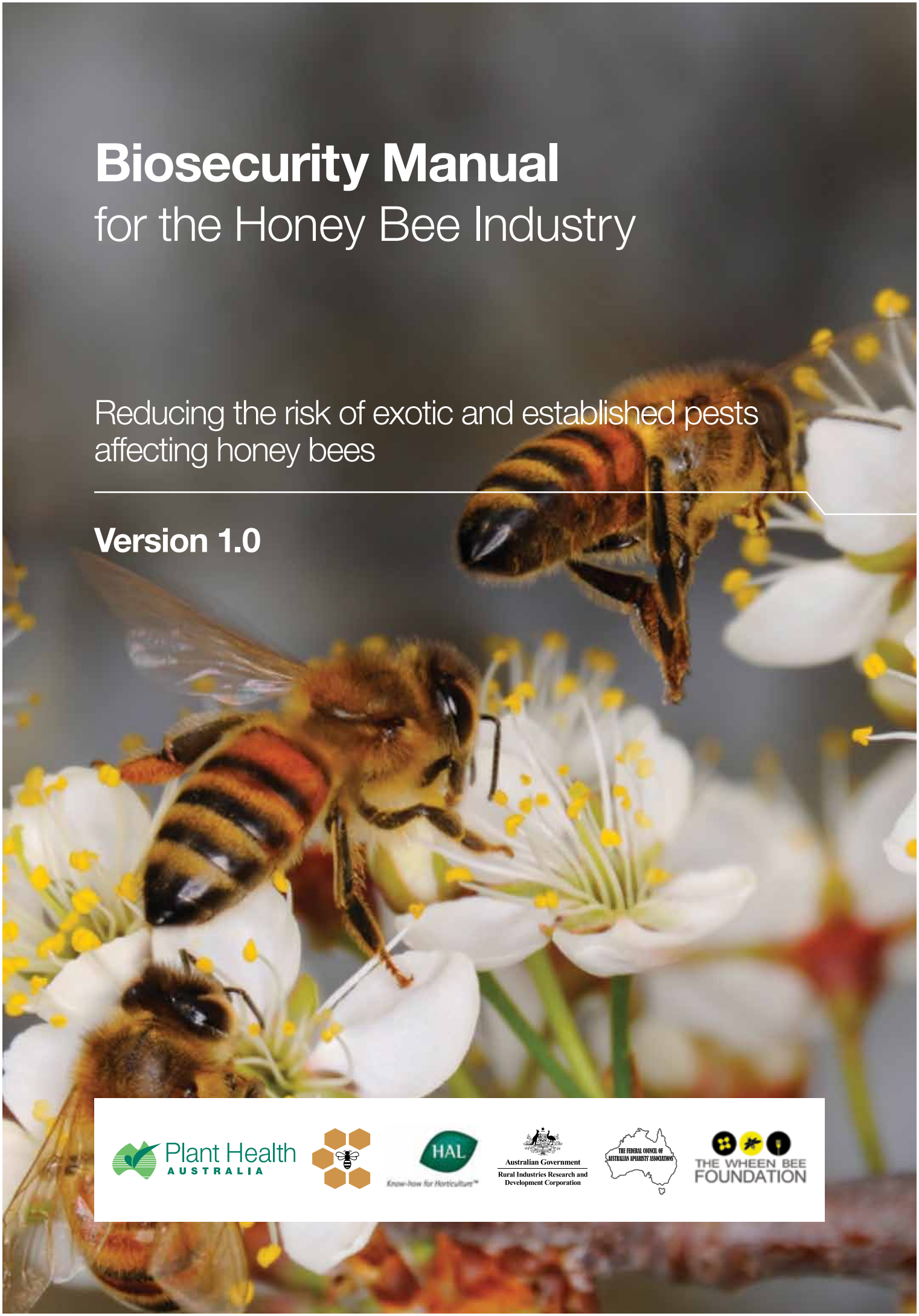
# Biosecurity Manual
## for the Honey Bee Industry

Reducing the risk of exotic and established pests affecting honey bees

**Version 1.0**



Plant Health AUSTRALIA

HAL Know-how for Horticulture™

Australian Government
Rural Industries Research and Development Corporation

The Federal Council of Australian Apiarists Associations

THE WHEEN BEE FOUNDATION

Plant Health Australia (PHA) is the national coordinator of the government-industry partnership for plant biosecurity in Australia. As a not-for-profit company, PHA services the needs of Members and independently advocates on behalf of the national plant biosecurity system. PHA's efforts help minimise plant pest impacts, enhance Australia's plant health status, assist trade, safeguard the livelihood of producers, support the sustainability and profitability of plant industries and the communities that rely upon them, and preserve environmental health and amenity. **www.phau.com.au**



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An electronic copy of this manual is available from the website listed above.



The Australian Honey Bee Industry Council (AHBIC) is the peak honey bee industry body that represents the interests of its member state beekeeping organisations and beekeepers from around Australia. **www.honeybee.org.au**

Horticulture Australia Limited (HAL) is the industry owned rural research and development corporation for the Australian horticulture sector. **www.horticulture.com.au**

The Rural Industries Research and Development Corporation (RIRDC) invest in research and development that is adopted and assists rural industries to be productive, profitable and sustainable. **www.rirdc.gov.au**

The Federal Council of Australian Apiarists' Associations (FCAAA) is the national representative body of the state beekeeping organisations from around Australia.

The Wheen Bee Foundation supports research and education aimed at keeping Australia's honey bees healthy. The foundation advocates for the betterment of beekeeping in Australia and efficient pollination of our food crops. **www.wheenbeefoundation.org.au**

PHA acknowledges the funding provided by HAL and RIRDC for the development of this manual. The Biosecurity Manual for the Honey bee industry is available for free download from **www.phau.com.au** or by contacting Plant Health Australia at **biosecurity@phau.com.au**.

# Table of contents

# Six easy ways beekeepers can protect their honey bees

## 2 Beekeepers have an important role to play in protecting their honey bees and the entire honey bee industry from biosecurity threats.

Here are six easy ways beekeepers can reduce the threat of exotic and established pests affecting their livelihood. Each of these practices should be embedded in the everyday management of an apiary as it makes good business sense to reduce the risk of spreading pests. Don't put your livelihood and the honey bee industry at risk by neglecting honey bee biosecurity.

**1. Be aware of biosecurity threats**

Beekeepers and their workers should be familiar with the most important exotic and established honey bee pest threats. Conduct a biosecurity induction session to explain required hygiene practices for people, equipment and vehicles in an apiary.

**2. Use pest-free honey bee stock and apiary equipment**

Ensure all queen bees and package bees are from trusted sources, pest-free and preferably certified. Keep good records of the apiary inputs.

**3. Keep it clean**

Practicing good sanitation and hygiene will help prevent the entry, establishment and movement of pests within and between apiaries. Workers, visitors, vehicles and equipment can spread pests, so make sure they are clean before entering and leaving the apiary.

