In search of the Hornet Moth - *Sesia apiformis*

by Pete Smith

One of the positive things to come out of the Coronavirus lockdown during spring 2020 was the opportunity to spend much more time than usual exploring the local footpaths, backroads and country lanes around the village of Heighington, where I have lived for 23 years. On a daily basis my wife and I took many long walks, with the dog in tow, and were amazed at just how much wildlife we had right on our doorstep. We thoroughly enjoyed watching the changing flora along the roadside verges as it developed over the days and weeks of glorious weather during April and May, and we began to identify more of the flowering plants that occur in the neighbourhood. Seeing Small Tortoiseshells egg-laying, then watching their young larvae developing, and enjoying Orange Tips, Speckled Woods and Holly Blues appearing on the wing, along with observing Yellowhammers, Skylarks and other wildlife became the new normal. The pace of life slowed down. Nature was everywhere!

One morning in early June our morning meander took us on a different route, and brought us out onto a footpath running by a long line of mature Poplars on a field boundary. This got my entomological nerve twitching straight away (it doesn't take much!) and I began to look closely at the base of the trunks of these huge trees in search of "exit holes". The habitat looked ideal for the Hornet Moth, whose larvae feed low down underneath the bark of the tree, and whose pupae push their way out of the bark as the moths emerge, leaving the tell-tale holes. I soon found a number of promising looking signs, but having never seen this species before, I needed to do a bit more research to confirm that what I was seeing was likely to be the result of this moth, which is by no means common in Lincolnshire.

A bit of reading and googling confirmed that the holes I had found did indeed look perfect for this species. But were they recent? Or were they decades old? Was the Hornet Moth really breeding right on the edge of my village? And if so, did I stand a chance of seeing this handsome insect in the flesh? A major project was breaking out here, and I began a comprehensive study of this site, which would run for several weeks during June and July. The story unfolds below:

The Study Site

The study site is situated just to the West of the village of Heighington, and comprises a long line of mature Poplars, just over 400 metres in length. Just under half of the line runs from East to West, with the remainder running North-east to South-west. Whilst some of the trunk bases are covered in climbing Ivy, or obscured by Bramble growth, many of the trunks are bare and therefore easily accessible. Every 2nd or 3rd day during June, our morning dog walk would now follow the Poplar route, and I would spend about an hour each day searching the trunks for freshly emerged moths. But all that I was finding were old

exit holes. This was strong evidence that the species had been here previously, but what I really needed to find was either a moth, or failing that, an empty pupal case, or *exuvia*. When the moths emerge, they leave behind the pupal case, which hangs part way out of the exit hole for a while, before it is either pecked off or weathered away. If I could just find an exuvia, this would be evidence that Hornet Moth was actually still present at this site. Needless to say, finding one now became the new search for the holy grail!

The study site – a line of Poplars to the west of Heighington – with Lincoln Cathedral visible in the distance through the gap in the tree line.

June came and went, and I was still no closer to finding definitive proof that *Sesia apiformis* was here. But I was finding plenty of exit holes, and I also found another line of Poplars to the East of the village. This line was shorter, but three of the trees also showed multiple exit holes. Was this another potential colony?

Exit holes at the base of a Poplar

The lack of absolute proof was beginning to weigh heavily on me, but I kept telling myself that the potential flight period extended well into July and that maybe the moths hadn't starting emerging yet this year.

The 8th of July was to bring a big and exciting discovery. Lockdown restrictions had been eased further, and for the first time in months my excellent friend and fellow enthusiast Bob Lambert was able to come across from Liverpool for a long-overdue visit. We had spent the previous night catching up over several bottles of fine red wine. Early on the morning of the 8th, we headed off to the study site in poor weather, and had a good look at the Poplars. I was very keen to have Bob's opinion and input. After casing out the whole length of trees, we had found nothing but exit holes. Just before we left the site, Bob went close up to the third from last trunk for a final look, and remarkably found a pupal case protruding from the trunk! Here was absolute proof that at least one Hornet Moth had emerged very recently!

Proof of recent eclosion of Sesia apiformis – a fresh exuvia

This only served to re-invigorate my enthusiasm for finding a freshly emerged adult moth, but the next two days were cold, damp and cloudy, and despite further searching, nothing else was found. On Saturday 11th, the early morning dawned bright, sunny, and significantly warmer than recent days. I had a good feeling, and was so keen to set off in search that I left wife and dog at home to finish breakfast by themselves, with a departing shout of "see you later at the Poplars!" as I exited the house. I checked each and every

Poplar trunk as I moved along the line, getting the usual occasional strange looks from passers-by (water off a duck's back!), as the morning wore on. At exactly 9:55am, on the 44th trunk along, I finally got my "Eureka!" moment; a freshly emerged female Hornet Moth, so fresh that she still had her wings held above her body as they were still drying off.

