Behaviour of Purple Hairstreak butterflies in the canopy of oak trees at Sheringham Park, Norfolk

D E Newland

Introduction

Matthew Oates' paper "Mate-location strategies of the Purple Emperor butterfly" (Oates 2008) makes interesting and entertaining reading. One important conclusion is that Purple Emperors (*Apatura iris*) do not always, if ever, perch on the highest point in a woodland canopy. Instead they use gaps or "sacred groves" between the highest trees. Here there is shelter from the wind and here, perhaps, they are less conspicuous to flying predators.

Based on 23 hours of observations of Purple Hairstreak butterflies (*Neozephyrus (Quercusia) quercus*), made at canopy level over 4 days at Sheringham Park, Norfolk, I confirmed that this conclusion applies also to Purple Hairstreaks. However the mating strategies of the two species are essentially different.

Background

During the day, Purple Hairstreaks seldom stray far from the tops of oak trees. They only become active during the early evening when they can sometimes be seen performing aerial gymnastics in a foliage gap in the trees, if there is one. The photos in figs 1 and 2 show what one typically sees from the ground. They were taken at Brampton Wood, Cambridgeshire, on a fine, still evening on 16 July 2008. Activity built up between 5 and 8 pm BST, peaking about 7 pm, with butterflies making intermittent forays at high level within a sheltered gap between two oak trees. As is known, occasionally specimens are found at ground level and, at least once, a mass migration has been recorded (Holloway 1980). However close observation from the ground is virtually impossible and, of course, interaction between the sexes cannot be seen.

Therefore I decided to look in more detail at Sheringham Park, Norfolk. This is a well-maintained National Trust site which has a wooden gazebo set deep in its oak woods (for details, see Newland 2006). The gazebo, fig. 3, is high enough to look out over the tops of the trees, but near enough to have good views of insect activity in the surrounding canopy. I spent July 19 (4-7 pm, sunny, breezy), July 20 (10am – 1pm and 5-7 pm, intermittent sunshine, calm), July 22 (3-8 pm, intermittent sunshine, breezy), and July 25 (10 am – 8 pm, intermittent sunshine, calmer but still perceptible leaf movement in the canopy) at the top of the gazebo.

Figure 1 Canopy gap favoured by Purple Hairstreaks (one arrowed) at Brampton Wood, 7 pm, 16.08.08

Figure 2 Aerial activity occurred intermittently here throughout the early evening

Figure 3 View north from the gazebo in Sheringham Oak Wood

Figure 4 View downwards from the NE corner of the gazebo with Purple Hairstreaks' primary territory (arrowed)

Primary and secondary territories

The Oak Wood is a flourishing plantation of sessile oaks of varying height and structure. It is situated on a low hill, looking north towards the sea. The gazebo is at the highest SW corner of Oak Wood and is ringed by trees, mostly with canopy at gazebo height. There is, however, one tree on the NE corner of the gazebo which is about 4-5m lower than the rest of the trees, fig. 4, and another to the SW which is also below the main canopy height, but by 2-3m. During the day, most activity centered at the top of the lowest tree in the NE corner. This is a relatively poor, old tree with open foliage which has been outgrown by its more vigorous neighbours. On one day, with good weather, the SW tree canopy was also used, but less so.

These centres of activity would appear to correspond with what Oates has defined as primary and secondary territories (Oates 2008). For Purple Emperors, "primary territories

are the best territories, occupied daily, in suitable weather, by usually more than two males. … Typical territories are in sheltered high-point situations, where shelter from the prevailing winds is provided by tall trees upwind." In contrast, the majority of secondary territories "are occupied intermittently" and "many secondary territories are utilized only in certain weather conditions, or during the peak period of the season …". The low tree on the NE side of the gazebo fits as primary territory while the higher but still low tree on the SW side is secondary territory. Oates also introduced the evocative term "sacred grove" to describe a gap in the canopy where Purple Emperors can be seen. At Sheringham, the gap above the Purple Hairstreaks' primary territory NE of the gazebo is a sacred grove within the terms of this definition. That, and places like it, appears to be where Purple Hairstreaks spend most of their daylight hours.

Purple Hairstreaks' observed behaviour

At Sheringham, both sexes of Purple Hairstreaks, figs. 5 and 6, shared their primary territory and there appeared to be little interaction between individual butterflies of either sex or between sexes. With the exception of the evening activity described below, the

Figure 5 Female Purple Hairstreak's afternoon basking in primary territory

Figure 6 Male Purple Hairstreak perching with wings open at high level during its period of early evening activity

several butterflies in view in their primary territory (numbering six or more on occasion) appeared to spend the whole of the day in quiet contemplation of their surroundings. In what was essentially a gap between the highest oaks, they were either basking with wings open, or perching with wings closed, or drinking honey dew. They only moved occasionally from their positions, sometimes disappearing to somewhere else in the wood or sometimes just crawling to a nearby position within the same territory.

