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*Suggested Personal & Professional Development (PPD)



BEES

Small hive beetles – a modern threat to the UK honeybee

The UK honeybee is under threat. Whilst the issues surrounding 'colony collapse disorder' – which causes the death of all bees in a hive – are still being investigated and may not even exist, an old and well-recognised problem of honeybees could infest the UK today and cause devastation. The culprit is the small hive beetle (*Aethina tumida*); which has been made notifiable within the European Community (Commission Decision 2003/881/EC) and all veterinary surgeons should be aware of its significance.

Aethina tumida is a problem that all veterinary surgeons must recognise, as it has re-entered the European Union via the 'boot' of Italy, around the Calabria region, and in Sicily in 2014 (Figure 1). This infestation has caused significant economic damage to the once-thriving honeybee industry of this region because bees and hive products – including honey, propolis, bee medical products and queens – cannot now be moved to other areas of the European Union (EU).

The EU has successfully dealt with this problem before, when it was found in Portugal in 2004 and eliminated. But elimination can only be effective when identification of the problem is swift. In contrast to the 2004 outbreak, the Italian incursion has proved very difficult to remove over the period of the last three years.

Small hive beetle (SHB)

Infestation with *Aethina tumida* is a notifiable condition in the UK and many parts of the world. However, during the past 20 years, the beetle has managed to spread out of its native sub-Saharan African territory to become a threat on a global scale on all continents, including Australia, despite fastidious regulations and biosecurity arrangements (Figure 2).

As the honeybee colony maintains the ambient temperature of its hive at 36°C, the small hive beetle

has been able to overcome most environmental constraints that would normally restrain an equatorial pest. Using the hive, the small hive beetle is able to overcome a wide range of adverse weather conditions – from the cold Canadian winter to the wet Philippine seasons – as an unwelcome 'guest' of its honeybee hosts. The temperate UK climate offers no particular challenge to its survival.

How can the bee keeper recognise the presence of *Aethina tumida*?

The hive and bees may offer few obvious clinical signs and the diagnosis can be difficult, especially when there is only a small number of beetles present. However, the most obvious indication is seeing a quickly moving, small beetle as soon as the crown board is removed. The same may happen when the 'super' or brood box is removed, because small hive beetles will rapidly run away from the light (Figures 3a & 3b).

If honeybees spot a SHB, they will generally react and fight for a couple of seconds, before the beetle scuttles away. In the normal 'darkness' of the hive, it is possible that, perhaps, the bees ignore them.

A small hive beetle is brown (young) to black (adult) in colour, 5 to 7mm in length and 3 to 4.5mm wide – making it approximately a third of the size of a worker honeybee (Figure 4).

The easiest way to catch a small hive beetle is by using a small damp paint brush (Figure 5). The beetle can be caught on



Figure 1. The extent of small hive beetle infestation in the Calabria region of Italy.

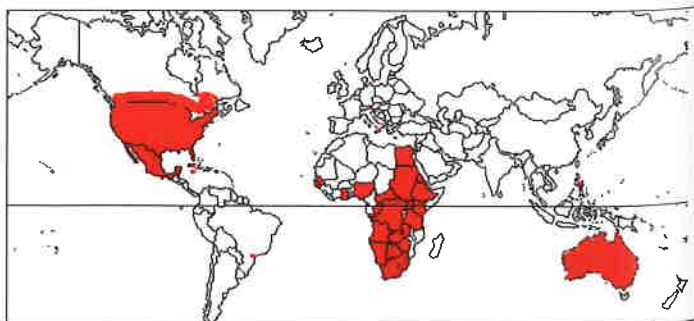
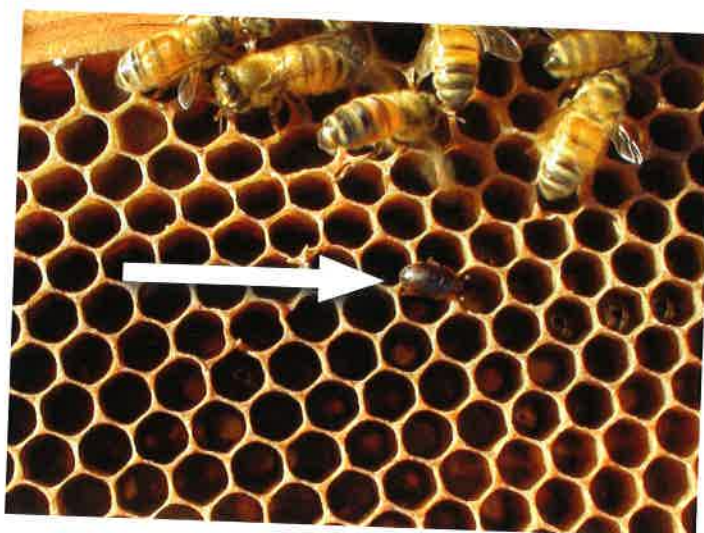


Figure 2. Infestation of *Aethina tumida* on a global scale (OIE, 2017). Positive areas are indicated in red.



