The ecology of the Brown Hairstreak (*Thecla betulae*)

*a* Lycaenidae butterfly

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1. Introduction

The Brown Hairstreak (*Thecla betulae*) is the largest of the five hairstreak butterflies native to Britain and Ireland. Wingspans are typically between 36 to 41mm for males and 39 to 45mm for females. Both sexes have dark chocolate-brown upper wings with orange tails projecting from the hindwings.
The Brown Hairstreak was once a relatively common sight amongst hedgerows and deciduous woodland edges in late summer across southern England. However, long-term declines in traditional woodland practices such as layering and coppicing and the great loss of hedgerows that began in Britain after 1945 has led to a severe decline in the distribution and abundance of this member of the Lycaenidae family. The long-term population trend is classed as stable under the UK Butterfly Monitoring Scheme with an increase of 58% since 1983. However, abundance has decreased by 22.9% between 1990 and 2010 and by 53.1% between 2000 and 2010 (Botham et al., 2011). The distribution of the species has also declined by 43% from 1970-82 to 1995-2004 (Fox et al., 2006). These trends have led to the Brown Hairstreak being classified as a UK Biodiversity Action Plan Priority Species. It is listed as Vulnerable on the new Butterfly Red List and is prohibited from sale under Section 9, Part 5 of the Wildlife and Countryside Act 1981 (JNCC, 2010).

2. Distribution

The butterfly is widely distributed across central Europe from northern Spain to southern Sweden, and east through Asia to Korea. Within Britain it is locally distributed in the heavily wooded clays of the West Weald in Sussex and Surrey; in sheltered valleys in north Devon and south-west Somerset, and in south-west Wales. Within Hampshire, the species is found in low numbers on the clay soils around Noar Hill and Selborne Common in the east of the county and on the drier chalk and clay soils around Shipton Bellinger in the north-west, close to the Wiltshire border.
3. Phenology and life cycle

The species is univoltine. Adults are first seen flying in late July or early August with a mean flight date, nationally, of 25 August (Botham et al., 2011).

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Table 1: The timing of the main life stages of the Brown Hairstreak. (Source: UK Butterflies, 2012)

4. The ecology of the Brown Hairstreak

4.1. Ovum stage

Ova are laid at low densities over wide areas of countryside almost always on the bark of Blackthorn (Prunus spinosa) at the base of a spine or where one-year-old wood branches from two-year-old stem (Thomas & Lewington, 2010). Fresh growth is always favoured over old, verdigris-covered growth. Most ova are laid singly (87.8%) in a fork (82.0%) (Merckx & Berwaerts, 2010).

The study by Merckx & Berwaerts confirmed earlier observations by Thomas (1974) on the egg-laying preferences of female Brown Hairstreaks: most eggs are laid on young blackthorn less than 1.5m above ground in sheltered positions with a west or south-facing aspect. Merckx and Berwaerts also observed that hedgerows with scalloped borders contained significantly more eggs than those with straight borders.

These preferences are not altogether surprising. Brown Hairstreaks are ectothermic insects and rarely fly in air temperatures below about 20°C (Thomas & Lewington, 2010). Cooler temperatures on north-facing or exposed sites would therefore tend to be less favoured by egg-laying females than sheltered sites. Lower relative temperatures would also have a negative effect on larval development. Nor is the increase in egg numbers in scalloped hedgerows surprising: structurally heterogeneous landscape features typically provide better micro-habitat resources for feeding, mating or egg-laying than homogeneous, linear features.

Mated female Brown Hairstreaks are known to devote a considerable amount of time and energy to locating suitable host plants. They may disperse over several kilometres (Asher et al., 2001) and egg-laying itself may take several minutes (Thomas & Lewington, 2010). This behaviour imposes costs in terms of increased risk of predation, access to food resources and exposure to parasitoids. However, in evolutionary terms, it increases the prospect of reproductive success, or "fitness", through successful egg and larval development. Eggs are laid directly on the sole larval foodplant within a short distance of a leafbud. What is not properly understood is why females incur these costs in preference to ovipositing on apparently ideal blackthorn growth closer to mating sites (M. Oates, personal communication, 23 February 2012). Allelochemicals on the surface of P.spinosa are known to be tasted by receptors on the front legs of females and to play a role in host-site selection by butterflies generally (Garcia-Barros &
and Lewington (2010) comment, this is a rarely
Virgin females fly to the master tree
around Shipton

