

## On the identity of a Northumberland *Epipactis*

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### ABSTRACT

*Epipactis youngiana* A. J. Richards & A. F. Porter, *sp. nov.*, is described from two sites in South Northumberland. Plants are rather robust with yellowish, somewhat two-ranked leaves, a pubescent rhachis, almost glabrous ovaries, and rather large, patent, open, pink-tinged flowers resembling those of *E. helleborine*, but automatically self-pollinating. The stigma is distinctively tricornute, the clinandrium deep, the anther usually sessile and the seeds rather large. A comparison is made between the characters of the new species and those of other western European cleistogamous species and of *E. helleborine*.

### INTRODUCTION

Interest in the genus *Epipactis* in Northumberland has been stimulated in recent years by the unexpected discovery of *E. leptochila* (Godf.) Godf. and *E. phyllanthes* G. E. Sm. growing on zinc and lead-rich soils, mostly beside the River South Tyne (Richards & Swan 1976). In July, 1976, A. F. P. discovered a single plant of unknown identity growing in company with typical *E. helleborine* (L.) Crantz. Many more plants of this type were found in this locality in the years 1977 to 1980, with between 50 and 150 flowering spikes altogether. The site, which is within 15 km of Newcastle-upon-Tyne (S. Northumb., v.c. 67), is an oak wood on clay soil with a dense ground-cover consisting chiefly of brambles (*Rubus* spp.). Although *E. helleborine* occurs scattered throughout much of the wood, the plant of unknown identity is restricted to an area of about 200m by 100m. It can be readily distinguished from *E. helleborine* at some distance by its more yellow colour, by its narrower, somewhat 2-ranked leaves, and by flowering some two weeks earlier (by July 20th in a normal year). A close examination reveals that the flowers resemble those of *E. helleborine*, being rather large, patent and open, but share with the self-pollinating species *E. leptochila*, *E. dunensis* (T. & T. A. Stephenson) Godf. and *E. phyllanthes* pollinia which usually disintegrate as the flower opens, and an evanescent viscidium. In outbreeding (allogamous) species, such as *E. helleborine* and *E. purpurata* G.E.Sm., the viscidium (sticky cap to the rostellum) on the upper central projection of the stigma is persistent until the flower ages, or until an insect (usually a wasp, *Vespa* sp.) visits the flower and removes it, with the intact pollinia adhering to it (Proctor & Yeo 1973, pp. 233-234). In the self-pollinating (autogamous) species, the viscidium withers as the flower opens, and the pollinia disintegrate on to the stigma surface.

In 1980, examination of photographs taken by A. F. P. in 1977 of an *Epipactis* growing with *E. helleborine* and *E. phyllanthes* at a site 27 km west of the first station, on a heavy metal polluted soil, led to the discovery of a second station at which at least 15 flowering spikes were found. Plants from the two sites differ in no significant particulars.

### IDENTITY AND DESCRIPTION OF THE NEWLY DISCOVERED TAXON

Since 1976, we have made strenuous efforts to obtain a correct name for this plant. Our experience with the other autogamous British *Epipactis* suggested that these populations belonged to a taxon not hitherto recorded in the British Isles. Of the recognised British species, *E. dunensis* seemed the most similar, particularly in vegetative characters, and in the short, broad, acuminate and reflexed epichile. However, comparison in the field with populations of the latter in Anglesey, N. and S. Lancs. and Cheviot showed that the flowers of *E. dunensis* were smaller, more yellow and less pink,

less widely open, and had smaller seeds, a quite different stigma shape, and pubescent ovaries (Table 1). *E. leptochila*, with its characteristic narrow epichile, and *E. phyllanthes* with its distinctive floral and vegetative characters, the most reliable of which is perhaps the glabrous rhachis, were discounted at an early stage. These three autogamous species, and *E. helleborine*, differ from our plant in six or more important characters.

