Conservation of Britain's biodiversity: *Hieracium tavense* (Asteraceae), Black Mountain Hawkweed

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ABSTRACT

Hieracium tavense is a very rare endemic species, restricted to one waterfall in the Upper Tawe Valley, Brecon (v.c. 42), Wales. It was first found in 1899 but appears to have only been seen a few times subsequently. In 1998, a survey by climbing found 13 inaccessible plants on one cliff. It is a polycarpic perennial which flowers in late July–August and reproduces by seed. Although rare and with a critically small population, it is not threatened except potentially by a severe rock fall.

KEYWORDS: Endemic, rare species, Wales

INTRODUCTION

Hieracium tavense (Ley ex W. R. Linton) A. Ley, Black Mountain Hawkweed, is a very rare endemic species, restricted to a ravine in the Upper Tawe Valley, Brecon (v.c. 42), Wales. Along with a number of other rare hawkweeds, it has been included in the 3rd edition of the Vascular Plant Red Data Book (Wigginton 1999), but very little was known about its detailed distribution or ecology.

H. tavense was first found by Augustin Ley in the Upper Tawe Valley 'above Callwen' in 1899, and was sent unnamed to the Botanical Exchange Club (Ley 1900). Ley took specimens into cultivation, and later submitted them to the B.E.C. as *H. protractum* Fr. (Ley 1903), but F. J. Hanbury suggested the general appearance of the plants was that of *H. rigidum* Hartmann rather than *H. protractum.* It was then described as *H. rigidum* var. *tavense* Ley ex W. R. Linton (Linton 1905). Later at Linton's suggestion, Ley raised it to species noting it was close to *H. latobrigorum* (Zahn) Roffey (*H. auratum* Fr.) (Ley 1909). Zahn (1921–1923) later relegated it to a subspecies of *H. laevigatum* Willd., but this view was not adopted by Pugsley (1948) who retained it as a species. It is currently accepted as a species by P. D. Sell (pers. comm. 1998).

This species has only been seen a few times. Pugsley (1948) had not seen it himself and noted that it had apparently not been collected since first found by Ley. B. A. Miles refound it in 1957 and visited it in 1959 and 1960, and M. Porter saw it in 1975 (Ellis 1983). In 1998, a survey was carried out to establish its current status and determine its needs for conservation (Rich 1999). The purpose of this paper is to summarise the work.

TAXONOMY

Hieracium tavense belongs to sect. *Foliosa* (Fr.) Arv.-Touv. This is a small section of ten microspecies, mainly distributed in the north and west of Britain (Fig. 1). Pugsley (1948) gives a good description, which appears to be largely based on cultivated material. Syntypes are located in **LIV** (annotated by Sell & West in 1959) and at **BM**.

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H. tavense is almost certainly a neoendemic which may have evolved from another member of the sect., such as *H. latobrigorum*, since the last Ice Age. There appears to be nothing particularly special about the waterfall on which it occurs (many similar waterfalls occur throughout the Brecon Beacons), and it is not especially isolated from other species in the sect. (Fig. 1). Whether it evolved *in situ* or is relict in this site from a wider distribution is unknown.

At least five *Hieracium* species grow in Nant-y-Llyn. *H. tavense* can be distinguished from *H. diaphanum* Fr., *H. scoticum* F. Hanb. and *H. sparsifolium* Lindeb. by having numerous stem leaves, the middle ones of which at least partly clasp the stem. It can be distinguished from the other, as yet unnamed, species of sect. *Foliosa* with which it grows at the waterfall by the linear-lanceolate (not ovate) upper stem leaves (this other species is currently under investigation). Another 23 *Hieracium* species are listed from the 10-km square SN/8.2 in Sell & West (1968), and more occur to the south in SN/8.1.