Source in

(Newland et

Dispersed population is solved by the use of a
Adults emerge in the morning and males

Mutualistic relationships

Incessantly for four

Formica

Protection from predation. Like many

The caterpillar becomes a mottled purple

4.3. Pupa stage

The eight-month hibernation reduces the food demands of the developing larva and is thought by de Vries et al., (2010) to be the result of selective pressure working against prolonged presence as a caterpillar. Once emerged, the larva immediately adopts a number of predator-avoidance strategies. It is monophagous (i.e. it eats only one kind of food) and its first action is to crawl into and commence feeding on an unfurling blackthorn leafbud. After a fortnight the caterpillar moults and spends two further instars hanging upside down from a silk pad spun on the under-surface of a leaf. The caterpillars are extremely well camouflaged and only emerge at dusk to browse on the tips of blackthorn leaves (Newland et al, 2010 and Thomas and Lewington, 2010).

Emerging too early in response to abiotic factors such as ambient temperature or day length risks starvation and reduced fitness. A study by de Vries et al. In 2010 concluded that budburst (and therefore larval food supply) typically preceded emergence by 7 to 9 days and that emergence was very well adapted to phenological shifts in budburst in warmer years.

Nevertheless, Thomas and Lewington (2010) note that up to 80% of caterpillars are found and predated by harvestmen (Opiliones), spiders and insects when small and by Willow Warblers (Phylloscopus trochilus), Blue Tits (Parus caeruleus) and other insectivorous birds when larger. Endoparasitoids such as Phobocampe quercus, an Ichneumonid wasp species, are also recorded as predate on Brown Hairstreak larva (Shaw et al., 2009).

4.4. Imago stage

Adults emerge in the morning and males generally appear a few days before females (Eeles, 2012). The problem of locating a mate in a dispersed population is solved by the use of a “master tree”. This is often a tall ash (Fraxinus excelsior) growing in a shallow basin within a colony. Males congregate on the tree canopy where they feed almost exclusively on aphid honeydew, occasionally descending to feed on Hemp Agrimony (Eupatorium cannabinum), Common Fleabane (Pulicaria dysenterica) or bramble (Rubus spp.) when honeydew is scarce (Newland et al., 2010 and Eeles, 2012). Local colonies can, however, exhibit local preferences. Hemp Agrimony is a highly favoured nectar source in the Noar Hill-Selborne Common area of Hampshire but Bramble and Creeping Thistle (Cirsium arvense) are most favoured around Shipton Bellinger. Adult Brown Hairstreaks in the Shipton Bellinger area can also be seen imbibing the juices of over-ripe blackberries and ripe Wayfaring (Viburnum lantana) berries (Dr A. Barker, personal communication, 10 November, 2012).

Virgin females fly to the master tree as soon as they emerge and mating occurs without any discernible courtship. However, as Thomas and Lewington (2010) comment, this is a rarely observed event. The females spend six to ten days in the canopy whilst their eggs are sunset in the morning and males return to the canopy in the evening to feed.
and Lewington (2010) comment, this is a rarely observed event. The females spend six to ten days in the canopy whilst their eggs develop before descending to search for suitable ovipositing sites. They only fly on the warmest days and are entirely diurnal, rarely seen before 10am or after 4pm. Long periods of site selection and egg-laying are punctuated by bouts of nectaring (Merckx & Berwaerts, 2010). Both sexes are oligophagous in this part of their life cycle feeding from a restricted range of food sources.

Thermoregulation plays an important role in the ecology of the species. This is done by micro-habitat site selection and by basking with wings held wide open 180° to the sun in weak sunshine. The tops of the wings are dusky and heat-absorbing. In hot weather, the upper-wings are held tightly closed. This exposes the shiny under-wings and white body hairs that reflect rather than absorb heat.

Figure 7: A male Brown Hairstreak. Note the white hairs on the body. (© Alan Thornbury, 2011).

5. Summary

The Brown Hairstreak occupies a range of habitat niches from cracks in the ground to tree canopies. It has a remarkable lifecycle and plays an important role in many food webs. It is, by any measure, a beautiful creature. It also, sadly, provides a further example of how much of the fauna and flora of lowland Britain today is struggling to survive in a modern agricultural landscape.

6. References

This article is based upon a wide range of primary and secondary sources, noted below. A fully attributed version is available from the author.


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