* (Laest. ex Hartman) Soó.

During the same field-work, *D. traunsteineri* was, however, confirmed in the following localities, in addition to those in W. Ross, v.c. 105 (Lowe *et al.* 1986): Mid Ebudes, v.c. 103, Tiree, GR 17/0.4, found by J. Cadbury in 1983 and recognized by D.J.T. from photographs; Kintyre, v.c. 101, Knapdale, GR 16/7–8.7–8, four localities found by A.G.K. between 1983 and 1986; Westerness, v.c. 97, Ardnamurchan, GR 17/6.6, found by L. M. Watson in 1983. The identities of the Knapdale and Ardnamurchan plants have been confirmed by R. H. Roberts. No specimens were found on North Uist, North Harris or Raasay, despite published reports (Campbell 1937; Heslop-Harrison *et al.* 1941; Heslop-Harrison & Morton 1951).

FIELD STUDIES

Between 1984 and 1986 field-work was undertaken on marsh-orchids in northern and western Scotland. Localities were examined in Westerness, v.c. 97, Kintyre, v.c. 101, N. Ebudes, v.c. 104, W. Ross, v.c. 105, and the Outer Hebrides, v.c. 110. In the Outer Hebrides the islands of North Harris, South Harris, North Uist, Benbecula and South Uist were visited, and in N. Ebudes, the islands of Skye and Raasay.

At eight localities in western Scotland rather small populations of dactylorchids were found which were very similar to those of a larger population of Knapdale plants which we described in an earlier paper (Tennant & Kenneth 1983). It therefore appeared that this taxon was much more widespread in this part of Scotland than had been realized and was also more variable than described in the 1983 paper. Additionally it was noted that these plants seemed to be confined to a very distinctive habitat in base-rich hill flushes at relatively low altitudes. Dactylorchids which appeared to correspond to those of the original Knapdale population were seen in the following localities:

Kintyre, v.c. 101, Knapdale, GR 16/7–8.7–8: Five separate sites, including the original location; Sites 1–5, all found by A. G. K. between 1967 and 1986.

Westerness, v.c. 97, Ardnamurchan, GR 17/6.6: Site 6, found by L. M. Watson in 1983.

Outer Hebrides, v.c. 110, South Harris, GR 18/0.9: Sites 7–8, found by the authors and by M.R.L. respectively during 1985 field-work at locations cited by J. W. Heslop Harrison for *D. majalis* subsp. *occidentalis*.

A further location was recognized from photographic evidence at CGE, being a site found in 1970 by P. D. Sell, viz:

Westerness, v.c. 97; Morven, GR 17/6.5: Site 9.

TABLE 1. COMPARISON OF *D. LAPPONICA* FROM SCANDINAVIA AND CENTRAL EUROPEAN ALPS WITH POPULATIONS FROM SCOTLAND

Figures quoted are ranges of mean values.

Character	Scotland ^a	Scandinavia/European Alps ^b			
Height (cm)	7.0-21.0	17.67-20.6			
Stem diameter at base of spike (mm)	2.4-3.2	2.21-2.66			
Number expanded sheathing leaves	2.3-3.0	-			
Number non-sheathing leaves	0.8-1.7				
Total number leaves	3.3-4.3	3.04-3.52			
Length longest leaf (cm)	5.0-8.9	4.75-6.8			
Width longest leaf (cm)	1.1-1.5	0.86-1.41			
Intensity leaf markings on upper surface	Heavy	Heavy			
Dimensions lower floral bracts (mm) ^c	$13-19 \times 3.4-4.1$	$13 \cdot 2 - 16 \cdot 5 \times 3 \cdot 51 - 4 \cdot 08$			
Length of inflorescence (cm)	3.0-4.6	3.7-4.92			
Number of flowers	8.9-12.8	8.73-13.43			
Distribution of flowers in inflorescence	Lax, rather secund	Lax, rather secund			
Labellum length to apex of central lobe (mm)	6·3-7·8 ^d	5.67-6.73			
Labellum maximum width (mm)	(6·4) 7·3–9.4 ^d	7.69-9.44			
Labellum degree of reflexion	Flat to semi-reflexed	Flat to somewhat reflexed			
Position of lateral sepals	Very erect to sub-erect	Very erect to sub-erect			
Spur length (mm)	7.5-9.2 ^d	7.82-9.57			
Spur maximum width flattened (mm)	2.6-3.4 ^d	Ducing the same field-word			
Ovary length (mm)	1- 16 swith 10 601 . o. v. eac	8.87-10.88			
Number of plants in sample mean	4-14	21–123			

^aMeasurements carried out by the authors on populations at Sites 1–7. The small number of plants in the sample reflects the size of some of the populations.

