An invasive pest on honey bees

The **Small Hive** Beetle

bee care

BAYER

Honey bees – *small insects bring big benefits*

As honey bees are important pollinators of many crops, they contribute to securing our food supply. Up to eight percent of global crop yields depend on the support of bees and other pollinating insects, and as such, healthy pollinators are a vital element of sustainable farming. As a partner in pollinator protection, Bayer is committed to the well-being of honey bees, wild bees, other pollinators and biodiversity in general, while helping farmers to optimize their agricultural productivity.

Over the last 60 years, the number of managed honey bee colonies has risen worldwide by 65 percent, but the health challenges facing these colonies in several regions of the world have been a cause for considerable concern. The contributory factors include various pests and diseases, among them the **Small Hive Beetle** (*Aethina tumida*), which has spread from its original geographic range in sub-Saharan Africa to many regions of the world in recent years.

If an article or image is marked with this sign, you can download it via the following link:
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We hope this material will prove useful for your Small Hive Beetle training courses.

The Small Hive Beetle can seriously harm honey bee colonies, especially weakened ones. For almost two decades, numerous bee health stakeholder groups have conducted research to improve our knowledge of the pest, developing ways to slow down its spread and looking to control it. Despite these efforts, the options to stop the beetle from spreading are still limited and, therefore, it poses a significant challenge for many beekeepers.

However, an integrated approach that combines currently-available control approaches with good beekeeping practices has great potential for reducing Small Hive Beetle infestations of honey bee colonies and the subsequent negative effects on beekeeping operations. A better understanding of the biology and habits of the Small Hive Beetle will also help beekeepers to make the best management decisions.

The Small Hive Beetle
– an invasive pest from Africa

"These species are not inherently bad. They're just in the wrong place."

David Lodge (* 28. January 1935), English author and literary critic

In view of this quote we should not be surprised if we come across non-native plant and animal species on an outdoor walk in any given place. In their native regions these species do not cause significant damage usually and, therefore, do not warrant particular attention. However, once they arrive at a new location where they do not belong and subsequently spread, they may cause considerable problems, e.g. seriously threatening the habitats of native species or jeopardizing the production of agricultural crops.

In fact, invasive species are nowadays one of the top challenges for nature conservation – second only to habitat destruction. Invasive species can also impact livestock like the honey bee.

The ability of the Small Hive Beetle (Figure 1) to spread in an invasive way very much depends on the availability of its hosts (honey bees, occasionally also bumble bees and stingless bees) and on the climatic conditions (temperature, moisture) needed for its reproduction during the pupation period in the soil.

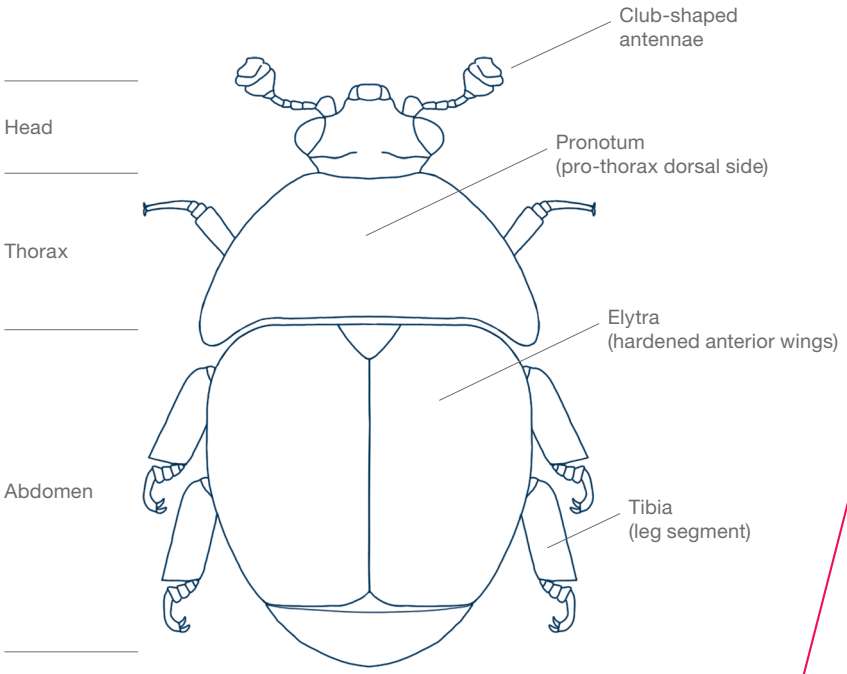


Figure 1
Characteristic features of the Small Hive Beetle (*A. tumida*)
Adult Small Hive Beetles are about five to seven millimeters long, dark brown to black in color and have an oval to oblong body shape. Antennae are distinctly club-shaped, with elytra not covering the entire abdomen.

From its native geographic range in sub-Saharan Africa, the Small Hive Beetle has spread to every continent except Antarctica during the past 20 years (Figure 2).