Beetle running across the frame away from the light (right arrowed).



Beetle after emerging from the pupal



Figure 5. Small hive beetle on the end of a small damp paint brush.



Figure 6. When looking at the beetle, note the clubs on the end of the antennae.

rapidly cleaned up – in minutes – by the worker bees.

When a hive, infested with SHB, is opened, there may be a smell of 'rotten oranges' owing to fermented honey. Any unusual odour from the hive must make the bee keeper very suspicious that there is a health issue with the hive. In the case of SHB, as the infestation progresses, fermented honey may even be seen dripping from the hive entrance and slime traces around the entrance made by SHB larva leaving to pupate may be observed.

The bees' response to this infestation may be to abscond – thus, inadvertently, moving some adult SHB with them – or the colony will collapse.

A vital differentiation between SHB and another important insect pest, the wax moth, is that the latter create dry 'webbing' compared to the wet slime associated with the small hive beetle.

How can the veterinary surgeon recognise the presence of *Aethina tumida*?

A client has brought in a sample bottle containing a small beetle found running around their hive – or possibly an unusual larva he or she has found in the hive or in the hive debris! What is it?

First, put the specimen bottle in a fridge to anaesthetise the beetle/larva. It must not be allowed to escape from the veterinary premises. If there is any suspicion regarding the specimen, place it in 10

per cent neutral buffered formalin and report to the local government office or bee inspector. Do not send live specimens through the post.

On close examination by means of a magnifying glass or a dissecting microscope, the adult beetle's characteristic club-shaped antennae can be readily visualised (**Figure 6**). In a defensive position, the antennae and legs are generally tucked under the carapace but can be easily teased out, especially in anaesthetised or dead specimens.

The larva of the SHB can be identified by the dorsal spines and three pairs of strong forelegs. The adult beetle may be confused with similar species, most notably *Cychramus luteus*. Note,



Figure 7. The larva of the SHB can be identified by the dorsal spines and three strong forelegs.

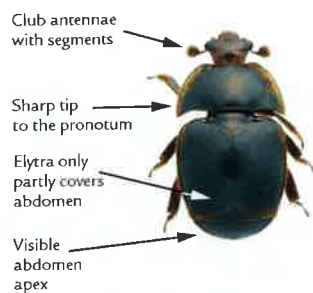


Figure 8. Detail of the adult small hive beetle (*Aethina tumida*). The elytra is the harden forewing used to protect the flying hindwings in some insects (notably beetles). [Photo: Crown Copyright]

however, that with the latter, the elytra covers the whole of the abdomen (**Figures 7 & 8**).

Once the suspicion has been notified, the presence of *Aethina tumida* is confirmed using a PCR test of beetles and larvae.

Biosecurity considerations

Unfortunately, there are a number of routes whereby SHB infestation could reach the UK. Even the Australians, who are renowned for their stringent biosecurity measures, still succumbed.

Possible routes of introduction include:

- honeybee movement
 - queens and their accompanying workers
- feral bee populations – not all honeybees choose to live in our hives
- alternative hosts – bumble bees and stingless bees (non-native)
- bee products – wax and honey
- bee-keeping equipment – clothing, tools, especially hive tools
- soil containing SHB pupae
- fruit – although uncommon, the SHB can lay eggs on a wide variety of fruit
- transport with freight or in the vehicles themselves.

Life cycle and eradication

In order to implement an effective control and to understand any eradication

programme, the veterinary surgeon must be familiar with the biology and life cycle of *Aethina tumida*.

The eggs are laid in the hive and hatch in three to six days. Larval development takes eight to 29 days depending on the environment. Larvae leave the hive and pupate in the soil for two to 12 weeks, again depending on the environment.

Larvae leave the hive and enter the 'wandering phase', during which time they may migrate 200m away from the hive (although normally within 20m), before burrowing to a depth of up to 20cm into the soil, where they pupate for two to 12 weeks, depending on the environment. Sometimes leaving the hive occurs as a mass migration, and this

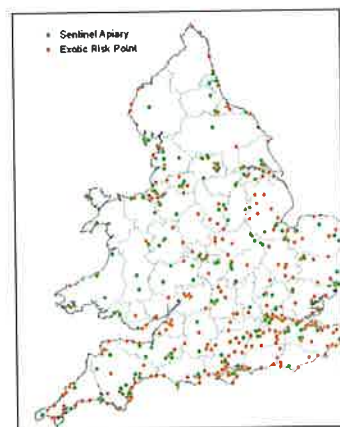


Figure 9. The whereabouts of sentinel hives in England and Wales (APHA).

"... the most obvious indication is seeing a quickly moving, small beetle as soon as the crown board is removed"

wandering behaviour results in a potential volume of over 25,000m² of soil per hive to be sterilised during a clean-up operation.