Thus, in our search to name these populations we were forced to consider non-British species, and of these there were two important possibilities: *E. confusa* D. P. Young, from southern Scandinavia and northern Germany; and *E. muelleri* Godf., from eastern France, Luxembourg, Belgium, Switzerland, Czechoslovakia, Austria and southern Germany. To this end we obtained descriptions, photographs, herbarium specimens and pickled flowers of each of these species, and sent dried and pickled material of our plant to European specialists who know these species well: C. I. Sahlin of Sweden and K. Robatsch of Austria.

It became clear that our plant differed from these two species in a number of features. *E. confusa* is most closely related to *E. phyllanthes*, and indeed in *Flora Europaea* it is merged with that species (Moore 1980). It differs from our plant in a number of vegetative characters, being often more delicate, less yellow, and, most importantly, almost glabrous, even on the rhachis. It shares with our plant a well-marked clinandrium groove on top of the column, in which the anther rests and is therefore inconspicuous, and a somewhat tricornute stigma, and before we received good material of *E. confusa* these features led us to believe that our plant might be this taxon. One of us produced a discussion paper for private circulation in which the proposal was made that our plant might be best referred to *E. confusa*, and this was unfortunately perpetrated in print (Lang 1980). However, it has since become clear that in addition to the vegetative differences, *E. confusa* has smaller, greener, more cernuous and less open flowers than our plant, and the two taxa are probably not closely related.

*E. muelleri* is probably more closely related to our plant; it shares with it most vegetative characteristics, in particular an indumentum distribution in which the rhachis is pubescent but the ovary nearly glabrous (Table 1.). Also the posture of the flower and the shape of the epichile resemble those of our plant, although *E. muelleri* can have smaller flowers. However, the flowers of *E. muelleri* lack the distinctive tricornute stigma of our plant, and have only a slight clinandrium, so that the anther is prominent and visible. The flowers of *E. muelleri* are also less pink in tone, and the whole plant is generally less robust.

To summarise, our plant shares many vegetative features with the group of autogamous *Epipactis* which have rather narrow, yellowish, rather two-ranked leaves and a pubescent rhachis (*E. leptochila*, *E. dunensis* and *E. muelleri*), but in floral features most resembles the allogamous *E. helleborine*, although it is clearly autogamous. The most distinctive feature is the strongly tricornute stigma in which the abnormally long and acute rostellum projects as far as the end of the anther and combines with the markedly acute bosses at the stigma base to give a characteristic stigma shape (Fig. 1). Although *E. confusa*, *E. phyllanthes*, *E. muelleri* and some plants of *E. helleborine* can show a stigma which is weakly tricornute, in no case does the rostellum project so far as to equal the anther. (In most accounts, for instance that given by Clapham (1962), the rostellum is said to disappear in autogamous *Epipactis*. These statements seem to have arisen through confusion between the rostellum and its sticky and detachable cap, the viscidium. In no case does the rostellum itself disappear, although it becomes brown and withers in old flowers.)

We are now firmly of the opinion that these populations (the exact sites of which are withheld for reasons of security) represent a new taxon, differing from all recognised taxa in *Epipactis* in a number of characters. Although minor variations in well-recognised species of *Epipactis* have in the past led to the creation of varietal epithets such as *E. leptochila* var. *cleistogama* (C. Thomas) D. P. Young and *E. phyllanthes* var. *pendula* D. P. Young, these differ from the nominate variety in only one or two quite minor characters. Also, they tend to occur in the same populations as the nominate variety, and show a much stronger morphological and ecological relationship with the species within which they are included than with any others. In the present case, the populations show no distinct affinity with any one species and differ from all recognised species by at least five characters. Consequently it is concluded that these populations deserve specific rank, which is formalised below. The chosen epithet *youngiana* commemorates the late D. P. Young, whose excellent and meticulous work clarified many problems in this difficult genus.