^bMeasurements published by Reinhard (1985).

^cMeasurements of lowest bract (Scotland) and four lower bracts (Scandinavia/European Alps).

^dNumber of floral parts measured in sample ranged from 10-45.

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Measurements were carried out on all of these populations except Site 9, and the results are given in Table 1. For simplicity the above locations are referred to later in this paper only by their Site number.

The dactylorchids studied at Sites 1 to 8 in western Scotland conformed to the following description: Tuber small, slender, deeply cleft into two. Height 6-18 (-24) cm. Stem rather slender to medium diameter and only slightly hollow, upper part often suffused purplish with anthocyanin. Expanded sheathing-leaves 2-3 with 0-2 non-sheathing leaves; lowest expanded leaf oblongoblanceolate, apex obtuse or sub-acute, 3.0-6.0 cm long $\times 0.8-1.5$ (-1.8) cm wide; second lowest narrowly oblong-lanceolate to narrowly elliptical, apex acute or sub-acute, 4.0-8.0 (-10.5) cm long \times 0.8–1.7 cm wide, spreading or semi-spreading, occasionally slightly undulate or recurved towards the apex; non-sheathing leaf erect; expanded leaves pale, dull or medium green, more or less uniformly and often heavily covered on upper surface with large dark violet-brown dots, bars, rings or blotches, occasionally heavily marbled, frequently tinged on the margin with the same colour, rarely unmarked; lower surface unmarked, or non-sheathing leaf sometimes with a few small flecks or blotches on the under-side. Inflorescence 2.5-5.5 cm long, usually lax and secund: flowers few, 3–12, occasionally up to 18. Floral bracts sometimes large, the lower to 25×5 mm, greenish, often tinged purple on the margin and invariably spotted on either or both surfaces, sometimes stained purple which more or less obscures the spots. Peripheral bract-cells 80 to 135 um (mean length), variable in shape and size, rounded to markedly angular. Flowers usually magenta-purple or magenta-red, rarely pale, with deeper markings. Lateral sepals very erect, occasionally sub-erect, invariably marked with darker rings, elongated spots and dots. Labellum flat or its lateral lobes somewhat reflexed, rhombic to sub-deltoid, with or without sinuses, usually with a broad-based central lobe often projecting well beyond the lateral lobes, heavily marked, usually with very intense dark violet-purple or dark crimson lines, rings and dots, occasionally merging in the central part to form a dark patch; spur robust, in flattened state $6.5 - 10.5 \times 2.2 - 10.5 \times 10^{-1}$ 4.0 mm, more or less cylindrical and straight, sometimes curved and slightly conical. Ovary c. 9 – 13 mm. The flowering period in western Scotland varies appreciably with seasonal climatic variation, commencing flowering from late May to mid-June and often extending into July.

A detailed examination of the length and shape of the peripheral cells of the floral bracts of the dactylorchids from Sites 1 to 7 was undertaken by R. H. Roberts, and the results summarized above clearly show that they correspond to those of tetraploid taxa.