Female Hornet Moth – Sesia apiformis

After about ten minutes she let her wings down into the more typical flat resting position of the clearwing moths.

A quarter of an hour later, Vicki (wife) and Jaz (dog) caught up with a very happy man, down in the undergrowth, with his first ever Hornet Moth!

It was difficult to leave the moth behind, but we eventually did so. However, three hours later I went back to have another look, as I had a strong hunch that she would get

paired up pretty quickly. The females release pheromones to attract a male, and I figured there was a good chance that a return visit might find more than one moth. My hunch paid off. The female hadn't moved an inch, and the icing on the cake of weeks of searching was there before me. A mating pair!

Mating pair of Sesia apiformis – the male on the left is smaller and has three narrow black rings to the posterior of the central abdominal black saddle, whereas the female has only two such rings, and a much fatter abdomen

It was well worth all of the nettle stings, barbed wire fence wounds, back-ache and soggy footwear of the past weeks to end up with this fabulous sighting!

Study site data

A total of **86** mature Poplar trunks were examined regularly during the course of this study. 3 young Poplars and 4 mature Poplars were excluded from the study due to inaccessibility.

Individual exit holes were assigned to North, East, South or West quadrants of the trunks.

The height above ground of each exit hole was assessed and assigned to one of four categories – less than 0.5M, 0.5 to 1.0M, 1 to 1.5M, or greater than 1.5M.

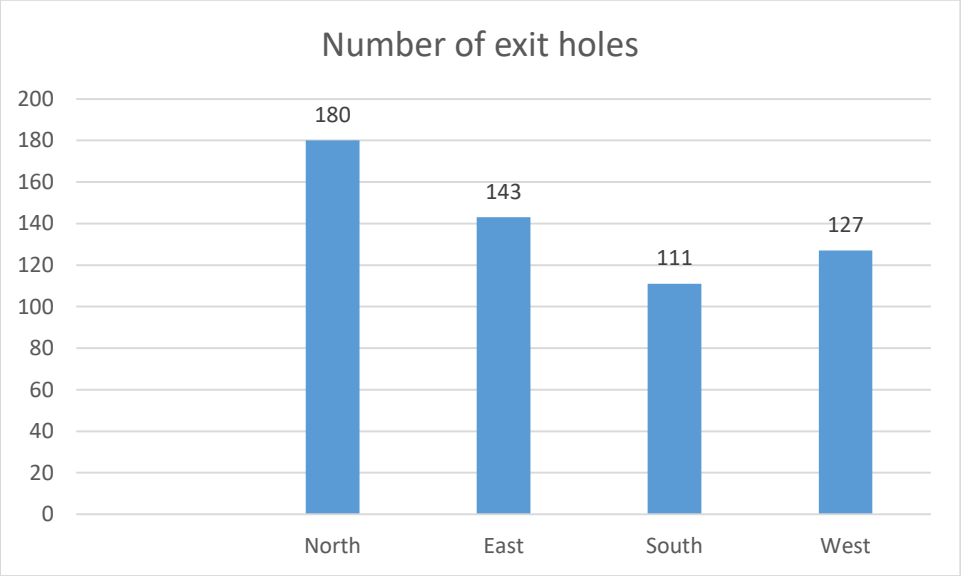
Each trunk was assessed for % vegetative cover up to 1.5 metres in height, with estimates made to the nearest 10% interval from 0 to 100% cover. The results are summarized below, along with some comments and tentative conclusions:

Total number of exit holes

A total of **561** exit holes were found during the searches. These were located on **65** of the 86 Poplar trunks, with 21 trunks showing no evidence of being occupied.
Of the trunks with exit holes present, the average number of holes was **8.9** per trunk. The lowest count on a single trunk was **1**, with the highest count being **26**.

Orientation of exit holes

Somewhat surprisingly, the North-facing quadrants of the trunks produced the highest count of exit holes, with the South-facing quadrants having the lowest count:



Vegetative cover on trunks up to 1.5M height

51% (44 out of 86) of the trunks had no vegetation covering them at all. These will be referred to as “bare trunks” in the discussion section. Of the 42 trunks that did have vegetative cover, the average estimated cover per trunk was **52.5%,** with a range of 10% to 100%. **15** of these 42 trunks had cover estimated at 80% or above, whilst **12** had cover estimated at 20% or less.