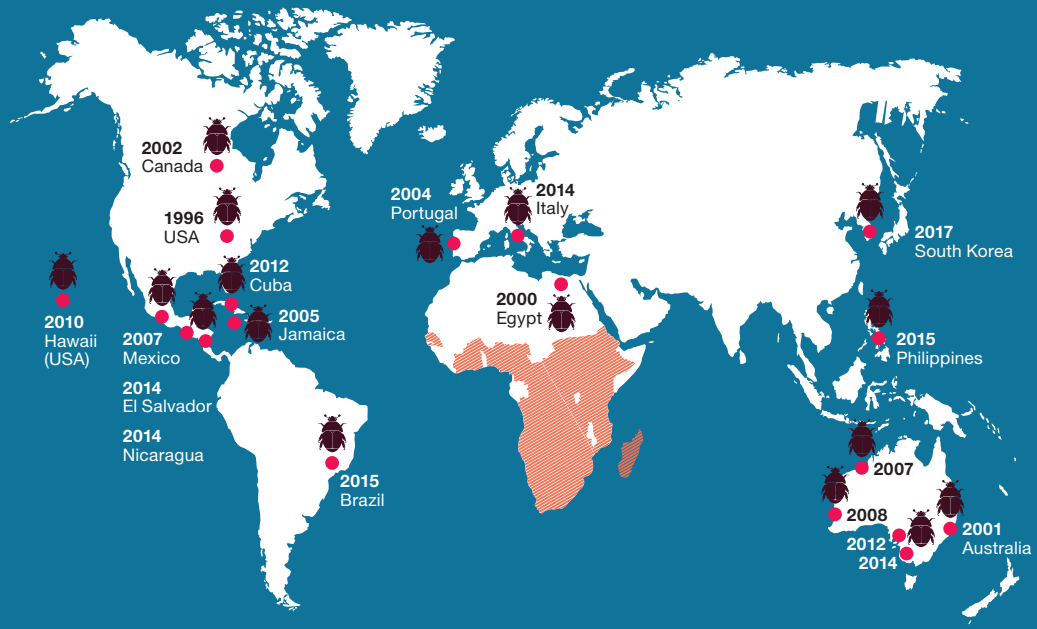


Figure 2
Global distribution of the Small Hive Beetle

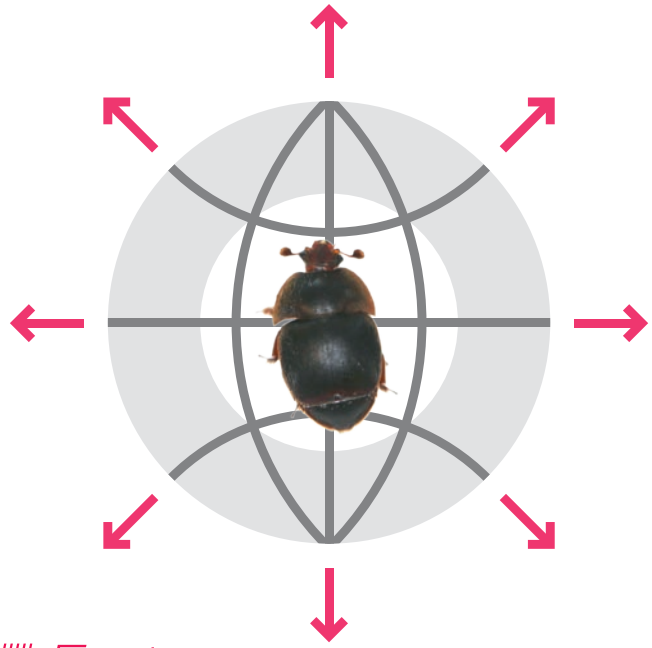
- Areas where the pest was introduced, with the year of introduction.
- Region of sub-Saharan Africa where the beetle is endemic.

For more information, see Neumann et al., 2016, and Lee et al., 2017.

In 1996, *A. tumida* was introduced to the USA where it has since spread throughout the country. It reached Mexico in 2007 and was reported in Canada in 2002. The invasive species has even reached remote islands like Hawaii. In 2001, the Small Hive Beetle also found its way to Australia where it conquered vast regions in a short period of time. In the USA and Australia, its spread was promoted by the practice of migratory beekeeping for commercial pollination, e.g. almond pollination in California. In the early 2000s, the Small Hive Beetle was also reported in Egypt, though no further evidence of its existence has been found there since.

Europe was spared infestation for a long time, probably due in part to strict border controls for importing bees and used beekeeping equipment (see also page 38: “Mandatory reporting and import restrictions”). However, after the first Small Hive Beetle occurrences in Portugal (2004) that were subsequently eliminated, the beetle reappeared in Calabria (Southern Italy) in 2014 and it currently seems that the Small Hive Beetle has established itself in Italy.

For that reason, the combined efforts of all stakeholders to prevent the beetle from spreading to other parts of Europe have become a race against the clock. If they don’t succeed, the Small Hive Beetle may well cause significant damage to honey bee and bumble bee colonies in new regions it colonizes. Beekeepers in any such region would clearly have to adjust their practices to mitigate infestations.



Facts

// *Nowadays, invasive species are one of the top challenges for agriculture and nature conservation, as they endanger both food security and natural biodiversity.*

// *The Small Hive Beetle is a nest scavenger, pest and facultative predator of honey bees and other social bees. Originating from Africa, it has become an invasive species, causing significant damage in new regions it has spread to.*

// ***In the European Union (EU)** the mere economic cost of invasive species is estimated to be around **€12 billion** a year.*

Biology

Biological features of the Small Hive Beetle

The Small Hive Beetle is a member of the sap beetle family (Nitidulidae), which comprises around 2,500 species worldwide. Some members of the sap beetle family are pests, affecting fruit crops or stored products.

The Small Hive Beetle lives in social bee colonies where it reproduces and can cause damage. Laboratory trials have shown that it can also successfully reproduce on a variety of fruits as well as other foods (i.e. meat), albeit usually less successfully than on bee brood and bee products. Under these conditions, adult Small Hive Beetles can survive for up to two days without water. The few field studies conducted so far suggest that alternative foods outside bee colonies are only of minor importance.

Under laboratory conditions the Small Hive Beetle can reproduce successfully on ripe bananas or citrus fruits.

