

***Epipactis leptochila* (Godfery) Godfery and  
*E. phyllanthos* G. E. Sm. occurring in  
South Northumberland on lead and zinc soils**

A. J. RICHARDS and G. A. SWAN

*University of Newcastle-upon-Tyne*

ABSTRACT

*Epipactis leptochila* (Godfery) Godfery has been found in 11 stations in S. Northumberland (v.c. 67), 180 miles north of the nearest previously known site. Plants appear to be typical except for short perianth segments. All sites are under birch and associated with apparently toxic heavy metal soils; one site in particular has a very high level of zinc. Most sites are on apparently natural gravels beside the Rivers Tyne and South Tyne, but one is by a disused lead mine. At another lead mine *E. phyllanthos* G. E. Sm. var. *pendula* D. P. Young is reported. This species is new to South Northumberland, the nearest previously reported station being in south-west Furness (v.c. 69b). On lead spoils at another site *E. helleborine* was found; depauperate forms of this species resemble *E. leptochila* vegetatively. The significance of *Epipactis* on heavy metal sites in Northumberland is discussed.

INTRODUCTION

*Epipactis leptochila* (Godfery) Godfery was said by Young (1962a) to be confined in England to calcareous areas in the south, where it is frequent very locally on the escarpments of the Chilterns and Cotswolds. Elsewhere it is uncommon, in scattered localities along the Chalk range from Wiltshire to Kent, on the Carboniferous Limestone of the Wye Valley and Mendips, and in two localities in Devon (Perring & Walters 1962). It also occurs in widely separated localities in France, Germany, Denmark, Sweden and Switzerland. The plant is said to be strongly calcicolous – much more so than any other European species of *Epipactis*. Every station for which geological data are available is on calcareous rock, and these comprise the great bulk of records. Conversely no station had been recorded on neutral or acid rocks. The usual habitat is in beech-woods under heavy shade, and with only a sparse ground flora; it often occurs with *E. helleborine* (L.) Crantz and *E. purpurata* Sm. From these, and from other related *Epipactis* species, it is readily distinguished by rather narrow, yellowish, two-ranked leaves, relatively few, yellowish flowers, which are held in an inclined position and which lack a rostellum, with rather long, narrow perianth segments, and a patent epichile which is longer than broad, and which equals or exceeds the hypochile. The anthers are borne on a stalk (clinandrium) in such a way that when viewed sideways a distinctive hole is visible between the column and anther (Young 1962a). As such it is usually a rather distinct species, and it has not normally been considered as being a critical member of this difficult genus.

It was therefore surprising to receive from M. Rawes and B. M. Cunliffe, towards the end of 1973, a record of *E. leptochila* from birch scrub on the east bank of the River South Tyne near Williamston, S. Northumberland (v.c. 67), 4 miles north-north-east of Alston (grid references of all sites are withheld, but have been deposited with the Biological Records Centre, Monks Wood). This identification had been confirmed by Dr J. T. Knight. It later transpired that the same colony had been observed and photographed a month earlier on the 21st July 1973 by Dr A. W. Williams, who had known it for some years.

HABITAT AND DISTRIBUTION

The colony was located on the 14th July 1974 by G. A. and M. Swan, although on that date it was only in bud, and a further search by A. J. Richards and G. A. Swan on 31st July revealed that

it was part of a larger colony of *Epipactis* with about 290 flowering spikes within a limited area. A voucher specimen was taken (herb. Swan) and some mature flowers were pickled in 70% ethanol. Reference in the field to Clapham (1962) and Young (1962a) established that the colony consisted of typical *E. leptochila*, differing only in short outer (mean 7.4 mm) and inner (mean 5.9 mm) perianth segments. All mature flowers examined in this and other populations lacked a rostellum and possessed a clinandrium. In addition, all had a narrow, patent, triangular epichile. In view of the apparent lack of floral measurements in the literature (except Godfrey 1933), those from one population of *E. leptochila* and two of *E. helleborine* are presented in Table 1, together with measurements made from Ross-Craig's (1971) excellent scale drawings.