TABLE 1. COMPARISON OF CHARACTER STATES BETWEEN *E. YOUNGIANA*, THE OTHER WESTERN EUROPEAN AUTOGAMOUS *EPIPACTIS*, AND *E. HELLEBORINE*

Character	<i>E. youngiana</i>	<i>E. muelleri</i>	<i>E. dunensis</i>	<i>E. phyllanthes</i>	<i>E. helleborine</i>	<i>E. leptochila</i>	<i>E. confusa</i>
Leaves	±2-ranked	±2-ranked	±2-ranked	spiral to 2-ranked	usually spiral	±2-ranked	spiral to 2-ranked
Bottom leaf	usually longer than wide	usually longer than wide	longer than wide	usually longer than wide	usually wider than long	longer than wide	usually longer than wide
Leaf colour	yellow-green to green	yellow-green	yellow-green	green to dark green	usually dark green	yellow-green	green to dark green
Leaf marginal cells	scattered	scattered	scattered	tufted	scattered	scattered	scattered
Upper rachis	pubescent	pubescent	pubescent	glabrous	usually pubescent, rarely glabrous	pubescent	glabrous or thinly pubescent
Ovary	thinly pubescent to glabrous	glabrous, or a few hairs only	pubescent	glabrous	usually pubescent, rarely glabrous	pubescent	glabrous
Colour of inside of hypochile	mottled purple	mottled purple or purple	mottled purple or purple	green	purple	mottled purple or purple	green, or mottled pink or purple
Colour of sepals	green, margin often rose or white	yellow-green	yellow-green	yellow-green to green	reddish-green	yellow-green	pale green
Sepal length (mm)	8-11	6.5-11	6-8	8-10	8-13	7-15	7-11
Anther	sessile or ±stalked	sessile	stalked	sessile	sessile	stalked	sessile
Clinandrium	fairly deep	shallow	shallow	fairly deep	deep	shallow	fairly deep
Viscidium	evanescent	evanescent	evanescent	evanescent in bud	persistent until flower visited by insect	evanescent	evanescent
Stigma base ornamentation	2 acute bosses	2 small blunt bosses	frilled	2 small blunt bosses	frilled or with small bosses	frilled	2 small blunt bosses
Comparative position of rostellum and anther	rostellum equalling anther, or nearly so	rostellum to ¼ of anther	rostellum to ½ of anther	rostellum to ½ of anther	variable, to not more than ½ of anther	rostellum to ½ of anther	rostellum to ¾ of anther
Pollinia	disintegrating	disintegrating	disintegrating	disintegrating in bud	intact	disintegrating	disintegrating
Mean length of seed from centre of capsule in (mm) (our measurements)	1.04		0.84, 0.95		0.85, 0.91	0.91	