Life cycle from egg to adult beetle

The Small Hive Beetle is a holometabolous insect that develops through egg, larva, pupa and adult stages (Figure 3). The female beetles usually lay their eggs in a protected site within a bee hive to prevent honey bees from removing the eggs from the hive. With a long, flexible and extendable ovipositor (tubular organ to lay eggs) they can reach inside narrow crevices to make some of the eggs inaccessible to the bees. In weakened bee colonies the female beetles even lay their eggs in the bee brood cells.

When the eggs hatch, the larvae feed on whatever food is available, preferring bee brood over honey and pollen, until they reach the post-feeding stage (wandering phase). The larvae then leave the hive and migrate to pupate in the ground. If the soil is suitable for pupation, the majority of larvae dig into the ground in close proximity (< 2 m) of the hive they originated from. If, however, the soil is not suitable, larvae can crawl a long way, with distances of 50 - 100 m having been reported. The larvae then dig into the soil and build pupation chambers up to 15 cm underground. The pupation period can range from three weeks to up to two months, depending on soil temperature and moisture. The Small Hive Beetle prefers humid, warm soil. Once the pupal period is completed, the adult beetles emerge from the soil and fly away to find new host colonies.

Life cycle stages of the Small Hive Beetle

Adult beetle

Eggs

Larvae

Pupa

It should be noted that the mere presence of adult beetles in a bee colony is not necessarily an indication that Small Hive Beetles are reproducing there to a significant extent. They apparently cannot successfully reproduce to a significant degree before the bee colony is weakened or otherwise disturbed.

Two levels of severity can be distinguished in the Small Hive Beetle's reproduction in a bee hive:

Level 1 ////

Cryptic low-level reproduction characterized by only a few larvae being visible: As these few larvae usually feed on debris on the bottom boards and do not cause any damage to the colony, this form of reproduction often goes undetected by beekeepers.

Level 2 ////

Mass reproduction: In sharp contrast to cryptic low-level reproduction, hundreds or even thousands of larvae usually destroy the entire colony and the comb material in a hive in less than a week. This obvious and typical form of reproduction is easily noticed, even by inexperienced beekeepers.

The exact causes of mass reproduction are poorly understood and its occurrence is unpredictable and irregular.

Hundreds or even thousands of larvae usually destroy the entire colony and the comb material in a hive in less than a week.

Diagnosis:
Eggs – Larvae – Pupae – Adult beetles

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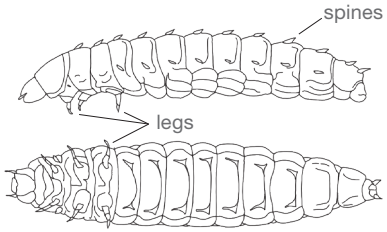
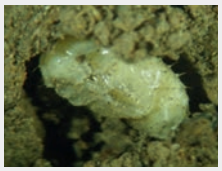
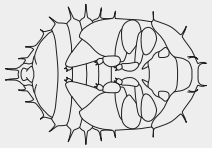
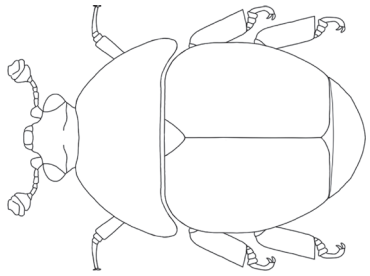
	Size	Shape	Color	Where	Special features
EGGS	// 1.4 mm x 0.26 mm // 1/3 the size of honey bee eggs	// Elongated oval 	// Whitish	// Large numbers of eggs, often in cracks and crevices of honey bee hives	

LARVAE	// 10 - 12 mm 	
		// Grub-like, long head
		// Three pairs of jointed thoracic legs but no fleshy abdominal prolegs like those on wax moth larvae (distinguishing feature).
			// Whitish-beige, though often a brownish color due to slime of excrement and fermented honey	// Early larval stage: within the hive
				// Late larval stage (wandering larvae): migrate to pupate in the soil around the hive
					// Two rows of spines on dorsal side and two rows of protruding spines from the rear (*urogomphi*)
					// In contrast to wax moths (*Galleria mellonella*), the beetle larvae do not spin webs.

PUPAE		 *Shaped similarly to adult beetles but with elongate spiny projections laterally and ventrally*	// Whitish, though darkening during metamorphosis	// In pupation chambers in the soil, usually in the immediate vicinity of a hive, yet can be found within a radius of up to 100 meters	// Pupation: normally three to four weeks but up to two months under unfavorable conditions
					// Sensitive to cold temperatures and extreme moisture
					// Sandy, moist and warm soils preferred