**4. Check your apiary**

Monitor hives and the health of the honey bee brood frequently. Knowing the usual performance of the hives and honey bees will help beekeepers recognise new or unusual events and pests. Keep written and photographic records of all unusual observations. As pest numbers can increase rapidly, constant vigilance is essential for the early detection of honey bee pests and pest honey bees.

**5. Abide by the law**

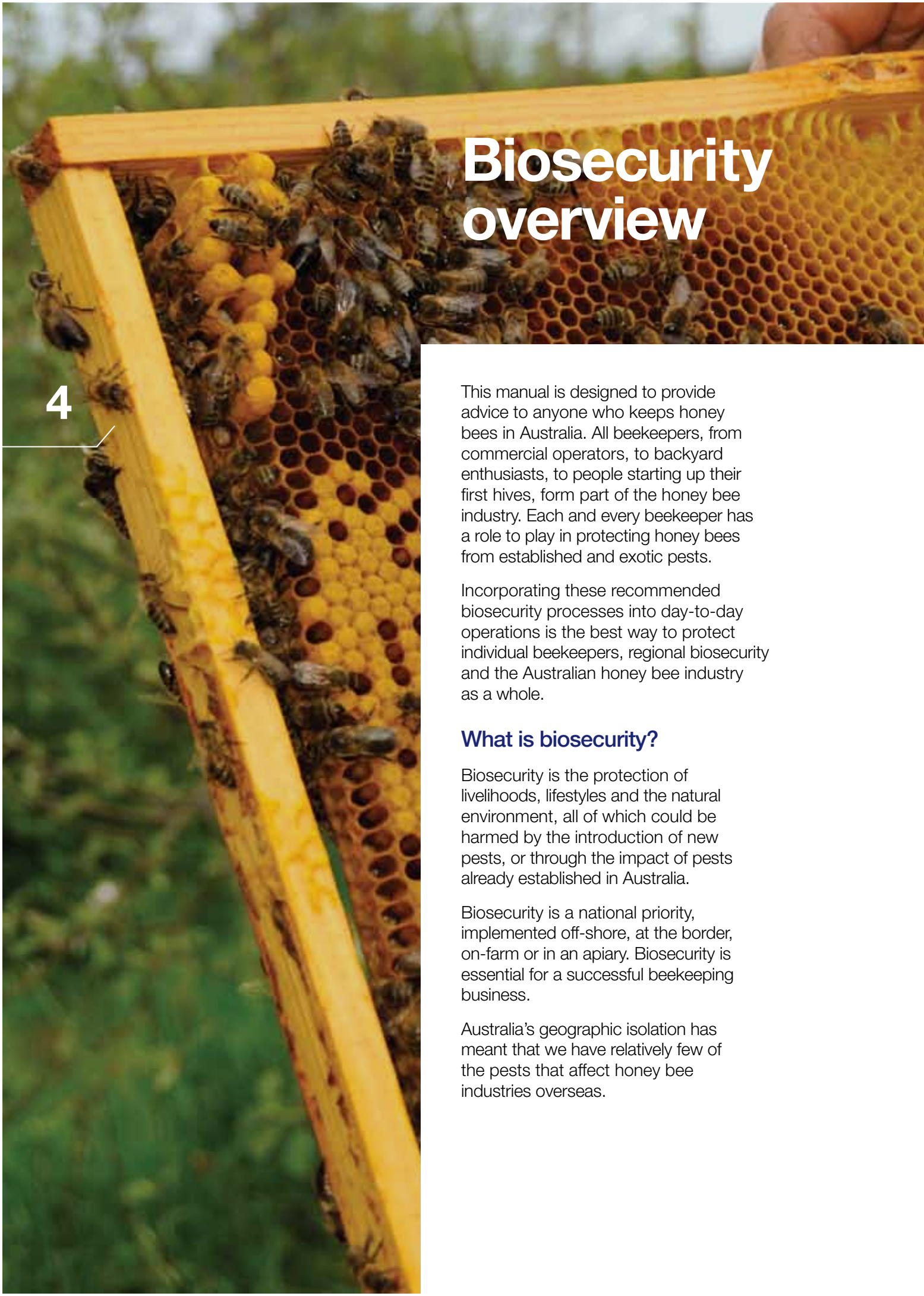
Respect and be aware of laws and regulations established to protect the honey bee industry, Australian agriculture and the local region.

**6. Report anything unusual**

If you suspect a new pest – **report it immediately to the Exotic Plant Pest Hotline**.

EXOTIC PLANT PEST HOTLINE
**1800 084 881**

3



# Biosecurity overview



This manual is designed to provide advice to anyone who keeps honey bees in Australia. All beekeepers, from commercial operators, to backyard enthusiasts, to people starting up their first hives, form part of the honey bee industry. Each and every beekeeper has a role to play in protecting honey bees from established and exotic pests.

Incorporating these recommended biosecurity processes into day-to-day operations is the best way to protect individual beekeepers, regional biosecurity and the Australian honey bee industry as a whole.

## What is biosecurity?

Biosecurity is the protection of livelihoods, lifestyles and the natural environment, all of which could be harmed by the introduction of new pests, or through the impact of pests already established in Australia.

Biosecurity is a national priority, implemented off-shore, at the border, on-farm or in an apiary. Biosecurity is essential for a successful beekeeping business.

Australia's geographic isolation has meant that we have relatively few of the pests that affect honey bee industries overseas.



Freedom from these exotic pests is a vital part of the future profitability and sustainability of Australia's honey bee industry. Biosecurity preserves existing trade opportunities and supports new market negotiations.

The definition of a **pest** used in this manual covers all insects, mites, snails, nematodes, pathogens (diseases) and weeds that may harm plants, plant products or honey bees. **Exotic** pests are those not currently present in Australia. **Established** (or **endemic**) pests are those present within Australia.

## What is honey bee biosecurity?

Honey bee biosecurity is a set of measures designed to protect a beekeeper's honey bees from the entry and spread of pests. Honey bee biosecurity is the responsibility of every beekeeper and every person visiting or working in an apiary.

Implementing honey bee biosecurity is essential for a beekeeper's business. If an exotic or endemic pest establishes in an apiary, business costs will increase (for monitoring, cultural practices, additional chemical use and labour), productivity will decrease (yield and/or colony performance) and markets may be lost. The health of the honey bee industry also ensures the continued success of many other plant industries that rely on honey bees for pollination.

Early detection and immediate reporting increases the chance of an effective and efficient eradication.