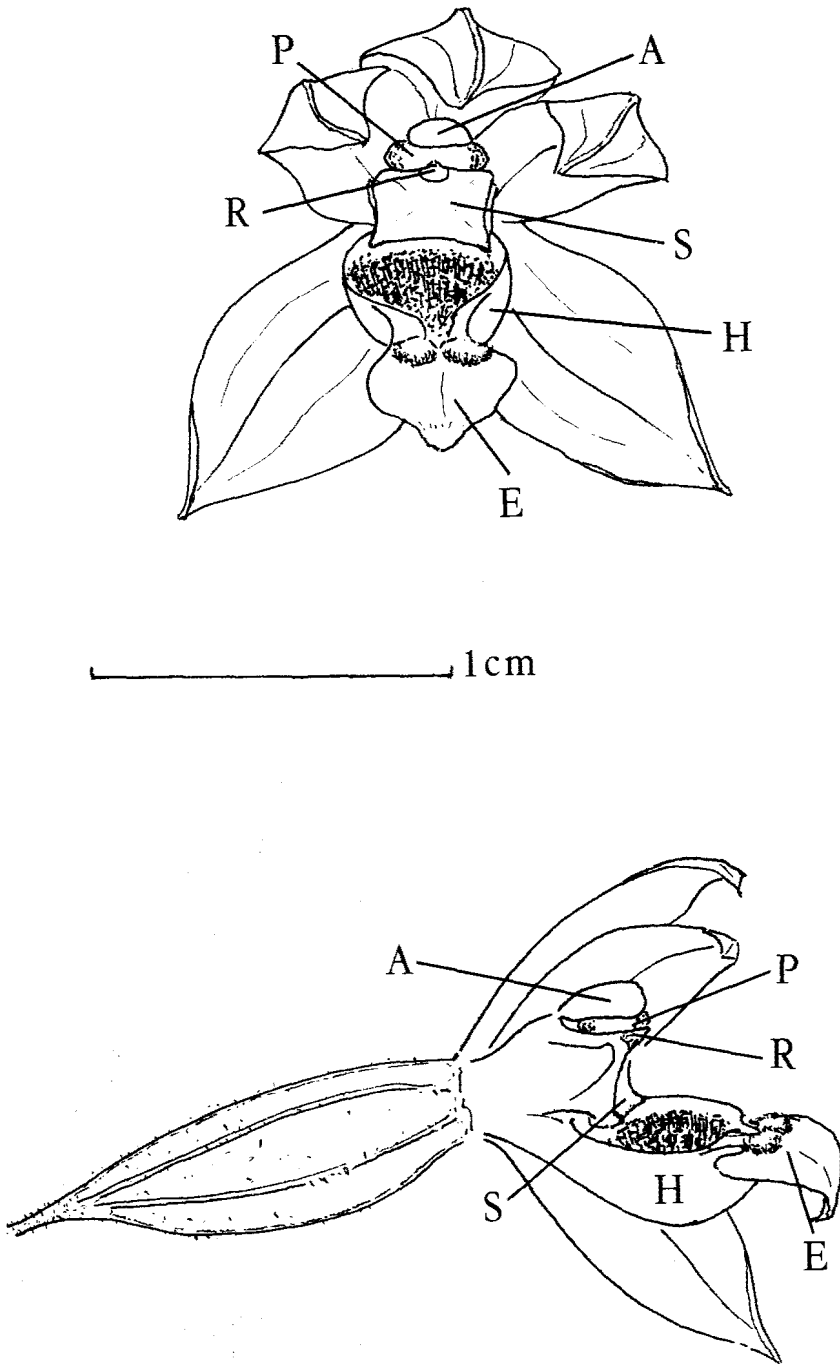


FIGURE 1. Frontal (above) and lateral (below) views of a fresh flower of *Epipactis youngiana*. A=anther, P=pollinia, R=rostellum, S=stigma, E=epichile, H=hypochile.

*Epipactis youngiana* A. J. Richards & A. F. Porter, sp. nov. (Fig. 1, Plate 1)

Rhizoma radicesque ignota. Caules plerumque solitarii, rarius bini vel aggregati, supra terram 30–58 cm longi, subgraciles, in terrae superficie 3–4 mm in diam., juxta floram inferioram 1.5–2.5 mm in diam., pallide virides, ab apice ad foliam superiorem valde pubescentes, alibi glabri. Folia laminaria 4–7 (saepissime 5), lanceolata vel ovato-lanceolata, superioria 5×1 usque ad 7×2.5 cm, media 5×2.5 usque ad 8×5 cm, inferioria 2×1 usque ad 4×3 cm, apice acuta vel subacuminata, patenti-erecta, luteo-viridia, margine subundulata ambitu papillis subaequalibus patentibus regulariter praetexta, omnia valde glabra; folia elaminaria vaginata inferioria 1–2. Racemus subsecundus, bracteis lanceolatis inferioribus c. 4×1.5 cm. Flores patentes vel subcernui, perianthis campanulatis. Ovarium pyriforme, 0.7×0.3 usque ad 0.8×0.4 cm sub anthesin, viride, subglabrum vel proximaliter paulo pubescens, costis longitudinalibus nonnullis ornatum, post anthesin turgescens. Sepala ovato-lanceolata, viridia vel roseo-marginata, carinata, cucullata, 0.8×0.5 usque ad 1.1×0.6 cm; petala ovata rosea, in medio pallidiora, 0.6×0.5 usque ad 0.8×0.6 cm. Labellum parvum, hypochilio hemisphaerico, 4 mm longo, intus plerumque purpureo-maculato; epichilio cordato, acuminato, valde reflexo, 0.3–0.4 cm longo, 0.4–0.5 cm lato, roseo, in medio viride, ad basin bigibboso purpureo. Columna supra inclinata, anthera ovoidea 0.2–0.3 cm longa lutea sessile vel breviter pedunculata praedita, pollinis cito in fragmentis deciduis sed in clinandrio parumper depositi; stigma tricornuta, cornu superiore rostellum glandularum parvum saepe evanescens inutile praedito, cornibus inferioribus in stigmatis angulis manifestis. Capsula obovoidea, crassa, 1.0–1.3 cm longa, 0.6–0.7 cm lata, perianthium marcescens ferens. Semina typica 1.0–1.1 mm longa, 0.25 mm lata.