At this locality the River South Tyne forms a broad valley at an altitude of 700 ft (220 m) with level gravels in the immediate vicinity of the river. To the east of the gravels, away from but scarcely raised above the river, is a thinly grassed bank on which birch scrub grows. *E. leptochila* occurs in scattered colonies both within and at the margin of this scrub. We noted the following species growing within 1m of *E. leptochila*:

<i>Angelica sylvestris</i>	<i>Conopodium majus</i>	<i>Leontodon hispidus</i>
<i>Anthoxanthum odoratum</i>	<i>Dactylorhiza fuchsii</i>	<i>Ranunculus acris</i>
<i>Armeria maritima</i>	<i>Epipactis helleborine</i>	<i>Salix nigricans</i>
<i>Arrhenatherum elatius</i>	<i>Equisetum arvense</i>	<i>Silene dioica</i>
<i>Betula pubescens</i>	<i>Geum rivale</i>	<i>Succisa pratensis</i>
<i>Carex ovalis</i>	<i>Holcus lanatus</i>	<i>Trifolium repens</i>
<i>Centaurea nigra</i>		

Open gravel and pathside within 5m of *E. leptochila* colonies, to the south and east, also supported:

<i>Acer pseudoplatanus</i>	<i>G. verum</i>	<i>Trisetum flavescens</i>
<i>Aegopodium podagraria</i>	<i>Hieracium</i> sp.	<i>Ulex europaeus</i>
<i>Agrostis canina</i>	<i>Linum catharticum</i>	<i>Vicia cracca</i>
<i>A. tenuis</i>	<i>Lotus corniculatus</i>	<i>V. sepium</i>
<i>Campanula rotundifolia</i>	<i>Luzula sylvatica</i>	<i>Viola lutea</i>
<i>Cerastium fontanum</i>	<i>Minuartia verna</i>	
<i>Cruciata laevipes</i>	<i>Parnassia palustris</i>	<i>Bryum caespitium</i>
<i>Deschampsia cespitosa</i>	<i>Plantago lanceolata</i>	<i>B. capillare</i>
<i>Euphrasia nemorosa</i>	<i>Rubus idaeus</i>	<i>Pleurozium schreberi</i>
<i>Festuca rubra</i>	<i>Rumex acetosa</i>	<i>Polytrichum juniperinum</i>
<i>Filipendula ulmaria</i>	<i>Sorbus aucuparia</i>	<i>Rhytidadelphus squarrosus</i>
<i>Fraxinus excelsior</i>	<i>Thlaspi alpestre</i>	<i>Tetraplodon mnioides</i>
<i>Galium saxatile</i>	<i>Thymus drucei</i>	<i>Weissia controversa</i> var. <i>densifolia</i>

The open nature of these gravels, which are almost bare in places, and the occurrence of species such as *Armeria maritima*, *Minuartia verna*, *Thlaspi alpestre* and *Weissia controversa* var. *densifolia* led us to suspect that the mineral content of the soil might be unusual. In the vicinity of Alston, lead, zinc and barium ores have been mined in the past. Soil samples were therefore taken from 2–10 cm below the surface in the immediate vicinity of *E. leptochila*, and from the bare patches in the adjacent open gravel. These were analysed by Dr K. Shaw (Agricultural Development and Advisory Service, Kenton Bar, Newcastle-upon-Tyne) (Table 2). The *Epipactis* sites are remarkable, with high levels of extractable zinc, of an order likely to result in toxicity in many plants (Bradshaw *et al.* 1965), although if the calcium level (unknown) is high relative to magnesium, there would be a less severe effect. However, the zinc levels are nearly twice the 'critical' level suggested by Halliday (1960). Levels of extractable lead are also rather high. The levels of extractable phosphorus and potassium are very low although not untypical of many upland soils, particularly those with a high pH. The pH of these soils is about 7 (neutral), which is unusual in this predominantly acidic area, and may well be comparable with the southern chalk soils on which this species has been previously reported.

The bare gravel areas are not dissimilar, although the figures are less extreme, particularly with regard to zinc, which is only a tenth of the *Epipactis* soils. This, coupled with the relatively high levels of lead and the low levels of phosphorus, are sufficient to account for the sparse but floristically interesting vegetation found in these areas. Nevertheless, it is noteworthy that the more

extreme soils, under birch, support a more vigorous ground vegetation. This may be due to such ameliorating factors as the shade, moisture and higher humus of these areas, and the higher pH. It may be that the open nature of the gravel communities owes much to free drainage, high leaching and low humus content, as Halliday (1960) has suggested that little direct heavy metal toxicity is associated with lead/zinc spoil soils in the Pennines.