DISTRIBUTION

Locality and habitat information were extracted from the literature and from **BM**, **CGE**, **LIV**, **OXF** and **NMW**. Information from the Countryside Council for Wales database of Red Data Book species was provided by R. A. Jones, and from the *Hieracium* database by D. McCosh. The historical records indicate it has been found in one specific locality only, i.e. 'waterfall at Nant-y-Llyn' (Table 1), though Ley cited it in several different forms. He also noted that it was 'not yet known from any other station other than those in the Upper Tawe Glen' (Ley 1909) suggesting it could occur elsewhere in this area, but no other stations are known.

Nant-y-Llyn is a ravine on the east side of the Black Mountain with a series of rocks and waterfalls. In 1998, 13 plants of *H. tavense* were found confined to an unstable cliff c. 20 m high on the north-facing side of a small cirque developed around the upper of the two larger waterfalls at c. 510 m altitude (grid reference SN/844.207). The plants could only be reached safely by climbing with ropes. One stem of one plant was removed as a voucher (**NMW**) and its identity confirmed by P. D. Sell.

The rocks of the waterfall are composed of the Brownstones of the Lower Old Red Sandstone of Devonian age (Geological Survey of Great Britain 1979; Barclay *et al.* 1988). The Brownstones are red-brown and purple sandstones interbedded with red mudstones and siltstones, with occasional intraformational conglomerates and less frequent calcrete nodules. They form beds c. 400 m thick, and outcrop over much of the Brecon Beacons. At the waterfall, there are a series of hard strata c. 20–50 cm thick, interbedded with softer silts, resulting in a series of unstable and overhanging ledges on which *H. tavense* grows. Lower down Nant-y-Llyn, green sandstone of the Senni beds also outcrops to form a waterfall.

TABLE 1. LIST OF *HIERACIUM TAVENSE* RECORDS

Date	Collector	Site	Source
26/7/1899	A. Ley	Tawe gorge above Cellwen	**BM**, syntype (Ley 1900)
3/8/1899	A. Ley	Waterfall at Nant y Llyn near Cellwen	**BM** (ex. herb. Hanbury)
3/8/1899	A. Ley	Upper Tawe Valley	**BM**, **LIV**; syntype (Ley 1900)
3/8/1899	A. Ley	Head of the Tawe	**BM**, **CGE**, **OXF** (Ley 1900)
3/8/1899	A. Ley	Baggards Glen, Nant-y-Llyn, Upper Tawe	**BM**, **CGE**
30/7/1902	A. Ley	Upper Tawe, cultivated	**BM**, **NMW**, **OXF** (Ley 1903)
18/7/1906	A. Ley	Upper Tawe Glen, cultivated	**BM**, **CGE**, **LIV**, **NMW**, **OXF**
1910	A. Ley	Upper Tawe Glen, cultivated	**BM**, **CGE**, **OXF** (Ley 1911)
26/7/1957	B. A. Miles	rocks by the waterfall, 1650', Nant-y-Llyn, Upper Tawe	**CGE**
1959	B. A. Miles	Nant-y-Llyn, Upper Tawe; 1 plant	Note on specimen in **CGE**
1960	B. A. Miles	Nant-y-Llyn, Upper Tawe; 3 plants	Note on specimen in **CGE**
1975	M. Porter	Upper Tawe	Ellis (1983)
28/8/1998	T. Rich & L. Houston	Nant-y-Llyn; 13 plants	**NMW**