IDENTIFICATION

Correspondence with Scandinavian specialists indicated that the Scottish dactylorchids from Sites 1-9 were very close to the Scandinavian D. pseudocordigera (Neuman) Soó (C. I. Sahlin and F. Björkbäck, pers. comm.) and D. lapponica (F. Wischmann pers. comm.) although none of these correspondents was prepared to make a positive determination. Fortunately, an extensive biometric study of Scandinavian and Alpine dactylorchids was recently published by H. R. Reinhard of Zürich (Reinhard 1985). Part of this study concluded that D. pseudocordigera, from central Scandinavia, and D. lapponica, from northern Scandinavia and Lapland, should be treated as a single, undivided species under the name D. lapponica; this view is also shared by the Norwegian specialist, F. Wischmann of Oslo (pers. comm. 1986). Earlier, Vermeulen (1947) and Landwehr (1977) had expressed a similar opinion, although both retained pseudocordigera and lapponica as subspecies of D. lapponica. Acceptance of this concept of a single species helped to crystallize our own thoughts on the status of the Scottish dactylorchids. In particular, Reinhard's biometric data for D. lapponica, based on 51 characters of 257 individual plants from 31 sites in Scandinavia and the Alps, enabled a comparison with the Scottish plants (Table 1). Following an examination of our biometric data and numerous photographs, Reinhard (pers. comm.) stated that without hesitation he could say that some of the dactylorchids from western Scotland were referable to D. lapponica, matching well some of the Scandinavian plants of that species examined during his own field-studies, and in a second communication he stated that a copy of our herbarium material (E), showing specimens collected from one of the populations in Knapdale (Site 2), matched the lectotype of D. lapponica very closely and were without doubt referable to that species.

R. H. Roberts has also made the following comments on the Scottish dactylorchids. "The shapes of the labella collected at sites 1, 2 and 6 are surprisingly like many of those of *D. lapponica* shown by Reinhard (1985) and Kalteissen & Reinhard (1986) and seem such a good match for the latter that they certainly do a lot to convince me. Some of the Scottish dactylorchids are so similar to the *D. lapponica* illustrated and described by Reinhard that one feels compelled to say that they belong to this entity, and hence I feel happy to agree with Reinhard's view. Additionally, some of the herbarium specimens of Scandinavian *D. lapponica* at Kew match the specimens (E) collected at sites 1 and 3 in Scotland well."

NOMENCLATURE

- DACTYLORHIZA LAPPONICA (Laest. ex Hartman) Soó, Nom. nov. gen. Dactylorhiza 5 (1962). Orchis lapponica Laest., nomen. Orchis angustifolia Krocker var. lapponica Laest. ex Hartman, Handb. Skand. fl., 4th ed., 281 (1843). Orchis traunsteineri Sauter var. lapponica (Laest. ex Hartman) Hartman, Handb. Skand. fl., 5th ed., 225 (1849). Orchis lapponica (Laest. ex Hartman) Reichb. f., Icones fl. germ. helv., 13/14: plate 53 (ccccv of the whole enumeration) (1850). Orchis latifolia L. var. lapponica (Laest. ex Hartman) Reichb. f., Icones fl. germ. helv., 13/14: 58 (1851). Dactylorchis lapponica (Laest. ex Hartman) Vermeulen, Stud. Dactyl. 155 (1947). Dactylorhiza cruenta O. F. Mueller subsp. lapponica (Laest. ex Hartman) E. Nelson, Monogr. Ikon. Orch. Gatt. Dactyl. 72 (1976). Dactylorhiza traunsteineri (Sauter) Soó subsp. lapponica (Laest. ex Hartman) Sündermann, Europ. medit. Orch. 45 (1975). TYPE: Karesuando, Tornea, Swedish Lapland, 1840, Laestadius (lectotype: UPS, chosen by Reinhard (1985) who also illustrated it in Plate 52 on p. 415 of his work). Vermeulen's (1947) choice of a Laestadius specimen collected in 1846 must be overuled because it postdates the protologue by three years.
- Orchis pseudocordigera Neuman in Bot. Notiser, 1909: 236 (1909). Dactylorchis lapponica (Laest. ex Hartman) subsp. pseudocordigera (Neuman) Vermeulen, Stud. Dactyl. 155 (1947). Dactylorhiza pseudocordigera (Neuman) Soó, Nom. nov. gen. Dactylorhiza 4 (1962). TYPE: Norvegia Dovre in paludosis juxta rivulum inter Tofte et Harbacken et in Kvitdalen, Neuman, specimen no. 1 (holotype: O).

