Escarpment crags on Bredon Hill, Worcestershire, as hibernacula for Hymenoptera with particular reference to Ichneumonidae

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01. Northern escarpment of Bredon Hill, Worcestershire, 20 July 2016. The position of the crags cited is marked by the arrow.

Introduction

Bredon Hill in Worcestershire is a site of major interest for its historic assemblages of invertebrates across a wide range of biotopes (Whitehead, 1992, 1995a, 1995b, 1996, 1999, 2019) reflected in its SSSI and NNR designations which nevertheless exclude some critically important areas. The extended time-patina of the northern escarpment (01) permits some understanding of the developmental history of these assemblages on landforms subject to only minimal human intervention over millennia.

Bredon Hill rises to 299 m a.s.l. and is capped by formations within the Middle Jurassic Inferior Oolite Group (Barron, Sumbler & Morigi, 1997; Williams & Whittaker, 1974). Much of the northern escarpment is composed of down-slumped material including Oolitic Limestone (Morris, 1984). On the hillcrest above Great Comberton (52º06'N 02º06'W VC37 SO94 285 m a. s. l.) vestigial vertical crags of very limited extent remain poised precariously in full exposure above extensive down-slumped hummocks.

These north-facing crags, ascribed to Aalenian Freestone Formations (Richardson, 1902) have also existed for millennia, some outcrops showing no recent major collapse features (02). The crags form a slope-top buttress of blocky laminated rock extending backwards for some 16 m containing an abundance of fissures, cavities and airspaces (02). They require to be treated with care because they conserve sediments and lithofacies within and behind them and are subject to weathering and gravitational dislocation in places (02). Following limited study these crags are now recognised as major hibernacula for female aculeate Hymenoptera.

Observations

On 14 October 2023 a female *Camposcopus nigricornis* (Wesmael, 1849) (03) was observed 35mm deep facing inwards within a very narrow fissure between two *in situ* thermally cracked rock fragments low in the face of the crag. The wasp was rather sluggish and was easy to pick up. The specimen was not immediately identifiable but was regarded as a regional geographic novelty and was therefore retained for imaging. Those images were eventually seen by Heinz Schnee who named the wasp.

It was initially contended that this wasp had entered the rock fissure for the purpose of diapause hitherto unrecorded in European anomalonine ichenumonids (M. R. Shaw, in litt.; Verheyde & Quicke, 2022). According to M. R. Shaw (in litt., 13 November 2023), in all known cases adult C. nigricornis have emerged from the host pupa in the same year that the host larva was collected; there is therefore no recorded account of how the wasps overwinter. However since the first draft of this account was submitted evidence has come to light in continental Europe that C. nigricornis can overwinter in the host pupa (M. R. Shaw, in litt., 11 January 2024). It seems likely therefore that this C. nigricornis entered the Bredon Hill crag for shelter as an end of life event although an attempt at diapause cannot be entirely ruled out.

These crags, sometimes reduced to down-slipped rocks, are evidently a marked focus for female Hymenoptera intent on overwintering and my attention was first drawn to this during 2021. On 12 March 2021 in a temperature of 12ºC 15 female *Ichneumon sarcitorius* Linnaeus, 1758 were observed milling around the base of the crag. Some radiated away from it but the general movement was indecisive and some actively re-entered the crag air spaces. It seems clear that in exposure at 285 m a.s.l. break of diapause is a potentially hazardous process because two intact adult *I. sarcitorius* were found dead at the base of the crag on 30 March 2021 with no live wasps then present. Similar crags on Cleeve Hill, Gloucestershire have not been fully investigated but collapsed rocks there are subject to intense thermal fragmentation. An overwintering localised carabid beetle *Licinus depressus* (Paykull, 1790) was found frozen in a frost crack on a collapsed rock at Cleeve Hill (51º93'N 02º02'W VC33 SO92 283 m a.s.l.) on 19 February 2017.