But, as evening approached, the situation changed. Males left their primary territory, and other male butterflies appeared, flying in at speed over the high canopy. These males then established perching positions higher than the levels of their primary and secondary territories, and on different trees, although still not on the topmost leaves of the highest trees. Females now appeared to be generally less conspicuous. I did not see many taking

high positions but some were on the wing in the general melee, both at the sacred grove and over the wider canopy. Male-female chases definitely took place and on one occasion led to mating within camera range of the gazebo.

This occurred at about 7 pm, was preceded by no obvious preliminary ritual, except a perfunctory face to face contact of antennae lasting about 10 seconds, figs. 7 and 8.

My observation point did not allow movements below canopy height to be monitored. On several occasions, I saw females which I believe were egg laying within the canopy of the lowest oak, but I was too far away to be certain. I did not see any butterflies descending to ground level, although I had been told by the Warden's staff that there had been one or two sightings in the preceding ten days on bramble bushes which grow at the edge of the Oak Wood. We know that Purple Hairstreaks lay at least a proportion of their eggs at low level (Thomas, 1975).

Figure 7 Purple Hairstreaks prepare to mate (male below) in evening sunshine, Sheringham, 22.08.08

Figure 8 Preliminaries lasted for only about 10 seconds before mating began, Sheringham, 22.08.08

Comment on mating strategies

Oates (2008) suggests three mating strategies for Purple Emperors. Two involve males searching for females, either by sallow searching or by patrolling woodland edges. One involves females searching for males by visiting the sacred groves.

In the case of Purple Hairstreaks, my observations, limited of course to only the four days described, suggest that males and females live together without interference in the same primary territory. For some reason, they only show interest in each other towards the end of the day. Then the new perching positions of males are essentially higher than before, although still within range of the observed primary and secondary territories. These positions were defended vigorously if challenged by another male or by any other insect. Meanwhile, it appeared that, although females continued to remain relatively sedentary, they did take to the wing from time to time. Then their mating strategy was different from

the three strategies identified for Purple Emperors, and may be more like the commonly-understood hill-topping strategy (see, for example, Dennis & Dennis, 2006). In Britain, this strategy, of males waiting at a hill-top summit for the arrival of females, has been observed for Painted Ladies (*Vanessa cardui*) and Red Admirals (*Vanessa atalanta*), and also, less so, for Whites (*Pieris*) and Walls (*Lasiommata megera*). The supposition is that hill-topping facilitates mating when butterfly populations occur at low density.

Some time ago, I had an interesting correspondence with Torben Larsen about hill-topping in Africa. He described how what was essentially a large mound in the Kalahari desert attracted virtually all the butterflies in the area as males vied for top of the pile and females jostled to meet the "top male" who must be strong and thus genetically fit. Dr. Larsen said that "a hilltop may be no more than 10 metres above the flat, dry savannah – that's sufficient." (Larsen 2005, 2006).

Could this same mating strategy apply to Purple Hairstreaks? Could the evening flights of females wishing to mate be for the purpose of searching for "top males" identified from the height of their perching positions? In other words could there be an element of "hill-topping" in the mating strategy of Purple Hairstreaks?

It is curious that, for the tree canopy in sight from Sheringham's gazebo, male Purple Hairstreaks never selected evening perches at the very top of the canopy. This may have been due to the effect of wind turbulence (although conditions on 20 July became quite still as the evening progressed) or due to concern about aerial predators, or it may be for some other, unknown reason. More evidence needs to be collected.

Conclusion

The gazebo at Sheringham Park has the huge advantage that Purple Hairstreaks can be seen at close range. Because of the structure of Oak Wood, their primary territory near the gazebo cannot be seen from the ground. Also, because there is no canopy gap visible from the ground, the butterflies' evening activity close to the gazebo cannot be seen from the ground. I found that many visitors who climbed the gazebo did not, at first, notice the Purple Hairstreaks, even during their period of evening activity. However, when their presence was pointed out, most people took great pleasure from seeing these tiny butterflies in their tree-top home.

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David Newland is a retired professor of engineering with a lifetime interest in butterflies. He is the author of *Discover Butterflies in Britain* (WildGuides, 2006).