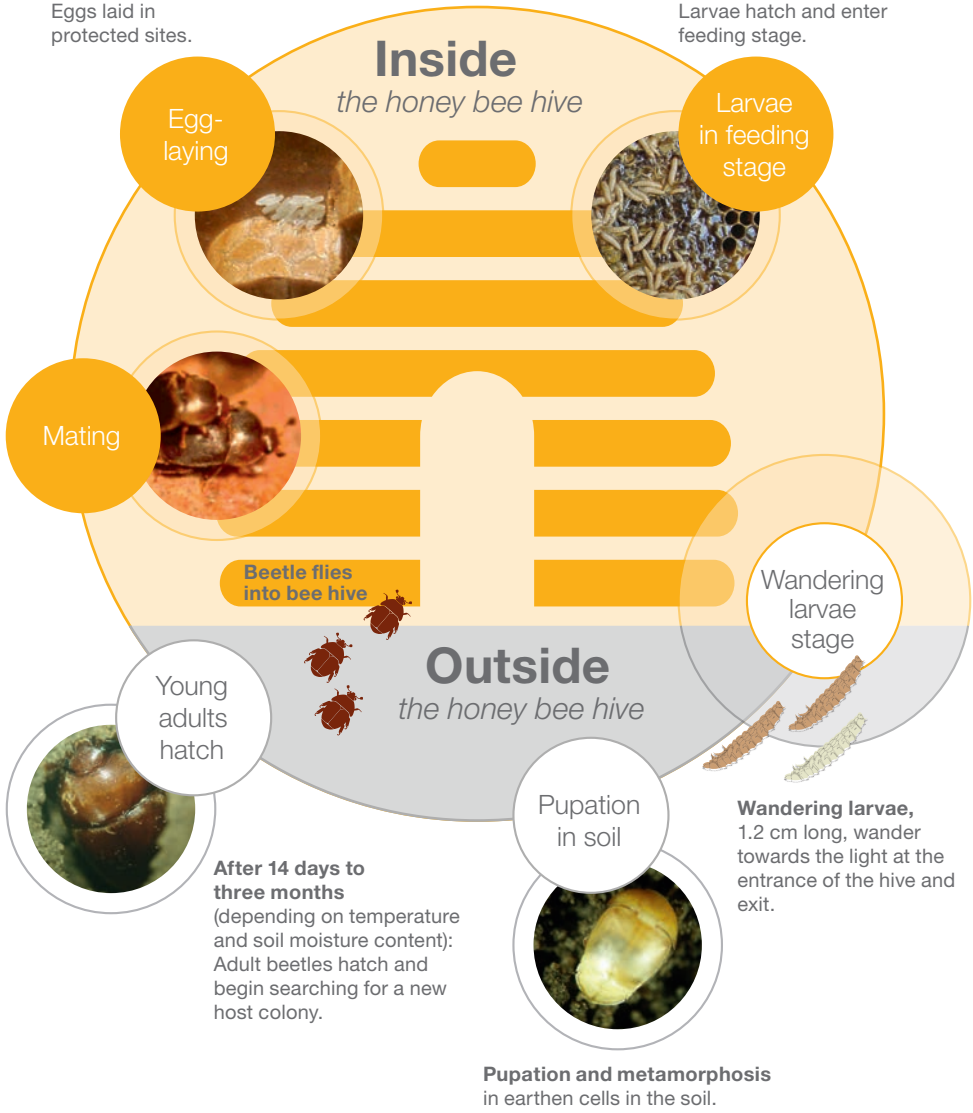
ADULT BEETLES	// 5 - 7 mm long
	// Up to 3.5 mm wide (females often larger than males)  *Adult beetles are about a third the size of a worker bee.*
		
		// Oval
		// Head, thorax and abdomen well-separated
			// Brownish-black
			// Young beetles are reddish-brown
				 *In bee hives for reproduction, and migration between bee hives by flight*	// Club-shaped antennae, forewings (elytra) shorter than abdomen
					// Female ovipositor normally not visible but extended when laying eggs

Life cycle
Development of the Small Hive Beetle takes place both inside and outside a bee hive.

Source:
Diagram adapted from an illustration by the Friedrich Loeffler Institute.

Facts

- *The life expectancy of a female Small Hive Beetle is up to **six months**. Each female can lay **1,000 - 2,000 eggs** in her lifetime. Under optimal temperature and humidity conditions, beetle numbers in the hive can grow rapidly, e.g. in South Africa where five or six generations can develop within a year.*
- *How severely the beetles damage a honey bee colony depends on the beetles' reproduction rate and the bees' defensive behavior. A large number of beetles can cause a weak honey bee colony to die within a week.*



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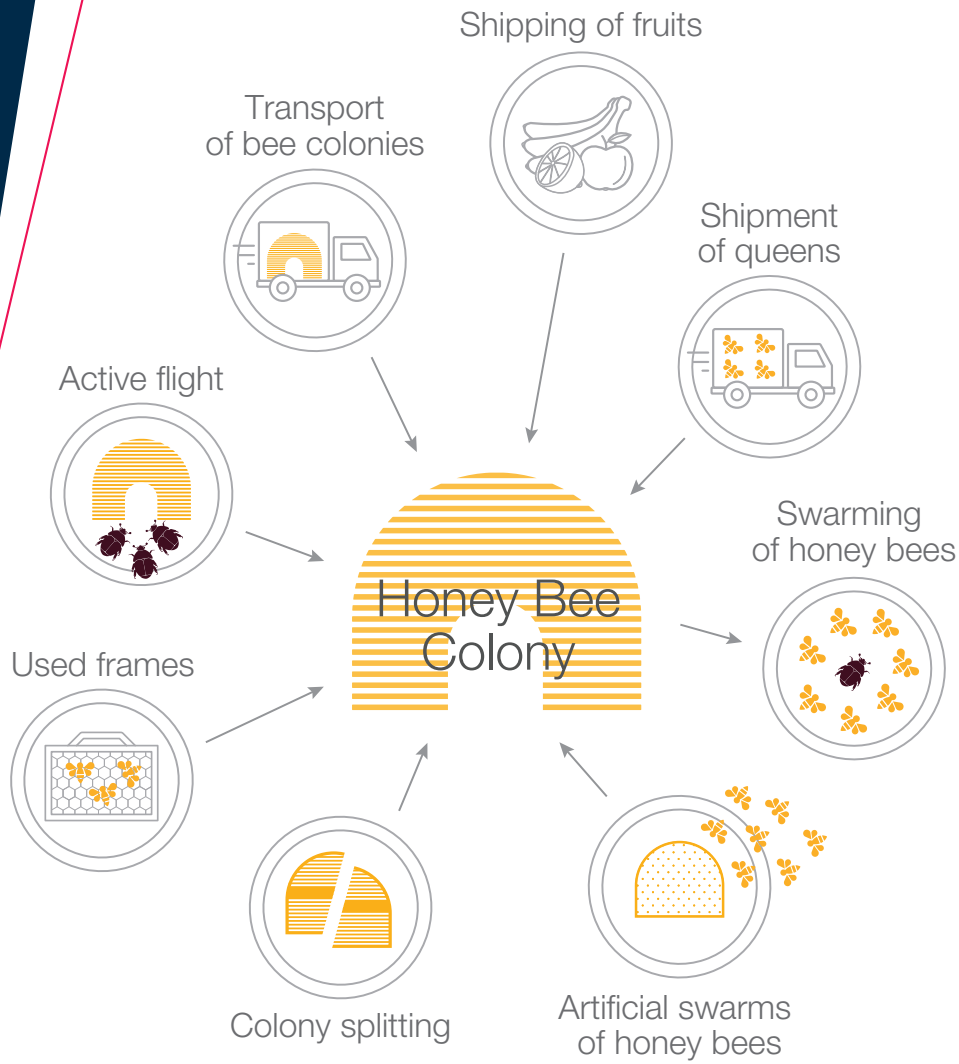
Infestation

