

ENEMIES ON THE WING

*They are both unwelcome guests in the beehive: the hornet species *Vespa velutina* and the Small Hive Beetle (*Aethina tumida*). They have traveled west and north from Asia and Africa and are now threatening honey bees in Europe and America. Researchers at Bayer are looking for effective solutions against these dangerous insects.*

So far, the sticky cage has kept the predatory hive beetle in check. The invader is held in a sturdy prison that African honey bees build out of propolis, a resinous mixture that they gather themselves. They even posted a guard to watch over the enemy. That is how these honey bees defend themselves against the voracious beetles, which are originally from Sub-Saharan Africa. However, since 1998 they have unfortunately spread to the USA, Canada, Mexico, Jamaica, Australia and Cuba, where they have proved to be a very serious pest of Western honey bees. In 2004, the beetle was intercepted and eradicated in Portugal in a consignment of queen bees from Texas. Now the Small Hive Beetle has also reached Italy.



The Small Hive Beetle mingles with the honey bees. The larvae of this African pest eats honey, wax and pollen and destroys the structure of the comb.

African honey bees know how to deal with this beetle: “Compared to their European relatives, they discover infested brood cells more quickly and clean their hive more thoroughly before they swarm,” explains Peter Trodtfeld, beekeeper and Bee Health Expert in the Bayer Bee Care Center. But the beetles have also become smarter: They imitate the behavior of begging bees to obtain food stealthily and can survive for up to two months in their prison. “Fortunately, under these conditions they cannot reproduce or mate,” explains Trodtfeld. “African honey bees can therefore better control the risk to the colony posed by the hive beetle, which measures just five millimeters,” says the bee expert.

Once a beetle has made its way into the hive, it lays its eggs in protected hiding places that the bees cannot reach.

After the larvae hatch, they eat honey, wax and pollen – and destroy the structure of the comb. The honey spoils and is no longer usable for human consumption. Some bee colonies even leave the infested hive in an emergency swarm.

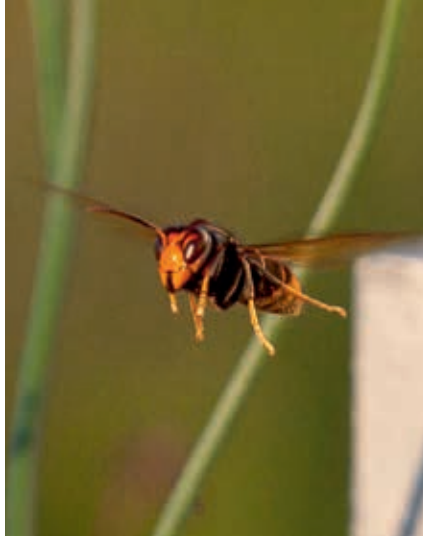
AT A GLANCE

- // Invasive insect species can disrupt the ecological balance and threaten honey bee colonies.
- // Examples include the arrival of the Asian hornet, *Vespa velutina* to Europe and the spread of the Small Hive Beetle from Africa to North America and Europe.

Efficacious bee resin

Propolis is a sticky mass that bees use to seal off tears and cracks in their home. It consists of about half resin, one third wax and ten percent essential oils and proteins, trace elements and vitamins. Propolis is effective against many bacteria, viruses and fungi. Bees use it to protect their hives, but propolis' properties are also useful in human health, for example for treating infections of the skin and mucosa or for strengthening the immune system.

Bees gather propolis from leaf buds and bark. Its color depends on the source trees and can range from yellow (alders) to brown (poplars) to black (birches).



Asian honey bees have already found a way to defend themselves from *Vespa velutina* (left): The bees gather round the hornet (right) and heat it to almost 50°C, killing it.

Another winged enemy is also threatening the Western honey bee: the *Vespa velutina* hornet, which comes from Asia.

You recognize the mostly black hornet by its broad orange stripe on the abdomen and the fine yellow band on the first segment. Experts fear a lasting disruption of the ecological balance if this insect, which measures about two centimeters, continues to multiply. "These hornets aren't any more aggressive than their European relatives, and they are not particularly dangerous to humans. However, honey bees and wild bees can suffer because of them," explains Trodtfeld. As the hornets usually create their new colonies quite close to each other, there is a very high concentration of nests in the area – and the pressure on food sources increases. And honey bees are already on the hornets' menu.

The hornet arrived in Europe in 2004, at the Atlantic coast of France. From there it started to invade the European mainland. In 2010, it was found in Spain and a year later in Portugal, before arriving in Germany in 2014. In their place of origin, Asian honey bee colonies have already developed a tactic for ridding their hives of this enemy. They attack the hornets as a group, forming a ball around their enemies and heating them to almost 50°C. "The bees can endure the high temperatures for a while, but the hornet perishes," explains Trodtfeld.

However, in Europe the bees do not know how to fight against *Vespa velutina* and therefore need support. To this end, the hornets' lifestyle is about to be studied closely and solutions to control the Asian hornet are to be evaluated. Bayer is supporting a Ph.D. thesis that is taking on this task, in collaboration with the National Institute of Agronomic Research (INRA). The 3-year project has started in November 2014 and its methods will include equipping the insects with electronic transmitters in order to collect information about the location of the colonies and the animals' hunting behavior. "Because the hornets usually build their nests high up in the trees, they are covered with foliage most of the year, and are thus difficult to find," explains Dr Benedicte Laborie, Ecotox Engineer at Bayer CropScience, France.

The experts at Bayer hope that the results of the Ph.D. study will provide effective tools to control this hornet – using baits, for example, could be an option. Dr Laborie: "If the hornets bring the active substance into the nest and feed it to their larvae, that would be an effective measure for better controlling this bee enemy." Until then, beekeepers can mainly protect their bees when they take refuge in the hive, by placing mesh across the entry hole through which the hornets cannot pass.

There is another thing that makes these quickly multiplying beetles dangerous for bee colonies: They can fly very well, covering distances of up to 20 kilometers and thus spread rapidly. Currently, there are hardly any methods available for combating the beetle. "In the USA and Canada, the Bayer product CheckMite+®, with active ingredient coumaphos, has been approved," explains Trodtfeld. "Also in Canada, Permanone®, with active ingredient permethrin, applied as a light soil drench against the larvae living in the ground, is registered." These treatments have to go along with improved bee husbandry and changes in honey handling. Once well established, the beetle cannot be eradicated.

Strict import regulations for honey bees have been established as the main defense against the introduction of the beetle as well as other serious bee pests and diseases from overseas. In Europe, however, there is currently only one solution: If a beekeeper has detected the vermin, he has to report it, as the Small Hive Beetle is a statutory notifiable pest in the EU. Hence, beekeepers must observe their hives extremely closely. In case of a beetle infestation, the only chance for eradication is the early interception of the beetle.