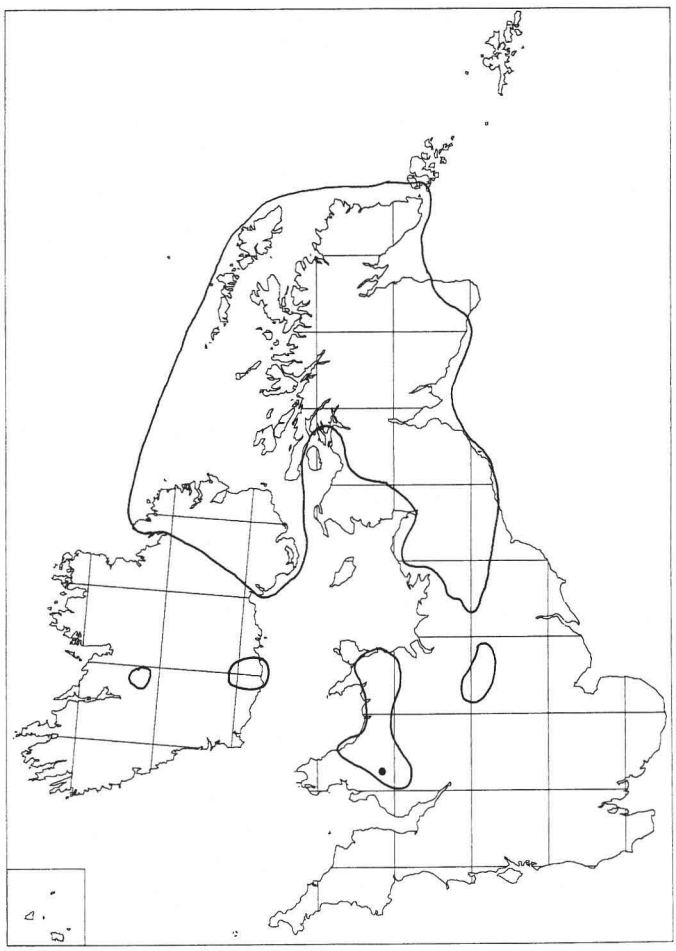

FIGURE 1. Distribution of *Hieracium tavense* (●) and *Hieracium* Section *Foliosa* (—).

ECOLOGY

LIFE CYCLE

Hieracium tavense is a polycarpic perennial which reproduces by seed. In 1998, the mean number of stems per plant was 2·9 (range 1–7) (Table 2). Nine out of the 13 plants (69%) were flowering, and most (76%) of the stems had flowers. The mean number of capitula per inflorescence was 3·2, which is smaller than the numbers observed on two specimens cultivated by Ley in **NMW** (eleven and 14 capitula respectively) suggesting sub-optimal growth conditions in the wild compared to cultivation. Some plants rooted in shallow crevices were vegetative, and most plants had some aborted capitula within each inflorescence. Many plants also had dead stems from 1997.

Plants were just beginning to flower on 14 August and had virtually all finished flowering by 28 August 1998. Herbarium specimens have flowers from mid-July to the end of August. It is assumed that *H. tavense* is an obligate apomict like other *Hieracium* species but this has not been tested. Flowers seen on 14 August had not fruited by 28 August in the wild, but did so rapidly when taken into cultivation. Seed ripening is thus estimated to take 2–3 weeks. The mean number of seeds produced by each flowering plant was 225 (range 35–1015), and the total seed production of the population was estimated as c. 2030 seeds.

TABLE 2. CHARACTERISTICS OF *HIERACIUM TAVENSE* AT NANT-Y-LLYN ON 28 AUGUST 1998

Plant	No. live stems	No. stems flowering	Number of capitula in each inflorescence	No. dead stems from 1997	Notes
1	3	0	-	4	
2	2	0	-	5	+ 3 possible seedlings
3	7	7	3,3,4,4,4,5,6	7	Huge clump
4	1	0	-	0	Stems growing downwards
5	4	3	1,2,2	6	
6	2	2	3,5	6	Four capitula picked + soil collected
7	4	1	1	0	Under an overhang
8	1	0	-	0	Very small, ± no soil, hanging out of cliff
9	4	3	1,3,aborted	3	Voucher specimen collected 14/8/1998
10	1	1	8	0	Two capitula collected
11	1	1	1	0	Growing sideways under overhang
12	7	1	?	9	Growing well
13	1	1	2	0	Plant dangling down, two capitula collected
Mean	2·9	1·53	3·2	3·1	

The seeds are wind-dispersed. Tests in windless conditions show that seeds fall at a velocity of c. 40–50 cm per second, but are easily kept afloat in the air by a gentle breeze (e.g. gentle blowing). Although the seeds have the potential for dispersal, the paucity of available habitat in the Upper Tawe Valley, restricted calcareous outcrops and low seed production suggest that the chances of *H. tavense* spreading are limited, though some possible reproduction by seed within the site was noted during the survey (Table 2). All four seedlings which germinated in cultivation had one of the cotyledons split into two, resulting in an apparent appearance of three cotyledons.