Distribution and spread of the Small Hive Beetle
Adult beetles can fly great distances, probably up to several kilometers, before entering new hives or joining a migrating swarm of bees. Human activities can also significantly enhance the dispersal of the Small Hive Beetle.

There is clear evidence that migratory beekeeping for commercial pollination or honey production in the USA and Australia has significantly facilitated the spread of the beetle. Besides transportation of infested colonies, there is also evidence that the trade of hives and apicultural equipment and shipments of queen and package bees can transport these beetles over long distances, enabling them to reach new locations (e.g. Portugal in 2004).

Facts

- *Small Hive Beetle adults can naturally spread over several kilometers in successive waves that further the expansion from an infestation epicenter.*
- *Human activities, in particular migratory beekeeping and apicultural trade, can promote long-distance jump dispersal of the Small Hive Beetle.*



How the Small Hive Beetle spreads

First infestations in wild bee colonies

The Small Hive Beetle also infests feral honey bee colonies and has, likewise, been observed to infest colonies of social wild bees. It has, for instance, been shown that bumble bees (*Bombus* spp.) and stingless bees (Meliponini spp.) can serve as alternative hosts. Both bumble bees and stingless bees can defend themselves against the beetle. For example, stingless bee colonies in Australia effectively defend themselves against the Small Hive Beetle by mummifying adult beetles in a mixture of resin, wax and mud. These bee species also destroy the eggs of the Small Hive Beetle and remove larvae from their nests. Nevertheless, they can act as vectors of the beetle, thus hosting the beetle and aiding its spread.

Overall, not much is known about the potential impact of the Small Hive Beetle on bee species other than honey bees and further research is required. However, it appears evident that eradication of the beetle in new areas of distribution becomes virtually impossible once this pest has started to infest wild bee colonies, which cannot be easily monitored.

Facts

- *Both bumble bees and stingless bees can defend themselves against the Small Hive Beetle.*
- *Bumble bees and stingless bees can be alternative hosts of the Small Hive Beetle, thereby acting as vectors for this pest.*
- *Once Small Hive Beetles have started to infest feral colonies of honey bees or bumble bee and stingless bee colonies, eradication in the affected areas becomes virtually impossible.*

Stingless bee colony in Australia (*Tetragonula carbonaria*)

Means of defense of African and European honey bees

Nowadays, the European subspecies of the Western Honey Bee, *Apis mellifera mellifera*, is managed almost everywhere in the world; it is more susceptible to Small Hive Beetle infestations than the African subspecies, *Apis mellifera scutellata*. This difference in susceptibility may be due to differences in the extent to which these two subspecies demonstrate certain behavioral traits that limit both the reproduction of the beetles and the damage they cause, e.g.:

// Aggressive behavior towards Small Hive Beetle adults and their larvae

// Incarcerating and guarding of adult beetles by worker bees in cells constructed of propolis (made by the bees from plant resins)

// Absconding of the bee colony from the hive in cases of heavy beetle infestation

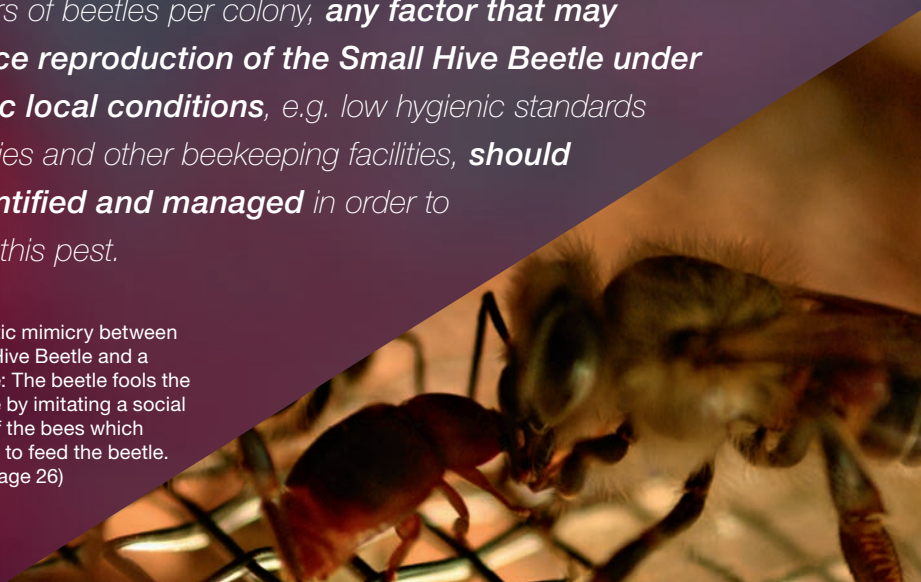
Providing suitable climatic and soil conditions exist, the beetle can, therefore, reproduce more successfully in its non-native geographical areas than in its original range in Africa.