The specific epithet *lapponica* has priority over the rival *pseudocordigera* because its publication as a new combination at species level was effected by Reichenbach in 1850 in the volume of illustrations to the text (which appeared a year later in 1851) of his *Icones*, even though in the text the name *Orchis lapponica* appears in synonymy under *Orchis latifolia*.

HABITAT

The Scottish populations of *D. lapponica*, with which the dactylorchids from Sites 1–9 were now united, were found in hill-flush communities at altitudes of approximately 150–300 m in Knapdale, Morvern and Ardnamurchan, but descended to below 30 m at a single locality in South Harris. *Schoenus nigricans* and *Molinia caerulea* were invariably co-dominant at these locations and at one South Harris site these were co-dominant together with *Carex panicea*. The list of associated species present in all the sites studied showed that they were very similar to the habitats described in Scotland for *D. traunsteineri* (Lowe *et al.* 1986) and also for *D. incarnata* (L.) Soó subsp. *cruenta* (O. F. Mueller) Sell (Kenneth & Tennant 1984, 1987) and therefore appear to be also referable to the *Pinguiculo-Caricetum* Jones syntaxon described by Wheeler (1980).

D. lapponica, however, appears to show a greater tolerance towards a slightly more acidic habitat, which is subject to a lower degree of flushing, when compared with D. traunsteineri, as a small percentage of plants of the former often stray into the adjacent wet heath community, whereas this has not been observed in the case of D. traunsteineri.

The recent discoveries of *D. lapponica* and *D. traunsteineri* in western Scotland discussed in this paper, and earlier of *D. incarnata* subsp. cruenta (Kenneth & Tennant 1984, 1987) in north-

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western Scotland, present a marsh-orchid flora with close similarities to that found in Scandinavia and the central European Alps.

CONSERVATION

Most of the sites for these taxa presently known in Scotland contain only a very small number of plants and possibly represent a relic flora remaining after late glacial times. The sites are all especially vulnerable to destruction either by afforestation or by land drainage. Since the discovery of the first Knapdale site for *D. lapponica* in 1967 one of these has recently been damaged in this manner, and further sites are currently under threat from afforestation. One of us (A.G.K.) has been actively involved, with the co-operation of the land-owners, in conservation measures for some of the Knapdale sites in 1986 in the hope that further damage can be prevented. An adequate number of specimens and many photographs were earlier placed in **E**, with copies also at CGE, in the hope that this will prevent the need for the collecting of further plants from these sites. It is hoped that additional localities will be recognized in the western Highlands and Islands of Scotland for these taxa now that they have become more clearly defined.

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STREET BORD

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The occurrence of *Dactylorhiza traunsteineri* (Sauter) Soó in Britain and Ireland

R. H. ROBERTS

51 Belmont Road, Bangor, Gwynedd, LL57 2HY

ABSTRACT

A recent study of morphological variation in *Dactylorhiza* has indicated that *Dactylorhiza traunsteineri* (Sauter) Soó does not occur in Britain or Ireland. Further sampling of some morphological characters in a putative population of this species on Anglesey has been carried out in an attempt to clarify the matter, and a comparison of data from this population with data derived from Alpine plants suggests that *D. traunsteineri* does occur in these islands.

INTRODUCTION

The marsh-orchid with which British and Irish botanists have become familiar over the last 30 years as *Dactylorhiza traunsteineri* (Sauter) Soó was first found in Ireland by H. W. Pugsley. He recognized it as a new plant from herbarium specimens in the National Herbarium (**DBN**) and from living material sent to him later from two localities in Co. Wicklow. Although he noticed the close similarity of the plant to *Orchis traunsteineri* Sauter ex Reichenb. (*D. traunsteineri*), which he had seen in southern Bavaria in 1934, he decided that it was not identical with that species, but, like another marsh-orchid, *O. majalis* Reichb. var. *occidentalis* Pugsley (*D. majalis* (Reichb.) Hunt & Summerhayes subsp. *occidentalis* (Pugsley) P. D. Sell) which had recently been found in Ireland (Pugsley 1935), was yet another entity allied to *D. majalis*. He consequently named it *O. majalis* subsp. *traunsteinerioides* (Pugsley 1936), but after seeing the plant in the field decided that it was not after all closely allied to *D. majalis* and ultimately raised it to the rank of species.