ASSOCIATED SPECIES AND SOILS

The species associated with *H. tavense* on the waterfall are listed in Table 3. An attempt was made to relate the vegetation type on the rock face to the National Vegetation Classification (Rodwell *et al.*1991 *et seq.*), but the site is somewhat heterogeneous. Most of the waterfall face appears to be H12 *Calluna vulgaris - Vaccinium myrtillus* heath vegetation. *H. tavense* occurred on the more base-rich ledges, often without any other species, and it has not been possible to ascribe it to a clear N.V.C. type.

Plants were rooted in immature rankers on the ledges or sometimes directly into rock crevices with no apparent soil. The soil from the base of one plant was composed of c. 70% large fragments of Brownstone, reddish-brown mineral material and fine organic matter, pH 7·1 (measured with a pHep2 Hanna pocket-sized pH meter in a 50:50 mixture with distilled water).

CONSERVATION

Although the population size is critically small, the only significant threat to survival of the species is a large rock fall which could wipe out the entire population. It is under no threat from collecting due to the very difficult climbing conditions and requirement for roped access. Although the area around the waterfall is intensively grazed, the cliff is inaccessible to sheep (*H. tavense*, like most hawkweeds, is likely to be sensitive to grazing). No site management is currently required, and the only potential management in the future might be control of *Sorbus aucuparia* trees to minimise shade.

Seeds from eight flowering heads were sent to the Millennium Seed Bank at the Royal Botanic Gardens, Wakehurst Place for long-term storage. Attempts are also being made to grow the plant in cultivation.

Hieracium tavense is not protected under Schedule 8 of the Wildlife and Countryside Act 1981, but is included in the Vascular Plant Red Data Book (Wigginton 1999), which should draw

TABLE 3. SPECIES ASSOCIATED WITH *HIERACIUM TAVENSE*, NANT-Y-LLYN, 28 AUGUST 1998 WITH 'DAFOR' COVER RATINGS

Agrostis capillaris	R	*Oreopteris limbosperma*	R
Anthoxanthum odoratum	R	*Oxalis acetosella*	O
Asplenium viride	R	*Polypodium vulgare s.l.*	R
Athyrium filix-femina	O	*Solidago virgaurea*	O
Calluna vulgaris	F	*Sorbus aucuparia*	R
Carex pilulifera	R	*Succisa pratensis*	O
Deschampsia flexuosa	A	*Thymus polytrichus*	O
Digitalis purpurea	O	*Vaccinium myrtillus*	O
Dryopteris dilatata	O	*Valeriana officinalis*	R
Dryopteris filix-mas	R	*Veronica officinalis*	R
Epilobium brunnescens	O	*Viola riviniana*	R
Epilobium montanum	R	Bryophytes	
Euphrasia sp.	R	*Brachythecium plumosum*	O
Festuca ovina	R	*Amphidium mougeotii*	F
Festuca rubra	R	*Blepharostoma tricophyllum*	R
Galium saxatile	R	*Ctenidium molluscum*	F
Hieracium sp.	R	*Diplophyllum albicans*	O
Hieracium tavense	O	*Dicranum scoparium*	O
Hypericum pulchrum	R	*Fissidens taxifolius*	R

attention to its rarity and be sufficient to ensure its survival. The upper part of Nant-y-Llyn is included within the Mynydd Du S.S.S.I., and is also part of the Brecon Beacons National Park. These designations give a significant degree of protection to the site.

Thus *H. tavense* has no specific conservation requirements despite being very rare. The population should be surveyed every five years to monitor the *status quo*.

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