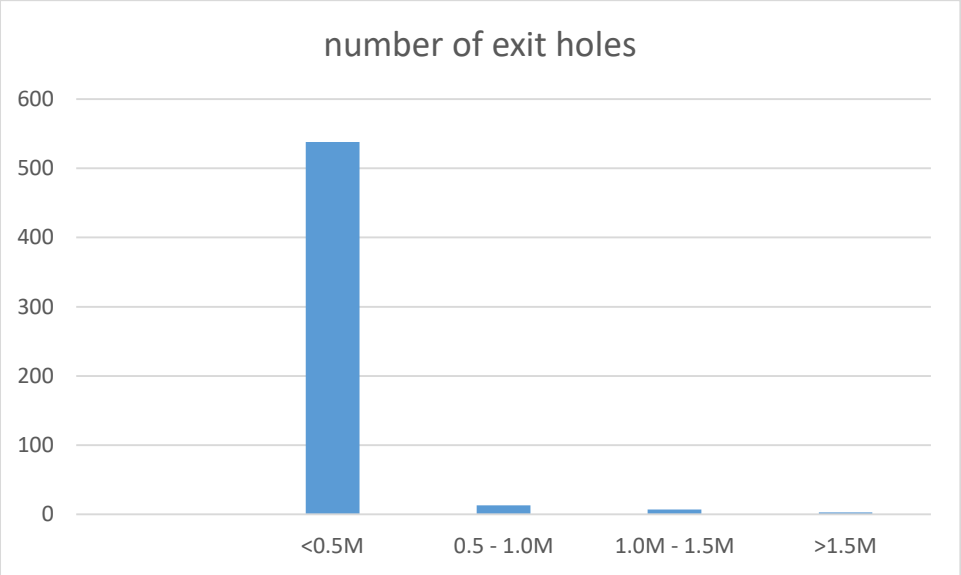
The cover on the majority of the individual trunks was usually of one type per tree, with Ivy being by far the commonest species.

The number of trunks and their respective cover type is shown below:

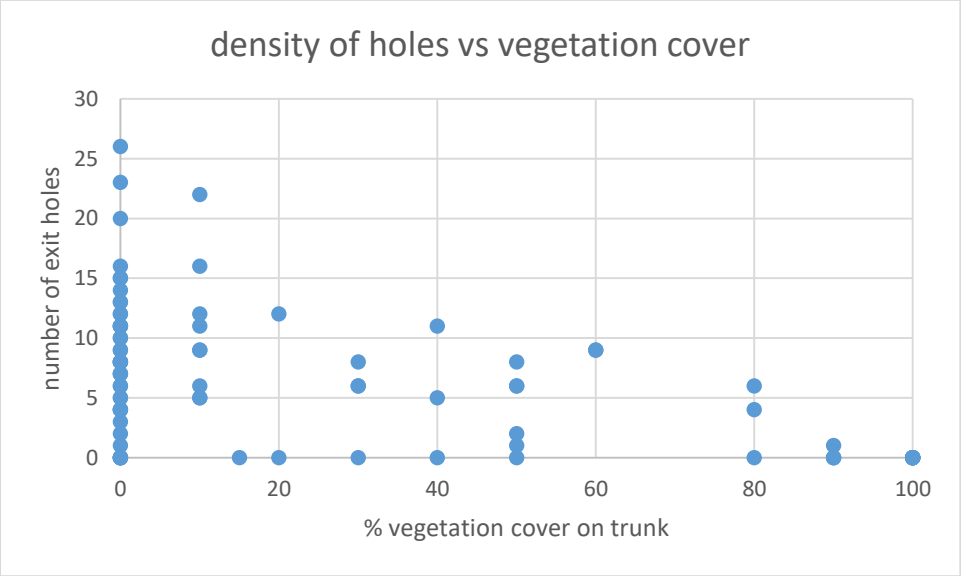
Ivy – **29** trunks
Mixed scrub – **5** trunks
Bramble – **4** trunks
Hawthorn – **3** trunks
Snowberry – **1** trunk

Exit hole height above ground

There was a very strong bias in distribution of exit hole height, with **96%** of holes falling into the "less than 0.5M" category. Even within this category, the majority of holes were very close to ground level. Only **3** holes were located above 1.5M.