## Regional biosecurity

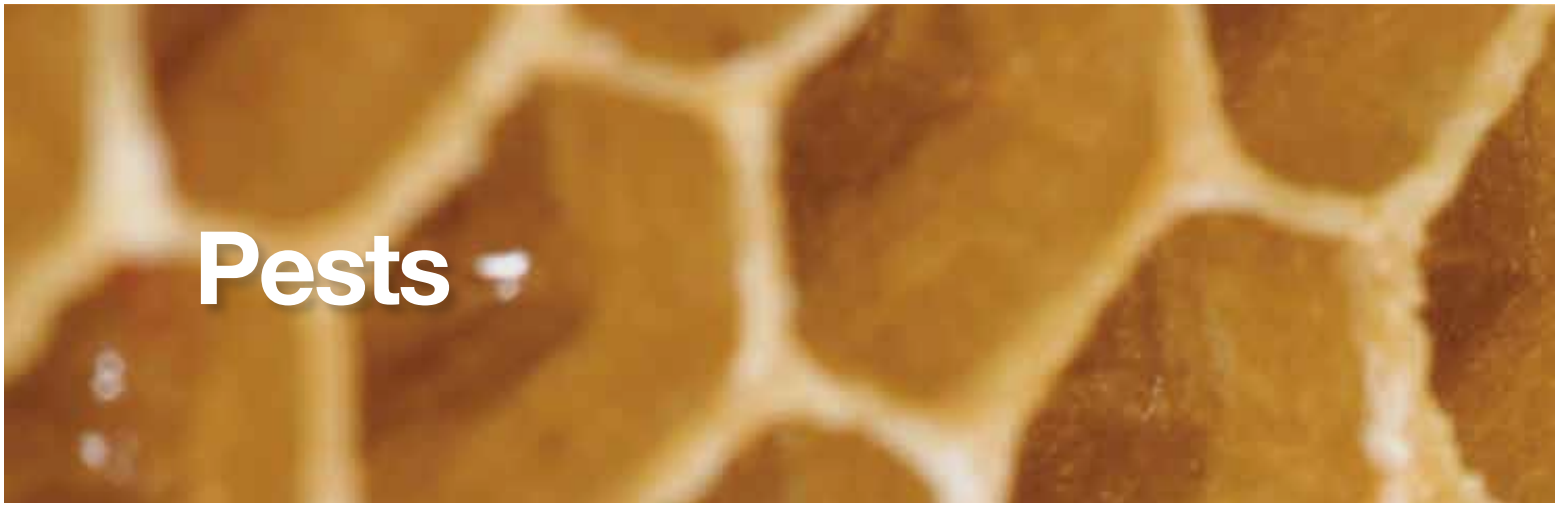
The biosecurity measures of an individual beekeeper can be enhanced by collaborating with others in a particular region. Through this collaborative approach, biosecurity threats to all apiaries in a region can be minimised.

Promotion of honey bee biosecurity at the regional level can be enhanced through the engagement of the community and by understanding the area's vulnerability, and the potential source and nature of threats. Neighbouring apiaries (managed or abandoned), feral colonies and/or unregistered hives are examples of potential biosecurity threats.

Regional biosecurity efforts are strengthened by identifying what resources and expertise are available, and by having a commitment from stakeholders to implement biosecurity measures and surveillance programs.

Implementation of honey bee biosecurity strategies underpins regional biosecurity, which in turn underpins national biosecurity.

Sam Malfroy



# Pests



## High priority exotic pests

These three exotic pests have been identified as high priority pests of the honey bee industry. The climate of Australian honey bee producing areas would allow each of these pests to survive, spread and establish should they be introduced. Any of these pests would have serious consequences should they enter and become established in Australia. Additional information on these pests is included in the fact sheets at the back of this manual.

These key pests were identified through the development of the Industry Biosecurity Plan (IBP) for the Honey Bee Industry. For a complete list of exotic pest threats for the honey bee industry, refer to the Honey Bee IBP available by contacting the Australian Honey Bee Industry Council (AHBIC) **www.honeybee.org.au** or Plant Health Australia (PHA) **www.phau.com.au**.

### Varroa mites (*Varroa destructor* and *V. jacobsoni*)

**OVERALL RISK – HIGH**

- External parasitic mites that feed on the haemolymph of both drone and worker bee larvae and pupae, and adult bees
- Detection possible by close examination of brood or testing of adult bees (p. 14-15)
- Symptoms include deformed pupae and adults (stunting, damaged wings/legs/abdomens), Parasitic Mite Syndrome (PMS) and colony decline
- Varroa mites can also spread viruses, further affecting the colony's health and disease susceptibility

Scott Bauer ARS/USDA www.bugwood.org

### Tracheal mite (*Acarapis woodi*)

**OVERALL RISK – HIGH**

- Internal parasite of the honey bee respiratory system
- Affects the honey bee's capacity to breathe, resulting in weakened and sick honey bees which have a reduced lifespan
- Symptoms include population drop, bees crawling on the ground and bees holding their wings at odd angles ("K wing") (right)
- Accurate identification requires dissection and microscopic examination of the bee's trachea

www.beekeepingforum.co.uk

### Tropilaelaps mites (*Tropilaelaps clareae* and *T. mercedesae*)

**OVERALL RISK – HIGH**

- External parasitic mites that feed on the haemolymph of both drone and worker bee larvae and pupae, and adult bees
- Detection possible by close examination of brood or testing of adult bees (p. 14-15)
- Symptoms include deformed pupae and adults (stunting, damaged wings/legs/abdomens), Parasitic Mite Syndrome (PMS) and colony decline
- Tropilaelaps mites can also spread viruses, further affecting the colony's health and disease susceptibility

Denis Anderson, CSIRO





## Priority established pests

Pests in this category are established in Australia, some only in localised areas and some widespread. These established pests can rapidly affect the strength and productivity of honey bee colonies and are difficult and expensive to manage. Beekeepers should monitor their hives frequently to check for the presence of these pests. Additional information on these pests is included in the fact sheets at the back of this manual.

### American foulbrood (*Paenibacillus larvae*)

- Fatal brood disease caused by a bacterium that is ingested by young bee larvae
- Spores germinate in the bee's gut and the developing bee usually dies at the pre-pupal or pupal stage
- Symptoms include irregular brood patterns, sunken and discoloured cell cappings with perforations
- Decaying infected larvae may be roped to a distance of 2-3 cm
- The bacterium is very infectious and remains dormant for over 50 years
- Present throughout Australia, but not confirmed in NT or Kangaroo Island (SA)

Food and Environment Research Agency (Fera), Crown Copyright

### Asian honey bee (*Apis cerana* Java genotype)

- Invasive and adaptive strain of Asian honey bee (AHB)
- Similar appearance to the European honey bee, although is slightly smaller, has more pronounced stripes on its abdomen and has an erratic flying pattern
- AHB cannot be managed for honey production or pollination, due to its frequent swarming and tendency to abscond
- Robs European honey bees of their honey stores and competes for floral resources
- Currently only present in the Cairns region (Qld)

CSIRO

### Black queen cell virus (*Black queen cell virus* (*Cripavirus*))

- Virus which causes mortality in queen bee larvae or pre-pupae
- Queen bee larvae or pre-pupae die after capping. The dead larvae or pre-pupae and the queen bee cell wall turn brown-black
- Symptoms reflect the appearance of worker bee larvae killed by Sacbrood virus (right)
- Black queen cell virus may be transmitted by *Nosema apis*
- Present throughout Australia, but not confirmed in NT