Heslop-Harrison (1953) made a critical study of this plant and as a result assigned it to *O*. *traunsteineri*, his only reservation being that a biometric study of Alpine plants might eventually enable the British and Irish variant to be segregated as a subspecies.

Bateman & Denholm (1983) have recently come to a different conclusion. They point out that a comparison of biometric data from British and Irish populations of *D. traunsteineri*, collected by themselves and others (Heslop-Harrison 1953; Lacey & Roberts 1958; Roberts & Gilbert 1963; Roberts 1966), with the descriptions of Alpine plants by Vermeulen (1949) and Nelson (1976) reveals several discrepancies. "True Alpine *D. traunsteineri* is reported to have narrower leaves (<1 cm wide), longer, more lax inflorescences, smaller labella with poorly-developed sinuses, shorter central lobes, and smaller spurs. They also flower later." (Bateman & Denholm 1983). From this they have concluded that the British and Irish plants have been wrongly assigned to *D. traunsteineri* and have reduced them to the rank of subspecies, as *D. majalis* subsp. *traunsteinerioides*.

Bateman & Denholm's data for *D. traunsteineri* were taken from three populations, one in Co. Kildare, Ireland (Pollardstown Fen) and the other two in Anglesey (Cors Erddreiniog and Rhos-y-gad). Biometric data for some morphological characters were already available from the Anglesey populations and it was therefore possible to compare the two sets of values. When this was done large discrepancies were found between them, particularly in the data from the Rhos-y-gad population, where the means for labellum length (7.9 versus 8.91 mm), labellum width (10.2 versus 12.1 mm) and spur width (3.5 versus 4.0 mm) are found to be so widely at variance as to raise doubts about the reliability of the procedures used in Bateman & Denholm's study.

In view of these widely different results, the Rhos-y-gad population was sampled again for some

of the morphological characters in 1984 and a number of the observations were repeated two years later in 1986.

MATERIALS AND METHODS

Morphological characters were recorded in 1984 from a randomly selected sample of flowering plants. Counts of the total number of leaves, number of non-sheathing leaves, number of flowers in the inflorescence and measurements of the width of the second leaf from the base of the stem and the length of the inflorescence were made in the field. A single flower, taken from halfway along the spike, was removed from each plant, and labella and spurs from the sample were mounted separately on card. The width of the labellum was measured at its widest part, together with its length from the spur opening to the tip of the central lobe. Spur dimensions were taken from the flattened, mounted specimens, spur width being measured at the entrance, and spur length from the entrance to the apex.

Counts of the total number of leaves, number of non-sheathing leaves and data for labellum and spur dimensions were repeated in 1986. In addition, the length of the central lobe of the labellum was measured.

RESULTS

Sample means for labellum and spur dimensions are given in Table 1, in which the data of Bateman & Denholm (1983) for these characters are included for comparison. They are also compared graphically in Figs 1a and 1b, from which it can be seen that while the three sets of data obtained by the present writer show good agreement for all four characters, those of Bateman & Denholm (1983) only agree with them for the character of spur length; their means for labellum length, labellum width and spur width differ from them by large and statistically significant amounts.

Dirat it hard		Labellum	length (mm)	Labellum	width (mm)	Spur	length (mm)	Spur	width (mm)
Sample	n	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
R.H.R., 1963	40	7.9	0.89	10.2	1.14	8.3	1.27	3.5	0.63
R.H.R., 1984	34	8.1	0.79	9.9	1.31	8.5	1.02	3.4	0.42
R.H.R., 1986	30	8.2	0.84	10.5	1.29	8.9	0.90	3.4	0.43
1983 ¹	10	8.9	0.78	12.1	1.95	9.0	1.39	4.0	0.82

TABLE 1. SAMPLE MEANS AND STANDARD DEVIATIONS FOR LABELLUM AND SPUR DIMENSIONS FROM THE RHOS-Y-GAD POPULATION OF *D. TRAUNSTEINERI*, TAKEN DURING FOUR SEPARATE SEASONS

¹Data of Bateman & Denholm (1983).