Cape Honey Bee
(*Apis mellifera capensis*)

Facts

// ***African honey bees appear to be more resilient to Small Hive Beetle infestations than European ones*** *as a result of different behavioral traits.*

// *As damage to colonies is more likely in areas with higher numbers of beetles per colony,* ***any factor that may enhance reproduction of the Small Hive Beetle under specific local conditions****, e.g. low hygienic standards in apiaries and other beekeeping facilities,* ***should be identified and managed*** *in order to control this pest.*



Trophallactic mimicry between the Small Hive Beetle and a worker bee: The beetle fools the worker bee by imitating a social behavior of the bees which leads them to feed the beetle.
(see also page 26)

A threat
to beekeeping

The Small Hive Beetle has become a serious problem for beekeeping in several countries and regions of the world. In its native geographic range in sub-Saharan Africa, the beetle is usually considered to be a relatively harmless pest in colonies of African honey bee subspecies. This may be due to the fact that there are many unmanaged honey bee colonies in the region, which swarm more frequently. Also, the natural density of colonies is lower. In Africa, the Small Hive Beetle reproduces primarily in abandoned hives after established bee colonies have left them due to extreme infestation.

Here, the beetles feed on pollen, honey and brood remains, left behind by the bee colony. In abandoned hives, the beetle is not exposed to any defensive measures by the bees and can reproduce relatively undisturbed.

In areas to which the Small Hive Beetle has spread, beekeepers have been surprised by the massive damage it can cause within a short period of time. The risk of damage by the beetles is particularly high in apiaries with low hygienic standards. The beetles and their larvae can, for instance, survive in remains of bee brood, nectar, or pollen in brood combs stored in the apiary, which can eventually lead to a stronger reproduction of the pest. This can be prevented by keeping the apiary and stored material clear of such remains.

A bee pest on the increase
The Small Hive Beetle has become a serious problem for beekeeping in several countries and regions of the world.

Destruction of comb structure damages a colony

Adult Small Hive Beetles that enter a bee hive inhabited by a bee colony have to constantly protect themselves from worker bees trying to defend the colony. To this end, adult beetles have developed several behavioral strategies to survive: They either hide in small cracks and crevices in the bee hive and assume a turtle-like defensive posture (with the beetle retracting its head, legs and posterior of abdomen under the protective thoracic shield and elytra); or they use trophallactic mimicry (the beetle deceives the bee by imitating a social behavior of the bees which leads them to feed the beetle).

The actual damage to the colony and its combs is caused by beetle larvae feeding on brood, honey and pollen. They burrow and mine under the combs and leave behind a layer of slime from fermenting honey and excrement. This results in a very characteristic rotting smell. Larval excrements causes the honey to ferment, become unsuitable for human consumption, and leak out of the combs and hives.

Once the honey combs are empty, powdery wax comb debris may be found on the bottom of the hive as a result of larval feeding. However, it is essential that beetle infestation is detected much earlier to allow for corrective management and avoid a total loss of the colony.

To protect the colony, bees may abandon an infested hive, leaving the honey and other stores behind. Unfortunately, this gives the beetles even more time and resources to reproduce undisturbed. The next generation of beetles can then seek out new host colonies. In the event of severe infestation, beekeepers should destroy the infested colony and the hive material as early and as quickly as possible so as to prevent reproduction of the beetles and limit spreading to other colonies (for other treatment options, see page 30: “Preventing the spread of the Small Hive Beetle”).

Slimy combs due to fermented honey from Small Hive Beetle infestation; the larvae on top of frames

The destruction caused by the Small Hive Beetle has caused extensive damage to beekeeping in the USA since the 1990s. Beekeepers in the South of the USA were hit worst of all. However, some beekeepers there have managed to curb beetle reproduction by promptly removing filled honey frames from the hive after Small Hive Beetle detection to reduce the number of frames in hives. This increases the ratio of bees to comb surface area, thereby strengthening the colony’s defenses. This method is highly recommended.

In the event of very severe infestation, the final option open to beekeepers is to burn the entire hive to prevent further spread of the pest, because beekeeping equipment is too difficult to clean for reuse.

The pest as a disease vector

Apart from the direct damage caused to honey bee colonies by the beetle, it may also act as a carrier of other bee diseases, such as American Foulbrood (AFB) or the Deformed Wing Virus (DWV). American Foulbrood is an infectious disease of bee brood caused by the bacterium *Paenibacillus larvae*. The Deformed Wing Virus can cause a highly-virulent disease that leads to bees having shortened abdomens and crippled wings and legs. The virus is vectored by the parasitic bee mite *Varroa destructor* and the Small Hive Beetle.

Adult Small Hive Beetles might ingest these pathogens when in close contact with infected bees (trophallactic mimicry, see page 26) and thus transmit these diseases to other bees.

American Foulbrood (AFB)

Adult bee with symptoms of Deformed Wing Virus (DWV) infection.

Varroa mite attached to an adult bee

Controlling
the Small Hive Beetle

Preventing the spread of the Small Hive Beetle

To protect honey bee health, it is important to stop the beetle from spreading further to new regions. Several precautionary measures can be taken to achieve this goal.

You can't control what you can't measure

Diagnosis through close observation

In regions affected by the Small Hive Beetle, monitoring is one of a beekeeper's routine tasks. Even in regions where occurrence of the beetle has not been confirmed, beekeepers should routinely inspect their honey bee colonies in order to detect any Small Hive Beetle occurrence at an early stage.