Food and Environment Research Agency (Fera), Crown Copyright



## Braula fly (*Braula coeca*)

- The Braula fly lives in honey bee colonies and attaches itself to the honey bee's mouth where it feeds on nectar and pollen
- Has a preference for attaching itself to queen bees which can decrease the efficiency and egg laying capability of queen bees
- Braula fly larvae tunnel under honey cappings which give honey comb cappings a fractured appearance
- Is only present in Tas and not on mainland Australia


Simon Hinkley and Ken Walker Museum Victoria, PADIL

## Chalkbrood disease (*Ascosphaera apis*)

- A fungus which is ingested by bee larvae causing death by starvation
- Symptoms include scattered brood with perforated cappings
- The larva dies after the cell is capped and becomes covered by the white/grey fungus, causing the diagnostic 'mummies'
- Incidence is usually greater when the colony is under stress due to cool weather or poor nutrition
- Present throughout Australia, but not confirmed in NT

Food and Environment Research Agency (Fera), Crown Copyright

## European foulbrood (*Melissococcus plutonius*)

- A brood disease caused by a bacterium that is ingested by honey bee larvae causing death by starvation
- Symptoms include spotted brood pattern intermingled with healthy brood, sunken and greasy cappings and a foul smell
- Infected larvae die before their cells are capped in a twisted position and become yellow-brown
- Incidence is usually greater when the colony is under stress due to cool weather or poor nutrition
- Present throughout Australia, except in WA, NT and Kangaroo Island (SA)

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## Greater wax moth (*Galleria mellonella*) and Lesser wax moth (*Achroia grisella*)

- Pests of weak and stressed colonies and combs in storage
- Both moths are a similar grey colour and tend to coexist in the same location (Greater wax moth pictured right)
- Both species prefer brood combs and eat wax, pollen and remains of larval honey bees, leaving behind silk webbing and silk lined tunnels
- Larvae spin white silk cocoons on frames and hive body parts which damages parts of the hive
- Both species are present throughout Australia

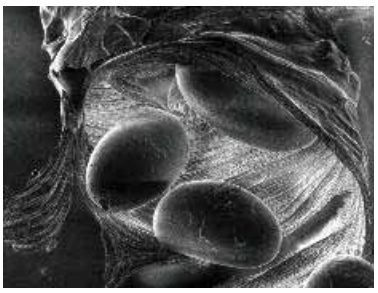

Simon Hinkley and Ken Walker Museum Victoria, PADIL





## Nosemosis (*Nosema apis* and *N. ceranae*)

- Disease caused by two species of microsporidian parasites which can infect drones, worker bees and queen bees
- Spores germinate in the bee's gut and may cause a declining hive population, poor honey production, reduced brood production and dysentery in and around the hive
- Infection results in reduced colony health and performance, as well as heavy winter losses
- Both species are present throughout Australia, except *N. ceranae* which is not present in WA



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## Sacbrood virus (*Sacbrood virus* (*Iflavirus*))

- A virus that affects bee larvae after consuming contaminated water, pollen or nectar
- Symptoms include scattered dead brood with discoloured, sunken or perforated cappings
- Infected larvae die shortly after capping and have a yellowish appearance as the larva becomes a fluid filled sac. The skin of the dead larva changes into a tough plastic-like sac
- Present throughout Australia, but not confirmed in NT

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## Small hive beetle (*Aethina tumida*)

- Brown-black beetle that consumes honey bee eggs, brood, pollen and honey within the hive, as well as laying eggs throughout the hive
- The hatched larvae chew through the combs causing the honey to ferment and the hive to become 'slimed out'
- Large numbers of Small hive beetle can result in the death of the colony or the colony absconding
- Present in NSW, Qld, Vic and parts of SA and WA, but has not been reported in NT or Tas

James D Ellis University of Florida www.bugwood.org

It is important to find out which pests are reportable in your local area. Some may have been found in your state or territory, but not in your region. If detected, contact your local department of agriculture.

Always obtain a health certificate which has been signed by an apiary inspector from the state or territory of origin before the interstate movement of honey bees, including queen bees, hives, honey bee products and used apiary equipment.

# Keeping honey bees healthy

## 10 Controlling pests and diseases

Many beekeepers in Australia move their hives for pollination contracts and to follow honey flows. This movement of hives, as well as the drifting and robbing habits of honey bees means that the spread of pests and diseases can be difficult to prevent or contain. However, the adoption of the following biosecurity related measures in day-to-day management practices will help minimise the risk of pest and disease transmission between honey bee colonies and apiaries.

### Purchase clean hives and equipment

- Purchase honey bees and equipment only from beekeepers that regularly check for established and exotic pests and diseases.
- Examine the colony and hive parts before purchase to ensure they meet the required standard and are pest and disease free.
- Isolate newly purchased hives for up to 6-12 months until satisfied of their health status.
- Sterilise or irradiate second hand beekeeping equipment before using in the apiary.

### Clean apiary equipment regularly

- Clean smokers, hive tools and other apiary equipment of any accumulations of wax, propolis or honey before commencing work at each new apiary, particularly if any pest or disease is suspected.
- Always clean extracting machines, drums or containers before and after use.
- Ensure honey containers are cleaned inside and out and dried and sealed before use.

### Dispose of waste material effectively

- Make sure that honey spills, exposed combs and wax are destroyed or covered to prevent robbing by honey bees.
- Maintain good hygiene practices around the apiary and remove beeswax scraps, old combs and dead-out colonies, which can attract and harbour pests and diseases.

Sam Malfroy



**Implement a health program**

- Develop a science and evidence based understanding of pest and disease risks for each apiary.
- Develop appropriate measures for pest and disease control and record all treatment details.
- Implement a barrier management system to reduce the risk of spreading pests and diseases within and between apiaries.
- Control swarming in colonies by providing extra space for the colony during build up and remove queen cells to keep the colony population strong and healthy.
- Regular comb replacement can improve honey bee health. New frames for each hive should be assembled with a new wax or plasticfoundation at least every 4 years.
- Requeen colonies every 2 years with a young and healthy queen bee from a reputable breeder.
- Inspect brood combs on a regular basis throughout spring, summer and autumn.

All pest and disease (exotic and established) surveillance activities on the property or apiary should be recorded. These records can be used in the response to an incursion to inform management practices as well as provide support to industry surveillance activities.

# 12 Inspecting hives

It is critical to inspect all hives on a regular basis, especially the brood. This is an important management practice to determine the presence or absence of many established pests and diseases within Australia. It is also an important precautionary measure for beekeepers to identify any exotic pests that may be in their hives, such as the exotic Varroa mite. The following are guidelines for every beekeeper to follow when inspecting hives.

Carly Housley

**Getting started:**

- Examine the brood and colony at least several times a year during spring, summer and autumn.
- Make sure that the circumstances are suitable to inspect the colony. For instance, do not start the inspection if the weather is likely to be wet or cold, or if there are people or animals in the vicinity.
- Make an assessment of the level of activity at the entrance of the hive. Observe whether honey bees are flying, if there are any dead honey bees, or if honey bees are bringing in pollen.
- Always be calm and methodical when working with hives, and try to avoid any sudden or sharp actions.

