

Asian Hornet Analysis

Maureen Wakefield and **Eleanor Jones**, Fera Science Ltd, describe analysis of nests and individuals from United Kingdom (UK) incursions using visual and genetic techniques

Asian hornet, also known as the yellow-legged hornet (*Vespa velutina nigrithorax*), is an invasive species that originates from Asia. In spring, a nest is founded by a single queen which emerged and mated the previous autumn. The queen creates a primary nest and starts to lay eggs which develop into workers. As the size of the colony increases, a secondary nest is formed. This can be at the same site as the primary nest, or at a different location. The size of the colony will increase during the summer months and, in the autumn, the queen will start to lay eggs that will develop into drones and new queens. These new sexual stages will leave the nest and, after mating, the males will die. The newly mated queens will overwinter and the cycle repeats.

Nests can reach up to one metre in length and, over the course of the year,

approximately 6000 individuals can be produced in the nest.

Vespa velutina nigrithorax was identified in France, in 2004, and has subsequently spread throughout much of France and to neighbouring countries, including Spain, Portugal, Belgium and Italy. The hornet feeds on a mixture of invertebrates, but one of the primary food sources is honey bees. Predation by the hornet can result in colony losses and in France it has been estimated that this can range from five to 50 per cent, depending on the pressure from the hornets.

In the United Kingdom (UK), we have been aware of the threat that this species poses for some time and have undertaken risk analysis to examine likely pathways by which this species could enter the UK, the likelihood that this species could establish and spread in the UK, and the effectiveness of control

measures that can be used to treat nests once found.

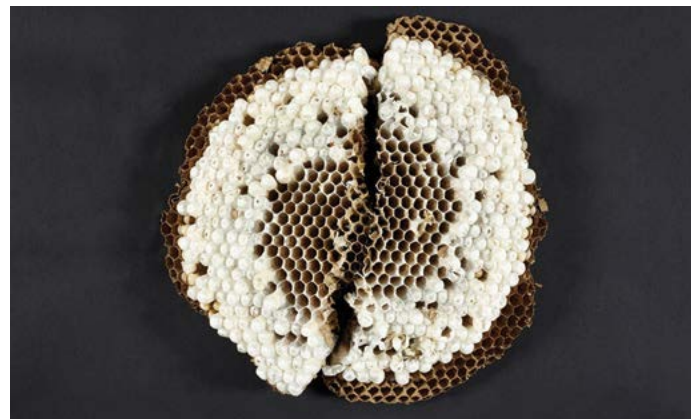
In 2016, the first Asian hornet nest was found in the UK, near Tetbury. A beekeeper reported a sighting of the hornet at an apiary. Once the identity of the insect was confirmed, a contingency response was initiated and the Animal and Plant Health Agency (APHA) immediately deployed trained staff to the area to find and destroy the nest. The nest was found and treated on 29 September 2017.

Subsequently, the nest was sent to Fera Science Ltd to undertake a detailed study of the nest and the individuals that it contained. This was important to establish whether the nest had started to produce drones and new queens, and also to study the likely source of the individuals (whether from Europe or Asia) to assist in examining likely pathways for any future incursions.

Asian hornet nest found in September 2016 on arrival at Fera



A comb from the nest. Adults had emerged from cells in the centre





The difference in size between an Asian hornet queen (above) and worker (below)

The nest was approximately 35 cm in diameter and was found to contain five combs ranging in diameter from 7.5 to 23 cm. All life stages of the hornet (eggs, larvae, pupae and adults) were found in the nest. In total, across the five combs, there were 2,359 cells. Based on the diameter of the largest comb and using a formula described in Rome et al (2015), the total number of hornets produced by the nest was approximately 2,889.

Visual Study

Workers and drones can be distinguished visually by their genitalia and this feature was used to determine whether any drones were present in the nest. It was found that some of the individuals present in the nest were male.

It is not possible to distinguish workers and new queens by visual examination, but studies in France have looked at the dry and wet weights of 2,744 females to determine whether workers and founder queens can be distinguished by their mass (Rome et al, 2015). The female insects present in the nest had a wet weight ranging from 202–322 mg. This was below the threshold wet weight of 593 mg identified by Rome et al (2015) to distinguish workers and founder queens and, therefore, it was concluded that it was unlikely that any of the individuals present in the nest were founder queens.

Genetic Study

To add to the evidence from the visual examination of the nest and the individuals contained within it, a genetic

study of the individuals was also carried out. The genetic markers used were microsatellite markers, which are highly variable markers suitable for looking at how individuals (and potentially populations) are related that are also able to tell the difference between individuals with one copy of each chromosome (haploid) or two copies of each chromosome (diploid). Like the honey bee, Asian hornet workers and queens are both diploid and drones are haploid. Based on the results from the genetic study, it was concluded that:

- the Asian hornets from the nest found in the UK originated from a continental European population rather than an Asian population
- although males were identified in the nest based on visual characteristics, the genetic techniques showed that these were diploid males and therefore likely to be sterile. This has been observed in French populations and suggests a high degree of inbreeding
- a number of haploid eggs were found, indicating that the nest had just started the development of drones.

Further information on this study can be found in Budge et al (2017).

Second Nest

In September 2017, another confirmed sighting of an Asian hornet in Devon initiated a contingency response resulting in the identification and destruction of a second Asian hornet nest in the UK. This nest was located near Woolacombe,

Devon, and researchers at Fera again had the opportunity to study the nest and individuals, both visually and using genetic techniques. This second nest was larger than the nest found in 2016 and contained seven combs ranging in diameter from 12 to 27 cm. All life stages of the Asian hornet were present in the nest and all adults present in the nest were female. The wet weight was used to discriminate between workers and founder queens. Based on the results it was concluded that none of the females found in the nest were likely to be founder queens. This conclusion was also supported by the results from the genetic studies. Again, drones were found at the early life stages, indicating that the nest had once more just started developing drones. This nest also derived from the continental European population rather than being the result of a new colonisation from Asia.

In Conclusion

Examination of the nests and individuals has added to our knowledge of this species and aided the successful control efforts to prevent its establishment in the UK.

If you suspect that you have seen an Asian hornet, please report your sighting using the 'Asian Hornet Watch' app available for Android and iOS. This app uses GPS (global positioning system), allowing you to submit the exact location of the sighting. This enables any confirmed sightings to be followed up quickly. Alternatively, you can submit information including where you saw the sighting, your name, contact details and, if possible, an image by email to: alertnonnative@ceh.ac.uk Finally, you can also use an online recording form which can be found at: www.brc.ac.uk/risc/alert.php?species=asian_hornet □

References

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