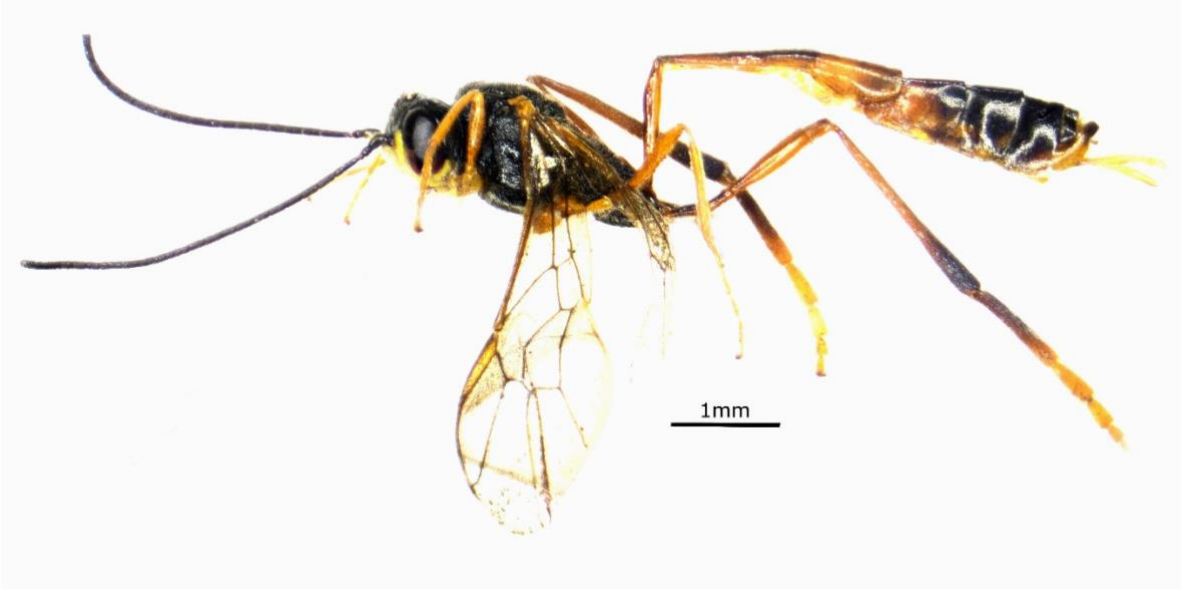
Although the Bredon Hill crags are an undoubted focus for *I. sarcitorius* this could be facultative and it is not clear how far wasps may travel to assemble there. On 26 February 1993 an assemblage of

14 female *I. sarcitorius* was observed quiescent in moss over Oolitic Limestone on the dipslope of Bredon Hill at Westmancote 1.87 km south-west of the crags (52º04'N 02º08'W VC37 SO93 195 m a.s.l.).

It should not be forgotten that exposed rock faces carry their own distinctive biota with high niche fidelity. This is strongly evidenced along the north Cotswold Hills but Hymenoptera overwintering on the Bredon Hill crags do so in a variety of ways evidently with varying degrees of commitment. Female *Bombus lapidarius* (Linnaeus, 1758) (Apidae) prefer loose grass-covered friable sediments at their base. Female *Lasioglossum* (Halictidae) have other distinct preferences. They enter narrow rock crevices and create cells in slightly damp very fine products of weathered rock where they remain curled on their sides over winter; *Lasioglossum morio* (Fabricius, 1793) has been found to enter the crags during October. On 21 May 2023 a female *Lasioglossum smeathmanellum* (Kirby, 1802) was observed quiescent disposed identically in fine damp rock dust under a large dressed rock at Perryfield Quarry, Portland, Dorset (50º54'N 02º43'W SY67 72 m a.s.l.). Had the rock not been lifted its egress would have been difficult. Social wasps of the genus *Vespula* also overwinter in the crags usually in wider crevices but this is certainly facultative.

The predatory staphylinid beetle *Ocypus olens* (Müller, 1764) develops cognisance of overwintering invertebrate assemblages in the Bredon Hill crag (Fig. 4). It is not certain how these crags may be categorised in relation to the hibernacula categories provided by Verheyde & Quicke (2022). They bear resemblance to caves but climatic buffering will be more variable. Probably a new overwintering niche category, rock fissures, needs to be created.

02. Inferior Oolitic Freestone crag, a major hibernacula for Hymenoptera, Bredon Hill scarp crest, Worcestershire, 28 May 2020.



03. Female *Camposcopus nigricornis* from Bredon Hill crag fissure, Great Comberton C. P., Worcestershire, 14 October 2023. P. F. Whitehead *leg*., *determinavit* H. Schnee.

04. Female staphylinid beetle *Ocypus olens* with female *Vespula vulgaris* (Linnaeus, 1758) in rock fissure exposed when adjacent rock sliver was removed. The wasp's head can be seen between the beetle's legs. Bredon Hill crag, Great Comberton C. P., Worcestershire, 14 October 2023.

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Images
01. Northern escarpment of Bredon Hill, Worcestershire, 20 July 2016. The position of the crags cited is marked by the arrow.
02. Inferior Oolitic Freestone crag, a major hibernacula for Hymenoptera, Bredon Hill scarp crest, Worcestershire, 28 May 2020.
03. Female *Camposcopus nigricornis* from Bredon Hill crag fissure, Great Comberton C. P., Worcestershire, 14 October 2023. P. F. Whitehead *leg*., *determinavit* H. Schnee.
04. Female staphylinid beetle *Ocypus olens* with female *Vespula vulgaris* (Linnaeus, 1758) in rock fissure exposed when adjacent rock sliver was removed. The wasp's head can be seen between the beetle's legs. Bredon Hill crag, Great Comberton C. P., Worcestershire, 14 October 2023.