If beetles are found, it is important to rapidly consult an expert to confirm its identification and to follow the treatment strategy provided by the veterinary authorities. A combination of different methods supports a precise diagnosis of whether, and how severely, a bee colony is infested. Several indications listed in the following table can help identify if a bee colony has been infested with the Small Hive Beetle.

Through careful observation, adult beetles can be identified with the naked eye. If beekeepers find the pest in a honey bee colony, they should react immediately and effectively to protect the colony, e.g. by using traps or adjusting the bee-to-comb area ratio, and continue with regular monitoring.

Overview of methods to diagnose whether, and how severely, a bee colony has been infested with the Small Hive Beetle, along with their advantages and disadvantages

Method	Procedure	Advantages / disadvantages
Visual diagnosis	Look for eggs, larvae and adult beetles inside the hive (frames, cover, bottom board and particularly in cracks and crevices). Perform weekly visual inspections. You can also tap frames inside an overturned outer cover to dislodge beetles so they can be counted and then removed.	● Method requires knowledge of how to identify the beetles and their developmental stages and entails additional work during routine weekly inspections. Beekeepers need to be trained in visual diagnosis.
Beetle traps	Several different types of traps have been developed and can be placed between frames, on bottom boards or at hive entrances. These traps can be equipped with attractants and substances to kill the beetles (often consisting of self-made, natural baits). The number of beetles trapped provides a rough estimation of the overall infestation.	● Helpful addition to visual inspection. ● A method for inspecting and removing the pest without investing a lot of time or effort. ● Not reliable for control purposes at low temperatures or at low infestation levels. ● Requires traps to be positioned properly; beetles can also find alternative places to hide. ● Bees may seal the traps with propolis.
Odor test	Severe infestation can usually be detected by the putrid smell of fermenting honey.	◐ Serves only as an initial indicator, as odor perception is subjective. ● Very late indicator to detect an infestation. ● Not a reliable method, as infestation with the beetle does not necessarily lead to fermenting (“dry infestations”). ● Low pest infestation may remain undetected.
Diagnosis following sacrifice of bee colony	Diagnosis of infestation and determination of the exact number of beetles after sacrificing a bee colony (e.g. by killing with surfactant spray, drowning or freezing).	● Enables precise diagnosis for scientists or veterinarians by counting the number of beetles and larvae after the hive has been sacrificed. ● Requires affected bee colony to be killed. ● Time-consuming; exact count of beetles is of no practical value to the beekeeper.
Soil investigation	Investigation of the soil underneath and in close proximity of the hive for larvae, pupae and adult beetles.	● Taking soil samples and analyzing them is usually a labor-intensive activity. ● Low pest infestation may remain undetected. ● Knowledge of the Small Hive Beetle's lifecycle is required, to know where and how to find the pest.
Molecular biological diagnosis (PCR)	Testing DNA of eggs, larvae or adult beetles in hive debris to unequivocally identify the Small Hive Beetle and its origin.	● Helpful if diagnosis of infestation with other methods is unclear. ● A molecular biology laboratory with trained personnel can precisely and reliably identify the beetle and its origin. ● Method can only be conducted in a molecular biology laboratory and involves considerable time, effort and expense. ● As infestations are normally relatively easy to identify by other methods with minimal training, this method is normally not needed.

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Treatment methods
for infested bee colonies

If beekeepers discover high levels of Small Hive Beetle infestation in their bee colonies, especially in a case of first detection in an apiary or a region, they should take rapid and systematic action in order to inhibit the spread of the pest within the colony and to other nearby colonies.

Depending on the severity of infestation, various methods can be used to control the pest.

"Well done is better than well said."

Benjamin Franklin (1706-1790)
American statesman, scientist and philosopher

Overview of methods available to control the Small Hive Beetle depending on the severity of infestation, along with their advantages and disadvantages

Method	Procedure	Advantages / disadvantages
Manual pest eradication	Collecting adult beetles and larvae and removing them from the hive.	● All beetles must be successfully removed to prevent further spread. ● Time- and labor-intensive method. ● Unwanted side effects during long routine inspection time – leaving a bee hive open for too long may induce robbing activities between bee colonies.
Bottom board traps	In some countries, various types of traps are available to catch adult beetles and/or larvae. Efficiency of the traps can be increased with approved synthetic or natural (e.g. pathogenic fungi) agents to kill the beetle, or with attractants (e.g. yeasts as bait).	● Appears to be the most efficient control method available so far. ● Rotating the use of different, approved classes of substances to control the beetle is recommended to avoid resistance.
Traps between frames	Catching adult beetles in oil traps, with containers set up between the frames near the brood nest. While searching for a hiding place, the beetles fall into the traps through small openings. Baits can be used to enhance trap efficacy (e.g. yeasts).	◐ Traps must be well-positioned (i.e. near the bee brood); bees may seal the trap with propolis; beetles may prefer hiding places on the bottom board.