Similarly their mean value of 1.0 for the number of non-sheathing leaves differs from the mean of 0.6 from a sample of 50 in 1963, while means of 0.7 and 0.66 were obtained by the writer from samples of 35 and 30 in 1984 and 1986 respectively. Thus, while the present writer's values differ at most by only 16.6%, Bateman & Denholm's estimate differs from the largest of them by 42.9%.

DISCUSSION

Repeated sampling of the Rhos-y-gad population during different flowering seasons has shown that the very large mean values for labellum dimensions and spur width obtained by Bateman & Denholm are not readily repeatable. The possibility was considered that the small size of their sample may account for the poor estimates of population means. However, an independent biometric study of the Rhos-y-gad population of *D. traunsteineri* by Jenkinson (1986) is also based

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SPUR LENGTH (mm)

FIGURE 1. (a) Scatter diagram of sample means of labellum dimensions. Bars represent one standard error on either side of the mean. A, B & C, data of R.H.R.; D, data of Bateman & Denholm (1983); E, data of Reinhard (1985). (b) Scatter diagram of sample means of spur dimensions. Legend as in (a).

on a sample of ten flowering plants and his mean values for labellum length (8.0 mm) and labellum width (10.15 mm) show very good agreement with those of the present writer. The other possibility is that Bateman & Denholm have included in their sample hybrids of *D. traunsteineri* with either *D. fuchsii* (Druce) Soó or *D. maculata* (L.) Soó, both of which occur in the same locality. While this could possibly account for the large labellum dimensions, one would expect the mean value for spur width to be smaller (not larger) than the mean from pure *D. traunsteineri*, and this possibility must also be ruled out.

Whatever the explanation for them may be, their large values for floral dimensions may have

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partly persuaded these authors that the British and Irish plants are not identical with Alpine *D. traunsteineri*, a view which was reinforced by placing too much reliance on descriptions (by Vermeulen and Soó) that were not based on biometric data. However, as the result of a recent study by Reinhard (1985), data from Alpine populations of this species are now available and a comparison of the mean values for some of the morphological characters with those from Anglesey plants (Table 2) shows that most of the supposed discrepancies cited by Bateman & Denholm do not exist. Most of the small differences between data means are not statistically significant. The only characters for which comparisons cannot be made are depth of sinuses, for which Reinhard gives no data, and spur width, for which he gives the diameter of the unpressed spur (mean = 2.59 mm).

	Rhos-v-gad $(n=30)^2$			Alpine localities $(n=75)$			³
	Mean	S.D.	S.E.	Mean	S.D.	S.E.	
No. of leaves	3.82	0.53	0.09	3.99	0.63	0.07	
Leaf width (cm) ⁴	1.00	0.21	0.04	1.00	0.23	0.03	
Inflorescence length (cm)	4.51	0.84	0.16	4.73	1.13	0.13	
No. of flowers per inflorescence	9.40	3.62	0.67	8.43	2.34	0.27	
Labellum width (mm)	10.50	1.29	0.24	10.63	1.12	0.13	
Labellum length (mm)	8.20	0.84	0.16	7.74	0.76	0.09	
Length of labellum mid-lobe (mm)	2.25	0.62	0.12	2.38	0.67	0.08	
Spur length (mm)	8.92	0.90	0.17	10.90	1.24	0.14	

TABLE 2. A COMPARISON OF DATA ON *D. TRAUNSTEINERI* FROM ANGLESEY AND ALPINE LOCALITIES

²Data of R.H.R.

³Data of Reinhard (1985).

⁴Taken from the second leaf from the base of the stem.

It is therefore clear that the British populations of *D. traunsteineri* show a remarkable similarity to Alpine ones, and that Heslop-Harrison (1953) was correct in assigning them to this species. Furthermore, the almost exact correspondence between the Anglesey population and the Alpine plants provides additional support for the view already expressed (Roberts 1966) that the Rhos-y-gad plants are not influenced to any appreciable extent, if at all, by introgression with *D. majalis* subsp. *purpurella* (T. & T. A. Steph.) D. Moresby Moore & Soó. It clearly does not support Bateman & Denholm's belief that gene-flow between these taxa "is at most only partially restricted."

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