**Opening the hive:**

- Remove the hive lid and any supers and place them to the side of the hive.
- Use the smoker sparingly to control the honey bees. Smoke the honey bee colony from the top down, as smoking from the bottom will drive the honey bees upwards.
- If the hive has a queen excluder, carefully remove it with the aid of a hive tool.

Opening up the hive



- Clean up any brace/burr comb or propolis from the queen excluder or on the top of the frames and place into a sealed container that can be taken away with you. Do not discard this on site as honey bees could rob this material which could then spread pests or diseases.
- Remove an end frame and place on the side of the hive to give more space to remove a centre frame without damaging the honey bees.

Removing a brood frame

**Inspecting the hive:**

- Remove a brood frame and inspect to see if the queen bee is on it. Place the frame with the queen bee back into the hive or remove the queen bee and place in a temporary queen bee cage.
- Remove a brood frame without the queen bee and shake or brush away most of the honey bees back into the hive or at the hive entrance, leaving the brood comb clear for inspection.
- Hold the frame by the top bars and inspect the brood thoroughly and in a regular pattern.
- Look for symptoms associated with exotic and established pests and diseases of honey bee colonies.
- Look for any queen bee cells on the comb surface and bottom side of the comb, and if present, remove to prevent swarming.
- Repeat this for all brood frames in the hive.
- Place combs back in the hive with care and push the frames tightly together to provide the correct bee space.
- Keep records of inspections, write down any occurrence of pests and diseases and look at possible control or management options.
- If anything suspicious is observed report it immediately to the Exotic Plant Pest Hotline.

Inspecting brood comb

Sam Malfroy

# 14 Early detection of exotic mites

When inspecting any hives, it is important to always be aware of the possibility that they could contain exotic pests. Exotic mites, such as *Varroa* sp. pose a constant threat to Australia's honey bee industry and beekeepers are in the front line for early detection. Early detection and reporting improves the chances of containing and eradicating any new pests.

Every beekeeper should include checks for external parasites in routine inspections of hives. The two methods listed below are simple procedures that should form part of a comprehensive health and surveillance program for honey bees. For more information about monitoring for Varroa and determining mite colony threshold levels, download Daniel Martin's Churchill Fellowship report at **www.churchilltrust.com.au/site_media/fellows/Martin_Daniel_2010.pdf**.

## Uncapping drone brood

Up to 85% of Varroa mites in a honey bee colony are in capped brood cells. Since Varroa mites prefer reproducing on drone brood, uncap ~100 drone brood and remove individual drone pupae (right). **Please note** that this will kill the drone brood.



Examine each pupa for reddish-brown mites, which can be clearly seen against the healthy pearly white bodies of the drone pupa (left and above). Once the drone pupae are removed, check the bottom of the drone brood cells for any mites that may not have been attached to the removed drone pupae (below).

It is recommended that every beekeeper conduct this method as it is fast and can be easily carried out as part of a routine inspection. Uncap drone brood on at least three brood frames from randomly selected hives from each apiary. This should be conducted in early spring and at other times of the year when drone brood is present.



## Sugar shaking honey bees

Sugar shaking honey bees is a quick and easy method to detect external parasites such as Varroa mites. It does not kill the honey bees and removes 70-90% of external Varroa mites present. The sugar shaking method works because the sugar particles, and the grooming behaviour that it stimulates in honey bees, helps dislodge any Varroa mites for detection.


To sugar shake honey bees, add 1 tablespoon of pure icing sugar and approximately 300 honey bees (1/2 a cup) into a container that contains 1/8 gauze wire mesh for a lid (left). Roll and gently shake the honey bees for 2-3 minutes, ensuring the honey bees are covered in sugar. Leave for 2-3 minutes and then roll and shake the honey bees again for 2-3 minutes.

Shake the sugar out of the container through the wire mesh onto a white piece of paper or cardboard and look for any Varroa mites (right). The sugar and any Varroa mites (if present) will pass through the mesh, leaving the honey bees in the container.



Once completed, return the honey bees coated in icing sugar back to the hive (left). This process should be conducted on at least 10% of hives in an apiary. For more information about sugar shaking honey bees and the specific steps involved, contact the local department of agriculture or download the *NSW DPI Primefact 153 – Sugar shaking bees to detect external parasites.*

**If any mites are found using either of these methods, or if you see anything unusual, call the Exotic Plant Pest Hotline on 1800 084 881.**

**EXOTIC PLANT PEST HOTLINE**
**1800 084 881**

# Pest surveillance

## 16 Importance of pest surveillance

Apiary monitoring and surveillance involves looking for and recording the presence, absence and population levels of pests. Regular monitoring is a fundamental part of honey bee management practices and gives the best chance of spotting an exotic or established pest soon after it arrives.

Pest surveillance is necessary because of:

- **Market access:** Export destinations for honey bees can require 'evidence of absence' data for exotic as well as some established pests that are of concern. The Australian honey bee industry, in collaboration with governments, must prove through surveillance that exotic and/or established pests have been looked for and found to be absent.
- **Exotic pest eradication:** Early detection of exotic pests improves the chance of eradication or containment within a region. However, if eradication or containment is not feasible, early detection, in conjunction with contingency planning and preparedness by government and industry bodies (e.g. preparing emergency chemical registrations, awareness material and training in pest diagnostics) assists with more rapid and effective response management.

## Report suspect pests or symptoms

Early detection and reporting of any suspect pests or symptoms may prevent or minimise long-term damage to the honey bee industry and reduce any quarantine period that an apiary, or apiaries, are placed under.

When inspecting hives, look for unusual symptoms such as poorly formed honey bees with deformed wings (below), thoraces and abdomens as well as general honey bee colony symptoms of rapid population decline, or a low bee to comb to brood ratio. Also be aware of any mites that are observed on the honey bees or in the brood.

CSIRO

Worker European honey bee with wing deformities as a result of Varroa infestation



**If you observe any unusual symptoms or detect any mites on your honey bees or in the brood report it immediately via the Exotic Plant Pest Hotline on 1800 084 881.**

Calls to the Exotic Plant Pest Hotline will be forwarded to an experienced person in the state or territory government, who will ask some questions about what you have seen and may arrange to collect a sample.

Do not send samples without first speaking to someone from the state or territory department of agriculture, who can discuss the correct type of sample, its packaging, handling and transport to the laboratory assigned for diagnosis.

In some states and territories, the Exotic Plant Pest Hotline operates only during business hours. Outside these hours, leave your full contact information and a brief description of the issue and your call will be followed up as soon as possible. Every report will be taken seriously and treated confidentially.

If a beekeeper has found a suspected exotic pest, the following general precautions should be taken immediately to contain the pest and protect your apiary:

- Mark the hive or area where the pest was found. Limit access to both the apiary and area for both people and equipment.
- Wash hands, clothes, apiary equipment and vehicles that have been in contact with the suspect hive/s or apiary. Make sure sick or infested honey bees are not removed from the apiary or area.
- Stop beekeeping operations immediately while waiting for the identification of the suspected exotic pest.