Rhizomes and roots unknown. Stems most often solitary, occasionally in pairs or groups, 30–58 cm long above ground, rather slender, 3–4 mm wide at ground level, 1.5–2.5 mm wide at lowest flower, pale green, markedly pubescent from the apex to the uppermost leaf, the rest glabrous. Leaves 4–7, most often 5 in number, with 1–2 additional leafless sheaths below, lanceolate or ovate-lanceolate, the top leaf 5×1 to 7×2.5 cm, the middle leaf 5×2.5 to 8×5 cm, the lowest leaf 2×1 to 4×3 cm; apex acute or subacuminate, spreading-erect, yellow-green, with the margin somewhat wavy and decorated with small regular papillae of subequal length, otherwise glabrous throughout. Raceme usually one-sided, the lowest bracts about 4×1.5 cm. Flowers patent to more or less nodding; perianth campanulate. Ovary pyriform, 0.7×0.3 to 0.8×0.4 cm during flowering, green, subglabrous or slightly pubescent proximally, with six longitudinal ribs, not swelling until after flowering. Sepals ovate-lanceolate, keeled, cucullate, green or rose-margined, 0.8×0.5 to 1.1×0.6 cm; petals ovate, rose with a paler central zone, 0.6×0.5 to 0.8×0.6 cm. Labellum small; hypochile hemispherical, 4 mm long, usually purple-spotted inside; epichile cordate, acuminate, markedly reflexed, 0.3–0.4 cm long, 0.4–0.5 cm wide, rose with a green central zone and two purple basal bosses. Column inclined; anther 0.2–0.3 cm long, yellow, sessile or with a short stalk; pollinia soon fragmenting and falling, but remaining for a short time in the clinandria; stigma tricornute, the upper projection (rostellum) bearing a very small glandular viscidium which usually appears ineffective in preventing self-pollination and usually disappears soon after the opening of the flower or before, the other two projections on the lower angles of the stigma. Capsule obovoid, plump, 1.0–1.3 cm long, 0.6–0.7 cm wide; the perianth persistent but shrivelled. Typical seeds 1.0–1.1 mm long, 0.25 mm wide.

**HOLOTYPUS:** Within 15 km of Newcastle-upon-Tyne (locality withheld), S. Northumb., v.c. 67, 30/7/1980, A. J. Richards & A. F. Porter (**BM**). Isotypus: **herb. A.J.R.**

**PARATYPUS:** 27 km west of the type station, around a disused lead mine, S. Northumb., v.c. 67, 14/8/1980, A. J. Richards & A. F. Porter (**herb. A.J.R.**).

The main distinguishing features of *E. youngiana* may be briefly repeated here: robust size; yellowish, more or less two-ranked leaves; a pubescent rhachis but subglabrous ovary; large, more or less patent, pinkish-green flowers with a tricornute stigma; a usually sessile anther; a deep clinandrium; an autogamous mode of reproduction; and rather long seeds. Our measurements of seeds for four species in six Northumberland populations are given in Table 2. It will be seen from this that testa lengths do not vary greatly, but, of the species investigated, *E. youngiana* had the

TABLE 2. SEED DIMENSIONS OF SPECIES OF *EPIPACTIS*

All our readings give the mean and standard error of measurements of seeds, mixed from the centre of fruits and mounted in 'euparal', viewed at  $\times 100$ . Peripheral seeds adhering to the husk are smaller (0.5–0.6 mm long).