Similar possibly toxic gravels are found beside the River South Tyne from Williamston down to the junction with the River North Tyne at Warden, and species such as *Armeria maritima*, *Thlaspi alpestre* and *Minuartia verna* occur beside the combined River Tyne even below Wylam, only 7 miles west of Newcastle. Since we thought that birch scrub growing on apparently toxic Tyne gravel might constitute a habitat for *E. leptochila*, we went downstream on the same day in search of other examples of this type of habitat, and indeed we never failed to find the *Epipactis* in suitable areas.

South-east of Harper Town, the South Tyne forms a bend, on the western (and southern) bank of which a fairly level area is covered with birch scrub at an altitude of 500 ft (160 m). Here, growing in the scrub and also on an open grassy bank just above the river, we saw about 1,000

TABLE 1. FLORAL CHARACTERS OF EPIPACTIS LEPTOCHILA AND E. HELLEBORINE

Origin	Sample size	Outer perianth segment (mean)		Inner perianth segment (mean)		Epichile (mean)		Epichile L Hypochile L (mean)	Ros- tellum	Clin- andrium
		Length	L/B	Length	L/B	Length	L/B			
<i>E. leptochila</i>										
Williamston	9	7.4	2.1	5.9	1.75	3.5	1.9	1.10	-	+
Clapham (1962)	—	12-15		ca. 10		Tip patent Longer than broad			-	+
Ross-Craig (1971)	—	10	1.9	9.6	1.8	4.5	2.2	0.90	-	+
<i>E. helleborine</i>										
Haydon Bridge	10	9.6	1.6	7.9	1.5	2.4	0.8	0.44	+	-
Langley	9	8.8	1.5	7.0	1.4	Tip recurved 3.0 0.7		0.64	+	-
Clapham (1962)	—	ca. 10				Tip recurved Broader than long			+	-
Ross-Craig (1971)	—	11.0	1.55	9.6	1.5	Tip recurved 5.0 0.8		1.0	+	-

All measurements in mm

spikes of *E. leptochila*. These were very similar to those at Williamston, although some were much bigger plants. There was also one plant of *E. helleborine*. The associated species were very similar to those at Williamston, but the following additional species were also noted:

*Anthyllis vulneraria*  
*Geranium sylvaticum*

*Polygala vulgaris*  
*Rhinanthus minor*

*Taraxacum unguilobum*

Two further sites were visited the same day. On the southern bank, west of Beltingham, 13 spikes were found; and on the northern bank, near Crow Hall, 6 spikes were discovered after a long search. In both these sites, birch occurred on riverside gravels, but there was little evidence of soil toxicity and none of the characteristic gravel plants were present. The vegetation under the birch was much more rank and species-rich, and the *Epipactis* were poorly developed and apparently suffering from competition. This was also true of the other six riverside sites subsequently discovered downstream to Wylam during August. All were on riverside gravels or banks associated with birch, and in some cases (as at Wylam and Haltwhistle) open gravel or banks with

*Armeria*, *Minuartia* and *Thlaspi* occurred nearby. Nevertheless, colonies were invariably small both in number of spikes (2-20) and height, occurring in areas with vigorous ground cover. It is suggested that these birch woods might have colonized toxic gravels, and have developed a deep humus above the gravels, allowing more vigorous ground cover to develop.

In view of the association of *E. leptochila* with apparently toxic sites under birch, spoil heaps from disused lead mines were examined. Some of these proved negative, but a thriving colony of more than 50 spikes, accompanied by *E. helleborine*, was discovered in birch scrub on spoil heaps (altitude 450 ft, 140 m) some distance north of the River Tyne at Hexham.

TABLE 2. ANALYSES OF SOIL SAMPLES FROM WILLIAMSTON

Site	pH <sup>1</sup>	P <sup>2</sup>	K <sup>3</sup>	Mg <sup>4</sup>	Cu <sup>5</sup>	Zn <sup>6</sup>	Pb <sup>6</sup>
<i>E. leptochila</i>	7.2	3	56	99	26	2,370	692
<i>E. leptochila</i>	7.0	4	54	113	18	2,300	300
Open gravel	5.2	6	91	61	12	192	540
Open gravel	5.2	6	91	48	15	222	720

All element concentrations as p.p.m. of air-dry soil.

<sup>1</sup> Measured by glass electrode on 1:2 soil: water mixture.