Relationship between vegetation cover and density of exit holes



Additional findings

A total of 2 exuvia were found during the searches. A single freshly emerged female adult was found, which later attracted a mate. The details are as follows:

Exuvia 1 – located 08/07/2020 on SE of trunk at height of 15cm. The trunk had 10% Ivy cover, and held a total of 22 exit holes (5 North quadrant, 4 East, 7 South, 6 West).

Exuvia 2 – located 11/07/2020 on E of trunk at height of 6cm. The trunk was bare, and held a total of 5 exit holes (all East quadrant)

Adult female – located 09:55 11/07/2020 on E of trunk at height of 20cm. East side of trunk was heavily covered in Ivy, which the female was resting on. The trunk had 40% Ivy cover and held a total of 5 exit holes (2 North quadrant, 3 West). Same female was found *in cop* at 12:55 on the same day in exactly the same location.

Discussion

The study site is an extensive linear habitat for the Hornet Moth, and these observations show that many hundreds of moths have emerged from the trunks of the Poplars here. What is unclear is the timescale over which this has occurred. The exit holes may be relatively recent, or they may span decades. Historical distribution maps suggest that this species is largely absent from Lincolnshire, but this may well be due to under-recording, and in recent years more sightings have been made, aided by the use of pheromone lures. Alternatively, the species may be a relatively recent coloniser, having spread from its strongholds in the South and East of England.

A detailed study of this species was undertaken in Cambridge in 2013.[1] It was based on a single Poplar tree and a much smaller sample size, but went into a great deal more detail regarding the behaviour of the emerged moths, and the numbers and phenology of the small colony, as well as the habits of the larvae, and suggested eclosion methods of the pupae. Some of the findings are similar to my own, whilst some differ considerably.

In the literature[2] it is stated that favoured trees are those with "*little vegetation around the base so that the sun warms the trunks*". The scatterplot above appears to confirm this, with a reasonable negative correlation between vegetation cover and number of exit holes (i.e. the more cover, the less exit holes). However, a trunk covered with vegetation is by its very nature a trunk where exit holes will be much harder to detect, unless the vegetation is removed. This will inevitably bias the data into producing the observed correlation. Also, if the warmth of the sun on the trunks is an important factor, why were the largest number of exit holes to be found on the North quadrant of the trunks? It is also noteworthy that 6 bare trunks had not a single exit hole. And notably, the freshly emerged female was found on a large patch of Ivy on the East side of a tree. No exuvia or exit hole was found on this side of

the tree or indeed anywhere near the emerged female, suggesting that she had probably hatched from below the Ivy cover.

The Cambridge study in 2013 followed the fortunes of 7 male and 3 female Hornet Moths, which emerged between 24th June and 3rd July, with one of the authors noting that this was a particularly late emergence, and that the second week in June was more normal for that particular site. With Heighington being almost exactly 1° further North in latitude than Cambridge, an average emergence time of maybe 7 to 10 days later might be expected, which would correlate with the observed adults here being seen on 11th July, and this being a relatively late year for this species.
At Cambridge, 3 of the 10 exit holes fell into the >1.5M height category, whilst 5 fell into the less than 0.5M category. This gives a much higher average emergence height than in my study, but this may be due to the small sample size of the Cambridge data, or other local factors.
9 of the Cambridge moths emerged from the Eastern side of the tree, and 1 from the North, again differing in distribution from my data here, but with the same caveat as above regarding sample size etc.

Conclusions

This has been a fascinating project, a steep learning curve, culminating in the sheer delight of seeing a new and stunning species after putting in weeks of work! As is often the case, this study raises as many questions as it provides answers. I am particularly interested in just how big the colony really is. How many moths emerge here per year? How many other colonies are lurking out there waiting to be found? Lines of Poplars are after all, frequently found as windbreaks in this part of Lincolnshire.
I hope to pursue this further in the future, focusing more on the adult moths, and probably with the use of a pheromone lure to assist. It also occurs to me that searching for mating pairs slightly later in the day might be a good way forward. The moths are said to emerge between 7 and 11 am, and results from the Cambridge study suggests that pairs stay coupled for about 3 hours. The female calls for a mate using pheromones and is usually paired quickly, so searching around midday could be a good strategy for future searches. There is a good reason why so many photographs of this species are of mating pairs!

References

1 2014, Entomologist's Gazette **65**: 217-230. Eclosion mechanics, mating and ovipositing behaviour of Sesia apiformis. D.E.Newland. T.J.Sawyer.

2 Paul Waring and Martin Townsend. Field Guide to the Moths of Great Britain and Ireland (2003). British Wildlife Publishing.