Once the adult emerges from the soil, it will take flight looking for a hive to infest. Generally, the adult beetles will fly away from their emergence point and will often ignore local hives. Their dispersal zone is around 10 kilometres but can be 16 kilometres. This represents an area of over 800km² – which, interestingly, is very similar to the zone of spread for a swarm of honeybees.

The adult beetle appears to be attracted to new hives through their odour. When a hive swarms, the adult hive beetles may be seen following the swarm in their own cluster. Once in a hive, some adult beetles will leave it around dusk seeking another hive to infest.

The adult female beetle lives for about six months and will produce 1,000 to 2,000 eggs in her lifetime.

If an infestation were to be confirmed in the UK, there would be a 100km surveillance zone. In theory, this means

that with two infestations, the width of the UK could be covered! There is an active surveillance programme already in place looking for the first signs of any infestation with SHB or other bee pests. This consists of 120 sentinel hives, most notably distributed around the coasts and near international ports (**Figures 9 & 10**). A kind of bee 'Home Guard'!

It cannot be emphasised enough that to maximise our chance of removing a SHB infestation from the UK, it must be recognised rapidly by both the veterinary and bee professionals.

Management and control today to reduce the risk of incursion

The veterinary profession must encourage bee keepers to practise enhanced biosecurity that involves:

- not sharing equipment between apiaries, especially hive tools
- storing supers in an environmentally controlled room with a relative humidity below 50 per cent
- storing empty combs with moth crystals (paradichlorobenzene)



Figure 10. A sentinel hive at a port in Australia.

- freezing (-20°C) combs overnight to kill the beetle
- fumigating the stored combs with 70 per cent ethanol (e.g. methylated spirits)
- keeping the super storage area clean
- selecting for hygienic behaviour in the queen bees.

A longer term control programme is to select and purchase queens for hygienic behaviour. This is becoming increasingly popular as a means of controlling the Varroa mite (Hill, 2017). The same hygienic behaviour would offer the hive more 'skills' to control an infestation with SHB.

Zoonotic implications

Kodamaea ohmeri is a yeast that is carried by the small hive beetle larva in Australia. This yeast may contaminate the honey resulting in fermentation. This yeast can be a problem in immunocompromised humans. ■

Postscript note

There are other hive beetles. Some are not a problem, but one to consider is the hive chafer or large hive beetle (*Hoplostomus fuliginosus* and *H. haroldii*) also from sub-Saharan Africa. Other common insects/arthropods may also be seen incidentally in the hive, including woodlice, earwigs and spiders.

The large hive beetles have very hard carapaces presumably to withstand any stinging action by the worker bees. They consume a great deal of honey and can contribute to a weakened hive's collapse. Outside the hive the beetle is attacked by

a large number of workers, yet inside the hive, appears to be unmolested.

These beetles are often seen just under the crown board and may emit a sound or chemical to disguise themselves within the hive. Once the workers can see the beetles they attack en masse (Figure 11 & 12).

If any of these beetles were found outside Africa, they would also constitute a notifiable condition. Biosecurity at ports and when purchasing queens from abroad is the key to controlling their introduction.



Figure 11. A large hive beetle inside a hive.



Figure 12. A large hive beetle under attack outside the hive.

PPD Questions

- Select the best answer from the options below. The small hive beetle:
 - has abdomen visible beyond the wing coverings
 - has clubbed antennae
 - is one third the size of a honeybee
 - has dorsal spines in the larval phase
 - has all of the above
 - has none of the above.
- Where is the native home of the small hive beetle?
- During the 'wandering phase', how far may the mature larvae move away from the hive?
- The small hive beetle is found on which continents?
- The cold, damp climate of the UK is likely to prevent the SHB from spreading. True or false?

Further reading

British Bee Veterinary Association (BBVA), website: <http://britishbeevets.com>

BeeBase Small Hive Beetle, www.nationalbeeunit.com/index.cfm?pageid=125

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OIE website, www.oie.int/wahis_2/public/wahid.php/Diseaseinformation/Diseaseoutbreakmaps

Plant Health Australia (2016). *Biosecurity Manual for Beekeepers.* ISBN 978-0-9872309-2-8

Ritter W (2014). *Bee health and veterinarians.* OIE World Organisation for Animal Health. pp149-156. ISBN 978-92-9044-923-2

Vidal-Naquet N (2016). *Honeybee Veterinary Medicine: Apis mellifera L.* 5M publications. ISBN 978-1-91945-504-3 Section 7 pp177-182.

Answers

1. E. all of the above
2. sub-Saharan Africa
3. up to 200m but normally around 20m
4. the SHB is now present in Europe, Africa, Asia, Australia, and North and South America.
5. false, unfortunately SHB will not be deterred by the UK weather and, if introduced, could easily spread throughout the British Isles.