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Method	Procedure	Advantages / disadvantages
Traps for wandering larvae	Traps at the hive entrance catch **wandering** larvae before they reach the soil where they pupate.	🟢 Simple method for reducing the spread of beetles. 🔴 Method only suitable when mass reproduction occurs. 🔴 Suitable only with specific types of hive body as larvae may also leave the hive body through open, screened bottom boards. 🔴 Is not helpful to protect an already-infested colony.
Traps outside the hive	Honey, pollen, dead bees and bee brood can be placed in traps outside hives to attract and catch the beetles (alternative bait: pollen mixed with yeast).	🟢 Baited traps are a preventive measure and can keep the beetle from entering a bee hive. 🔴 Traps must be checked frequently to ensure beetles do not complete their life cycle in the trap. 🔴 Effectiveness of the traps with existing baits is still insufficient. New, more effective attractants/ pheromones would be required to optimize these traps. 🔴 Is not helpful to protect an already-infested colony.
Sacrifice of affected bee colony	Sacrificing the entire affected bee colony as a final resort in the case of extreme infestation (e.g. by killing with surfactant spray, drowning, burning or freezing).	🟢 Efficiently and effectively kills all beetle stages in the hive. 🔴 Beekeepers lose the entire bee colony (and also all hive material in case of burning).
Attracting beetles with UV light	UV lamps close to the ground attract the wandering larvae at night so they can then be collected by hand or with traps.	🟢 Good effect when using UV light with a 390 nm wavelength. 🟢 Method well-suited for use in hive storage rooms. 🔴 Electric power source has to be provided (mains, solar power, generator, batteries etc.), which can involve significant effort.
Soil treatment / insecticide drenching	Treating the soil around an infested bee hive with an insecticide that kills larvae, pupae and hatching beetles.	🟠 Limited spectrum of solutions is available, since only products that are registered for the respective kind of treatment can be used. 🔴 Is not helpful to protect an already-infested colony.
Natural enemies	Use of insect-pathogenic fungi (e.g. *Metarhizium* spp. and *Beauveria* spp.) or nematodes (e.g. *Heterorhabditis* spp. and *Steinernema* spp.) approved for this treatment, which kill Small Hive Beetle larvae or pupae in the soil.  Entomopathogenic nematodes – females and juvenile	🟢 Good results under laboratory and field conditions. 🟠 Effectiveness depends on the timing of soil treatment as well as the temperature and moisture content of the soil. 🔴 Does not protect an already-infested colony.

"Example is not the main thing in influencing others. It is the only thing."

Albert Schweitzer (1875-1965) German theologian, philosopher and physician

Mandatory reporting and import restrictions
To inhibit further spreading of the Small Hive Beetle and other pests, many countries (including the USA, Canada, Australia and EU Member States) have established import restrictions and controls for the import of bees and used beekeeping equipment.

Since August 2003, any infestation with *A. tumida* is subject to mandatory reporting in the EU. In other words, any person who handles bees (including beekeepers, bee inspectors, veterinarians and laboratory staff) are obliged to report a Small Hive Beetle infestation to the official veterinarian service or the competent government authorities.

Additionally, an EU-wide import restriction, which took effect in December 2003, prohibits the import of bees from countries outside the EU where the Small Hive Beetle is already known to occur, but is not a notifiable pest. This regulation applies to honey bees, bumble bees and used beekeeping equipment.

Research and Prevention
Measures going forward

By using combinations of the available measures, beekeepers are able to reliably identify the occurrence of *A. tumida* in their bee hives and minimize the potential of infestations.

Integrated Pest Management, involving the use of various control measures (integration of early detection and diagnosis as well as mechanical, biological and chemical options), is a holistic approach to control the pest. However, these measures can only slow the spread of the pest but not halt it entirely. As many countries have no suitable and approved veterinary products for controlling the Small Hive Beetle, constant vigilance by beekeepers is required to use alternative treatment methods (e.g. traps) in a timely manner to contain the spread of the Small Hive Beetle.

Generally speaking, weak honey bee colonies are more susceptible to infestation by the Small Hive Beetle than strong colonies. Therefore, beekeepers should regularly check the condition of their bee colonies (*Varroa* infestation, diseases, stored food, strength of the colony). Colonies already weakened by disease or other bee pests, such as the *Varroa* mite (for more information on this topic, see the Bayer Bee Care brochure: “The *Varroa* mite – a deadly bee parasite”), might be at greater risk of infestation by the Small Hive Beetle. While healthy and strong honey bee colonies often succeed in removing Small Hive Beetle eggs and larvae from their hives, weakened colonies allow the pest to reproduce.

Measures to ensure the health of bee colonies include good hygiene at the apiary and in rooms where beekeeping equipment is stored or honey extracted. The set-up of hives can also limit the potential for an infestation by the Small Hive Beetle. Bees should also have access to all areas of the hive body, to make it harder for a beetle to remain undetected. Beekeepers can create these conditions by giving their bees the optimum amount of space in the hive; sufficient room for the colony, yet not so much room as to allow for spaces unguarded by the bees.

Though scientists are increasingly conducting research into the Small Hive Beetle, not enough is known about the beetle's natural enemies; mating behavior; sensory perception in locating its host; or how it can, in rare cases, coexist with honey bees in a hive with limited interference by the bees. Better knowledge would support the development of new treatment options. Several bee health research institutes have launched a project to identify suitable attractants that could be used in novel pheromone traps for the Small Hive Beetle. Bayer is funding this promising project.

Until now, only a few synthetic insecticides have been developed for controlling the Small Hive Beetle. Several active ingredients, such as coumaphos, are only approved for use in certain countries, such as the USA, Canada and Australia.

In the search for new and effective products and strategies, Bayer is collaborating with researchers at the University of Florida and other research institutions who are working together to examine the available options that could be used to control the Small Hive Beetle in the future. The goal of this intensive research and development work is to help beekeepers protect their honey bees more effectively against the Small Hive Beetle and protect the health of their bee colonies, which make such an important contribution to our food supplies.

Another threat
to bee health

One of the main causes of poor bee health, and one of the honey bee's worst enemies, is a tiny mite known as ***Varroa destructor***. Currently, only a handful of effective methods exist to protect bees from this mite. However, by combining the few effective control measures with good beekeeping management practices, it is possible to reduce the harm caused by *Varroa* and to control the impact of this parasite.

The *Varroa* Mite
A deadly honey bee parasite

Find more at:
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PUBLISHED BY
Bayer AG
Alfred-Nobel-Straße 50
40789 Monheim am Rhein
Germany

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June 2019

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