	number of fruits	number of seeds	testa length (mm)	testa width (mm)	embryo length (mm)	embryo width (mm)	testa cell length ( $\mu\text{m}$ )
<i>E. youngiana</i> Newcastle	10	40	1.04 $\pm$ 0.04	0.24 $\pm$ 0.01	0.23 $\pm$ 0.01	0.13 $\pm$ 0.01	53.6 $\pm$ 9.2
<i>E. 'dunensis'</i> River S. Tyne	1	10	0.95 $\pm$ 0.06	0.30 $\pm$ 0.01	0.19 $\pm$ 0.04	0.12 $\pm$ 0.01	—
<i>E. dunensis</i> Cheviot	1	10	0.84 $\pm$ 0.08	0.26 $\pm$ 0.03	0.20 $\pm$ 0.02	0.11 $\pm$ 0.02	46.5 $\pm$ 9.9
<i>E. leptochila</i> River S. Tyne	4	10	0.91 $\pm$ 0.06	0.29 $\pm$ 0.02	0.19 $\pm$ 0.01	0.12 $\pm$ 0.01	54.1 $\pm$ 13.6
<i>E. helleborine</i> Newcastle	1	10	0.91 $\pm$ 0.10	0.23 $\pm$ 0.03	0.15 $\pm$ 0.01	0.10 $\pm$ 0.10	58.7 $\pm$ 12.7
<i>E. helleborine</i> River S. Tyne	1	10	0.85 $\pm$ 0.07	—	—	—	—
Data from Young (1962) for comparison:							
<i>E. dunensis</i>			0.95 $\pm$ 0.06	0.29 $\pm$ 0.03			
<i>E. helleborine</i>			0.97 $\pm$ 0.02	0.27 $\pm$ 0.01			
<i>E. muelleri</i>			0.91 $\pm$ 0.14	0.27 $\pm$ 0.004			
<i>E. phyllanthes</i>			1.28 $\pm$ 0.01	0.28 $\pm$ 0.001			
<i>E. confusa</i>			1.15 $\pm$ 0.08	0.27 $\pm$ 0.003			
<i>E. leptochila</i>			1.15 $\pm$ 0.01	0.27 $\pm$ 0.005			

longest seeds, although ranges in seed length overlap somewhat. Our measurements do not correspond well with those of Young (1962), being generally about 5–10% shorter (Table 2).

In view of the complexities of character combinations in western European *Epipactis*, these characters are tabulated for *E. helleborine* and the autogamous species (Table 1) and a dichotomous key for identification is provided below. The allogamous species *E. purpurata*, *E. palustris* and *E. atrorubens* are excluded from these as they pose no problems of identification.

#### KEY TO *E. HELLEBORINE* AND THE WESTERN EUROPEAN AUTOGAMOUS SPECIES OF *EPIPACTIS*

- |    |   |                       |
|----|---|-----------------------|
| 1. | Leaves dark green, rather rigid, strongly ribbed, the bottom-most usually wider than long; viscidium remaining in the open flower unless removed by an insect with the pollinia intact .....  | <i>E. helleborine</i> |
| 1. | Leaves yellowish-green, green or dark green, if dark green not rigid or strongly ribbed, the bottom-most usually longer than wide; viscidium evanescent and pollinia disintegrating <i>in situ</i> .....  | 2                     |
| 2. | Upper rhachis glabrous or very sparsely pubescent; leaves green to dark green, usually flaccid, scarcely ribbed, acute to acuminate .....   | 3                     |
| 2. | Upper rhachis shortly but rather densely pubescent; leaves yellowish-green, flaccid to rather rigid, scarcely ribbed to ribbed, acute .....   | 4                     |
| 3. | Hypochile absent or green inside; marginal leaf-cells in tufts .....  | <i>E. phyllanthes</i> |
| 3. | Hypochile present, usually purplish but sometimes green inside; marginal leaf-cells ± regular, not forming tufts .....  | <i>E. confusa</i>     |
| 4. | Rostellum long, acute, often ± equalling anther, with two acute basal bosses forming a tricornute stigma; clinandrium deep, with pollinia sunk into it and scarcely visible; sepals green or with paler or rose margins; petals mostly rose ..... | <i>E. youngiana</i>   |
| 4. | Rostellum shorter, not exceeding $\frac{1}{2}$ length of anther; basal bosses to stigma absent or short and inconspicuous; clinandrium shallow (see Table 1), exposing the pollinia; sepals and petals yellowish-green .....                      | 5                     |
| 5. | Ovary almost glabrous; anther sessile .....   | <i>E. muelleri</i>    |
| 5. | Ovary hairy; anther shortly stalked .....   | 6                     |
| 6. | Epichile longer than wide, narrow, acute, usually patent .....  | <i>E. leptochila</i>  |
| 6. | Epichile wider than long, acuminate, reflexed .....   | <i>E. dunensis</i>    |