If a suspected or confirmed honey bee Emergency Plant Pest (EPP) is identified, every beekeeper should follow the simple guidelines listed below:

- Always follow the relevant state or territory regulatory requirements and the directions given by the state or territory apiary inspectors.
- Do not move, or attempt to move any hives from the Infected Premises or apiary site.
- Always adhere to any movement restrictions that apply to hives, honey bee products, machinery or equipment within the Control and Restricted Areas.
- If requested, provide the relevant state or territory apiary inspector with a list of known beekeepers who own hives within the Control and Restricted Areas or Quarantine Zone.
- It is important to work with the various state or territory apiary inspectors. Emergency Containment and preserving the ability to eradicate the EPP is the first priority for all parties.

Following these guidelines provides the best protection for every beekeeper and the entire honey bee industry.

**If you see anything unusual, call the Exotic Plant Pest Hotline.**

EXOTIC PLANT PEST HOTLINE
**1800 084 881**

18

## The Emergency Plant Pest Response Deed

The (EPPRD) is a formal, legally binding agreement between the Australian Government, state and territory governments, plant industry signatories and Plant Health Australia (PHA).

As a signatory to the EPPRD, the Australian Honey Bee Industry Council (AHBIC) has a seat at the decision making table and also contributes to funding if an approved Response Plan is implemented to eradicate an Emergency Plant Pest (EPP).

Under this agreement the Australian honey bee industry has a responsibility to report suspect pests. The earlier a new pest is detected, the greater the chance an eradication response will be mounted and the more likely it will be successful.

## Owner Reimbursement Costs

Under the EPPRD, beekeepers may qualify for Owner Reimbursement Costs (ORCs) for direct costs incurred as a result of the implementation of an approved Response Plan. ORCs may apply to direct beekeeper losses such as the destruction of the honey bee colony, hive parts and/or honey stocks. ORCs may also cover the replacement of hive material and additional chemical treatments.

Calculation of ORCs is prescribed in the EPPRD, including the different formulae used to accommodate the wide range of crops grown by industry signatories. Honey bee ORCs are calculated using the “Bees, hives, honey and associated products” formula. To ensure that these calculations are accurate, beekeepers should keep records of key information.

It is important to remember that ORCs only apply to approved Response Plans aimed at eradication, which are more likely to be developed following early reporting.

For more information on the EPPRD refer to **www.phau.com.au/epprd**.

19

David Cappaert, Michigan State University, Bugwood.org

# Product management



## Queen bees and packaged bees

Use only clean and healthy queen bees and packaged bees (i.e. tested with no pest or disease detections) from reputable breeders. This assists in managing biosecurity risk as it is hard to visually assess the health of purchased queen bees or packaged bees. Viruses, bacteria and mites may not induce symptoms under some circumstances.

To minimise the risk of introducing pests or diseases into an apiary:

- Obtain queen bees and/or packaged bees only from an apiary that takes biosecurity, hygiene, health testing and record keeping seriously.
- Check package bees and queen bees and the brood that is produced thoroughly within one month of arrival.
- Maintain a register of the apiary's purchased queen bees and packaged bees, including their source (with contact details), breed/strain, locations, what was bought and the date of possession of the new honey bees.

Sam Malfroy

Queen cell cages



## Pollination

Every beekeeper should aim to use best industry practices to provide a high standard of pollination service. When placing hives for pollination, many beekeepers and growers find it preferable to use a pollination contract that specifies the responsibilities of both parties. Contracts are useful to clarify what the grower is hiring and what the beekeeper needs to supply.

Some of the issues raised in a contract should include:

- hive stocking rates
- strength of hives
- dates of hive introduction and removal
- placement of hives
- payment of fees
- protection from spray damage.

For more information about pollination and providing pollination services, download the RIRDC report '*Pollination of Crops in Australia and New Zealand*' by M. Goodwin released at the end of 2012.

Honey bee forager on an orange blossom

## Honey and specialist products

Honey, comb honey, wax, pollen, royal jelly and propolis are all specialist products that are produced by beekeeping operations in Australia. In order to produce honey and specialist products of the highest standards, every beekeeper should follow industry best management practice guidelines which are outlined in quality assurance schemes.

To minimise the environmental impacts of beekeeping, every beekeeper should follow the guidelines that are published in the '*National Best Management Practice for Beekeeping in the Australian Environment*' which was published by AHBIC, DAFF Commonwealth and NSW DPI in 2007. This report is available at **www.honeybee.org.au**.

Tim Malfroy

Frame of honey comb

# Biosecurity and quality assurance



## Barrier management system

The main way that pests and diseases are spread between hives and apiaries is through the transfer of infested materials and disease contaminated equipment. Unfortunately, it is not always possible to know if equipment is contaminated, so it is better to be cautious to prevent spreading the pest or disease from infected to healthy colonies. One way to reduce any possible transfer is to use a barrier management system.

The barrier management system is used to separate hives or apiaries into different units. This prevents the interchange of honey bees, combs, honey and hive components from one unit (hive, loads of hives or apiary) to another. The adoption of this system can also enhance traceability, biosecurity and quality assurance aspects of the beekeeping enterprise, as well as building on best practice principles.

Barrier management systems alone are not a replacement for good beekeeping and good pest monitoring and management.

## B-Qual

Auditable quality assurance schemes can be valuable to beekeepers with benefits to biosecurity, market access, meeting specifications, customer expectations and food safety. The B-Qual Australia Program is an industry owned quality assurance scheme that allows beekeepers and honey packers to meet food safety and biosecurity requirements. If an apiary or business is accredited with B-Qual it is likely that some fundamental techniques of biosecurity best practice are already being applied.

B-Qual standards are underpinned by best beekeeping and processing practices, which have been backed by research into hygiene, quality and chemical residues. Quality standards have been developed for apiary operations, extraction and packing plants, biosecurity procedures, organic production and other specialised activities.

For further information about B-Qual, or if you are considering signing up to B-Qual go to **www.honeybee.org.au** or call 1800 630 890.



## Biosecurity signs

Well-designed signage informs visitors that biosecurity management of honey bees within an apiary is important, and that there is a shared responsibility for maintaining it. The signs serve to alert people that they should register their presence before entering the apiary, as well as demonstrating a beekeeper's commitment to apiary hygiene and safety.