<sup>2</sup> Extracted in sodium bicarbonate and determined by the phosphomolybdate procedure.

<sup>3</sup> Extracted in N ammonium nitrate and determined by flame-photometer.

<sup>4</sup> Extracted in N ammonium nitrate and determined by atomic absorption spectrophotometer.

<sup>5</sup> Extracted in EDTA and determined by atomic absorption spectrophotometer.

<sup>6</sup> Extracted in 0.5N acetic acid and determined by atomic absorption spectrophotometer.

On 11th August 1974, G. A. and M. Swan visited the old heaps of a lead mine (altitude 400 ft, 125 m) north of Haydon Bridge. Although birch was abundant they failed to find *E. leptochila*. However, this disappointment was more than compensated for by the discovery of a flourishing colony of *E. phyllanthes* G. E. Sm. var. *pendula* D. P. Young. About 50 spikes were present, growing particularly under *Corylus avellana*, along with *Salix* spp., *Alnus glutinosa*, and *Betula* sp. Although the plant occurred to within 5 m of the edge of a lead spoil tip 20 m high, and the ground vegetation was open, it was under heavy shade, and there was no external indication that the spoil was in any way affecting the soil or the vegetation. However, patches of birch scrub adjacent to and on the heaps held magnificent colonies of *E. helleborine*, of which there were several hundred spikes. The nearest records for *E. phyllanthes* to Haydon Bridge appear to be in W. Lancs. (v.c. 60) and S.E. Yorks. (v.c. 61) (Young 1962b), and south-west Furness (v.c. 69b) (Young 1952). The Lancashire record is known to be of var. *pendula*. This locality, therefore, is not only the first record of *E. phyllanthes* for S. Northumberland but it is also the northernmost known in the British Isles. The record from Holy Island (Cheviot, v.c. 68) cited by Swinton (1967) must surely be an error for *E. dumensis* (T. & T. A. Stephenson) Godfery, which is well known there (Young 1962a). Comparison of the Haydon Bridge plants (voucher in herb. Swan) with the account in Young (1952) shows these attractive and distinctive little plants to be in agreement with his var. *pendula* in every characteristic.

We also inspected the heaps at the site of the disused lead smelting works at Langley (altitude 700 ft, 220 m) where very many magnificent plants of *E. helleborine* were growing, particularly under conifers. Among birch scrub on these heaps were also some smaller, yellower plants with leaves in two ranks, which had the superficial appearance of *E. leptochila*. However, the flowers of both possessed a rostellum, lacked a clinandrium, and had an epichile and perianth segments indistinguishable from the Haydon Bridge population of *E. helleborine* (Table 1). Doubtless, they were merely odd and rather depauperate forms of this species.

#### DISCUSSION

The origin of *E. leptochila* in the Tyne Valley is quite unknown, although it can give rise to some interesting speculation. In view of the constancy of its habitat elsewhere it may be supposed that

it originally arose in woodland sites on chalk and limestone where it is widespread in this country and abroad. The majority of its close relatives are also most usually found in this type of habitat. In common with most members of the Orchidaceae it possesses a very light seed which is very readily windborne, perhaps over large distances on occasion. Thus the natural colonization of suitable habitats in Northumberland from the south of England is not beyond question. The Tyne Valley sites are not apparently of very recent origin. *Helleborine latifolia* Druce is recorded from open sites by the banks of the Tyne near Haltwhistle by Blackburn (1927), and her report is accompanied by an editorial note from J. E. Hull that he knew it in similar situations at Featherstone in 1897. Since *E. leptochila* had not been distinguished at that time, it has probably been present in the Tyne Valley for at least 80 years.

The Tyne Valley habitats share with southern sites features of shade, rather sparse ground flora, and, in one case at least, a neutral pH. Furthermore, they seem to be attractive to other species of *Epipactis*, *E. helleborine* being larger and more frequent here than elsewhere in Northumberland, and the very local *E. phyllanthes* occurring in one site. Nevertheless, the relatively high altitude (up to nearly 800 ft) must render these sites much colder than those in the south, and the unusual mineral content of the soil would be thought to pose many problems to these plants. However, it apparently has the effect of creating open ground suitable for these species; the poor showing of *Epipactis* in downstream sites with good ground cover was notable, and it may be that previously vigorous colonies have suffered from the progressive colonization of heavy metal gravels by birch, with subsequent increase of ground cover.

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