#### ORIGIN OF *EPIPACTIS YOUNGIANA*

It is interesting to speculate as to the origin and history of *E. youngiana*, although, until more is known of its geographical distribution and range of habitats, evidence is weak. Both the habitats described here are secondary in nature, having been strongly influenced by man. The eastern site is an oak wood, in which the trees are well-spaced and have been thinned in recent years. The remaining trees appear to be even-aged, and somewhat more than 50 years old. Maps from the late 19th century show a wood in the present place, which has presumably been clear-felled between 100 and 50 years ago. Latterly, the floor of the wood has been trenched to facilitate drainage and to allow the underplanting of several species of exotic conifer which, however, have grown poorly amongst the dense *Rubus*. *Epipactis youngiana* and *E. helleborine* occur mostly on the ridges which are less densely clothed with *Rubus* and are apparently better drained. Analysis by A.D.A.S. of soil from beside the roots of an individual of *E. youngiana* gave a soil pH of 5.5; it is a brown earth with a large admixture of clay.

The other (western) site consists of artificially and naturally regenerating vegetation around a disused lead mine, abandoned approximately 50 years ago. Here it grows on waste planted with *Pinus sylvestris* of about 15 years age, and track-embankments with naturally regenerating alder (*Alnus glutinosa*), sallow (*Salix caprea*) and birch (*Betula pendula*). *Epipactis helleborine* and *E. phyllanthes* var. *pendula* are both locally common and grow in company with *E. youngiana*.

Thus it seems likely that *E. youngiana* has not occurred on either of these sites for much in excess of 50 years, and maybe less. There are two possible hypotheses which could account for this distribution: dispersal by wind-borne seed from other, as yet undetected, or extinct, populations of greater age; or origin *in situ* on one or both sites.

In the latter case, a feasible origin might be through hybridization between *E. helleborine* and an autogamous species such as *E. leptochila*. Some authorities have considered that allogamy, and hence hybridization, of normally autogamous species of *Epipactis* does not occur. However, in *E. leptochila* and *E. youngiana*, visits to the nectar-containing hypochile by small insects are common, and it is likely that some casual cross-pollination of loose tetrads will occur. Our observations suggest that this is likely to be true of all the autogamous species except the cleistogamous and phyllanthous forms of *E. phyllanthes*, although it is usually stated that cross-pollination will not occur in the absence of a viscidium. There are some morphological arguments for suggesting a hybrid origin of *E. youngiana*, followed by stabilization through autogamy, for *E. youngiana* represents an intermediate morphological state between *E. helleborine* and autogamous species such as *E. dunensis* and *E. leptochila*. However, although one potential parent, *E. helleborine*, is present on both sites, the only autogamous species currently co-existing with *E. youngiana* is *E. phyllanthes* var. *pendula*. On morphological grounds this is highly unlikely to have been involved in the origin of *E. youngiana*. It also seems improbable that a potential parent such as *E. leptochila* has become extinct subsequent to hybridization at both sites.

Perhaps a more reasonable theory is that *E. youngiana* has been dispersed by seed to its present stations from an initial site where *E. leptochila* or *E. dunensis* and *E. helleborine* had already produced a stable autogamous hybrid population. Perhaps stations still exist where all three of these species occur together.

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