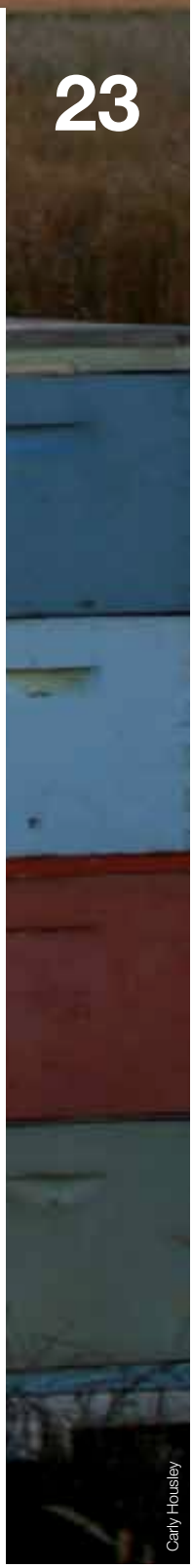
Biosecurity signs at entrances to a property or apiary should provide the name of the beekeeper along with a contact phone number. In cases where hives are transported to different sites, signs should accompany hives and be placed at the new apiary site.

Biosecurity signs are also important when the apiary is situated on another property, providing contact details in case of chemical spraying or a biosecurity incident, such as an exotic pest detection.

Beekeepers can produce their own biosecurity signs using templates provided in the honey bee section of the Plant Health Australia website **www.phau.com.au**.


One template is for a 600 x 900 mm corflute panel with four eyelets to be placed on gates to properties or apiaries. The second is for an A4 corflute sign that can be staked at each apiary or moved around with each load of hives.


Trevor Monson, Australian Pollination Services



Carly Housley

# Movement of hives, honey bee products and equipment

## 24 Movement of hives

The movement of hives for a honey flow or pollination contract can easily spread pests and diseases to other regions or apiary sites. Adopt the following management measures to reduce this risk.

- Minimise hive movements where feasible, and understand the stress that is placed on honey bee colonies that are regularly moved.
- Ensure that hives, honey and apiary equipment are secured and covered to prevent robbing by honey bees.
- When moving hives to a new location, assess any disease threat posed by possible abandoned or mismanaged hives nearby.
- Always obtain a health certificate which has been signed by an apiary inspector from the state or territory of origin before the interstate movement of hives.
- Find out which established pests are reportable for the region you are moving from, and to. If detected, contact the local department of agriculture (see contacts on page 28).

## Movement of honey bee products

Each state and territory has different restrictions on the interstate movement of honey and honey bee products, such as wax, propolis and pollen. Before moving any of these products interstate, always contact the local department of agriculture for advice on any specific health certification requirements (see contacts on page 28).

Lewin Goodwin-Brickhill

Moving hives to a new apiary

Keep accurate records of hive movements so that in the event of an incursion of an exotic pest or disease, trace back information about hive movements can be provided to identify possible risk areas for targeted surveillance.



## Movement of vehicles and machinery

Vehicles and all apiary equipment, including forklifts, trucks, hand tools and bee boxes can carry pests and diseases in adhering honey and wax. Pest and diseases can then spread, or be introduced to a previously clean apiary.

Take the following measures to reduce the risk of pest and disease entry on equipment and vehicles:

- Clean and wash down vehicle trays of honey, wax and associated colony debris, especially after visiting other apiaries.
- Limit the movement of vehicles within the apiary.
- Always make sure that borrowed and second-hand apiary equipment and machinery is cleaned and sterilised before moving into the apiary.
- Regularly clean and sterilise all tools and equipment, including hive tools, gloves, pallets, boxes and any other equipment used in the apiary.

While inspecting and cleaning machinery can seem onerous, remember that it is easier and cheaper than dealing with a new pest or disease.

## Movement of vehicles and apiary equipment between properties and apiaries

As well as ensuring good honey bee hygiene, beekeepers who travel to farms or properties need to consider farm biosecurity.

Pests, diseases and weeds carried in soil, apiary equipment, on vehicles, clothing and boots can introduce pests that are very damaging to other producers or to the natural environment.

- Always consider farm biosecurity when entering a property.
- Be aware of other industries' biosecurity risks and requirements.
- Adopt a ‘come clean, go clean’ policy wherever possible.
- Talk to the landholder about areas that have been visited or any specific biosecurity concerns that apply to their property.

For more information on farm biosecurity go to **www.farmbiosecurity.com.au**.

Sam Malfroy

# Biosecurity best practice checklist



Sam Malfroy

This list of recommended biosecurity practices allows beekeepers to self-assess their honey bee management. While all practices may not be applicable, working through the list will highlight the strengths and weaknesses of an apiary. This ensures the apiary has the best protection against the introduction and spread of new pests and diseases.

Once identified, a few simple and practical procedures can be implemented to strengthen areas of greatest risk. While changing everyday practices can take more effort in the short term, these will become second nature with time and are easier and cheaper than dealing with the introduction of a new pest.

Sam Malfroy

## Date of biosecurity check: _____

| RECOMMENDED PRACTICES | YES | NO | COMMENTS |
|---|---|---|---|
| **Pests** | | | |
| Apiary staff are familiar with common established pests and diseases and the high priority exotic pests of honey bees | | | |
| Hives regularly inspected for pests and diseases | | | |
| Apiary staff know how and where to report pests and diseases | | | |
| Pest surveillance regularly conducted, with activities and results recorded even when nothing is found | | | |
| Sugar shaking and/or uncapping drone brood forms part of a routine health surveillance program to detect any potential exotic mites | | | |
| A science and evidence based health program to monitor and manage pests and diseases is implemented | | | |
| Pest threat posters and manuals displayed and updated | | | |
| **Product management** | | | |
| Queen bees and packaged bees are certified or have a defined and documented health status | | | |
| Queen bees, packaged bees and newly produced brood are thoroughly checked within one month of arrival | | | |
| Records of queen bees and packaged bees and its source are maintained | | | |
| Apiary staff are aware of symptoms of honey bee pests spread with queen bees and packaged bees | | | |
| No exposed honey, wax and colony debris is left on vehicles and apiary equipment | | | |
| Honey and other products loaded and unloaded on paved or sealed pad away from production areas | | | |
| Waste material disposed of away from production areas (preferably buried or burnt to keep it from foraging bees) | | | |
| Biosecurity and quality assurance schemes such as B-Qual or a barrier management system are adopted | | | |
| Industry best management practices are adopted in the production of queen bees and packaged bees, honey and specialist products and in pollination services | | | |
| **Equipment and vehicles** | | | |
| Wash down facilities are provided and used to clean vehicle trays of honey, wax and associated colony debris, especially after visiting other apiaries | | | |
| All tools and equipment are regularly cleaned and sterilised, including hive tools, gloves, pallets, boxes and any other equipment used in the apiary | | | |
| Discussions are held with landholders about spreading pests and diseases that are significant to them or their industry | | | |
| Borrowed and second-hand machinery and equipment is cleaned and sterilised before use | | | |
| Before the movement of hives and honey bee products and equipment interstate, beekeepers should always contact their local department of agriculture on any specific health certification requirements | | | |

# Further information



Contact the organisations and agencies below for more information on biosecurity, apiary hygiene, interstate health certificates, pests and diseases and the Australian honey bee industry.

| | Useful contacts | Contact details |
|---|---|---|
| ORGANISATION | **Australian Honey Bee Industry Council** | **Phone:** 02 9221 0911<br>**Website:** www.honeybee.org.au |
| ORGANISATION | **Plant Health Australia** | **Phone**: 02 6215 7700<br>**Email**: biosecurity@phau.com.au<br>**Website**: www.planthealthaustralia.com.au |
| ORGANISATION | **Farm Biosecurity** | **Phone**: 02 6215 7700<br>**Email**: info@farmbiosecurity.com.au<br>**Website**: www.farmbiosecurity.com.au |
| GOVERNMENT | **Australian Government – Department of Agriculture, Fisheries and Forestry** | **Phone**: 02 6272 3933<br>**Website**: www.daff.gov.au |
| GOVERNMENT | **New South Wales – Department of Primary Industries** | **Phone**: 1800 808 095 or 02 6391 3100<br>**Website**: www.dpi.nsw.gov.au |
| GOVERNMENT | **Northern Territory – Department of Resources** | **Phone:** 08 8999 5511<br>**Website:** www.nt.gov.au/d/ |
| GOVERNMENT | **Queensland – Department of Agriculture, Fisheries and Forestry** | **Phone**: 13 25 23 or 07 3404 6999<br>**Website**: www.daff.qld.gov.au |
| GOVERNMENT | **South Australia – Department of Primary Industries and Regions** | **Phone**: 1300 666 010 or 08 8207 7975<br>**Website**: www.pir.sa.gov.au |
| GOVERNMENT | **Tasmania – Department of Primary Industries, Parks, Water and Environment** | **Phone:** 1300 368 550<br>**Website:** www.dpiwe.tas.gov.au |
| GOVERNMENT | **Victoria – Department of Primary Industries** | **Phone**: 13 61 86 or 03 5332 5000<br>**Website**: www.dpi.vic.gov.au |
| GOVERNMENT | **Western Australia – Department of Agriculture and Food** | **Phone**: 08 9368 3333<br>**Website**: www.agric.wa.gov.au |

EXOTIC PLANT PEST HOTLINE
**1800 084 881**

Carly Housley

# Production records



The following four pages are examples of records that every beekeeper should keep. Not only does it make good business sense to keep these records, they could be crucial if a beekeeper becomes affected directly, or indirectly, by the incursion of an exotic pest and a subsequent eradication program. A production record summary with supporting documentation will increase the accuracy of Owner Reimbursement Cost (ORC) calculations if required during an eradication program for an Emergency Plant Pest under an approved Response Plan. For more information about honey bee ORCs see page 18.

An electronic version of this production record to download and fill out every year/season can be downloaded from the Honey Bee section of the PHA website **www.phau.com.au**.

**Year/Season:** _____

| **Capital items for business** | | | |
|---|---|---|---|
| **Item** | Item details | Amount (at purchase) | Cost (current value) |
| Items used in the beekeeping business (extracting machine, vehicles, apiary equipment etc.) | | | |
| **Hive costs** | | | |
| **Hive costs** | Total value ($) | Evidence (e.g. receipt) | |
| New hive parts purchased this year (boxes, frames, foundation, excluders etc.) | | | |
| Feeding per hive (pollen, sugar syrups etc.) | | | |
| **Hive and material value** | | | |
| **Stocktake of hives and material** | Item details | Amount (at purchase) | Cost (current value) |
| Hives | | | |
| Supers | | | |
| Nucleus hives | | | |
| Miscellaneous (bee suits, escape boards, excluders, feeders etc.) | | | |

| Stored products | | | | | |
|---|---|---|---|---|---|
| **Products stored** | Product/ variety | Time period of storage | Amount (kg) | Estimated value | Evidence (quote) |
| | | | | | |

| Beekeeping and production costs | |
|---|---|
| **Time** | Total apiary staff hours for hive management |
| | Total apiary staff hours for assembling hive parts |
| | Total apiary staff hours for production of honey and specialist products (extracting etc.) |
| **Machinery costs** | Costs to run vehicles in hive management |
| | Costs to run machinery in production of honey and specialist products (extracting machine etc.) |
| **Contractor costs** | Costs of employing a worker over peak production periods (if used) |

| Net profit from season | | |
|---|---|---|
| **Total sales** | Value | Evidence (e.g. receipt) |
| | | |
| **Total costs** | Value | Evidence (e.g. receipt) |
| | | |
| **Total net profit** | Value | Evidence (e.g. receipt) |
| | | |

**Year/Season:** _____

## Honey production

| Number of hives | Honey produced (variety) | Honey production total (kg) | Average yield (kg/hive) | Wholesale price ($) | Honey sold wholesale (kg) | Retail price ($) | Honey sold retail (kg) | Total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

## Comb honey production

| Comb honey produced (variety) | Boxes of comb honey produced (#) | Comb honey ($ per box) | Comb honey sold total value ($) | Wholesale price ($) | Comb honey sold wholesale (kg) | Retail price ($) | Comb honey sold retail (kg) | Total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

## Wax production

| Wax produced (kg) | Wax sold ($/kg) | Wax total value ($) | Wholesale price ($) | Wax sold wholesale (kg) | Retail price ($) | Wax sold retail (kg) | Total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Pollen production

| Pollen produced (kg) | Pollen sold ($/kg) | Pollen total value ($) | Wholesale price ($) | Pollen sold wholesale (kg) | Retail price ($) | Pollen sold retail (kg) | Total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

## Queen bee production

| Queen bees sold | Queen bee value ($ per queen) | Queen bees sold at that price (#) | Queen bees sold total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|---|
| | | | | |

## Nucleus hive production

| Nucs raised | Nucs sold | Nuc value ($ per nuc) | Nucs sold total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|---|
| | | | | |

## Pollination contracts

| Crop | Number of hives | Price ($ per hive) | Length of pollination contract (weeks) | Total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|---|---|
| | | | | | |

## Packaged bee production

| Number of packages sold | Price ($) | Total value ($) | Evidence (e.g. receipt) |
|---|---|---|---|
| | | | |

* An electronic version of this Production Record can be downloaded from the PHA Honey bee website **www.planthealthaustralia.com.au**

EXOTIC PEST

# Varroa mites

## What are Varroa mites?

Varroa mites (*Varroa destructor* and *V. jacobsoni*) are external parasites of adult honey bees, and drone and worker bee brood. Varroa mites feed and reproduce on larvae and pupae, causing malformation and weakening of honey bees as well as transmitting numerous viruses. Heavy Varroa mite infestations can build up in 3-4 years and cause scattered brood, crippled and crawling honey bees, a reduction in honey bee population, supersedure of queen bees and ultimate colony breakdown and death of the hive.

Kathryn Sparks, AQIS, Victoria

Varroa mites can be easily seen on developing pupae

## What do they look like?

Adult female Varroa mites are oval, flat, red-brown and around 1.1 mm long and 1.5 mm wide. They can be seen with the naked eye. Varroa mites complete their life cycle in honey bee brood and can be observed in both drone and worker bee brood. Examining the brood involves uncapping brood (preferably drone) to check for the dark mites in the cell and against the pearly white bodies of the developing brood. They can also be observed between the sclerites and between the head and thorax on adult worker bees and drones.

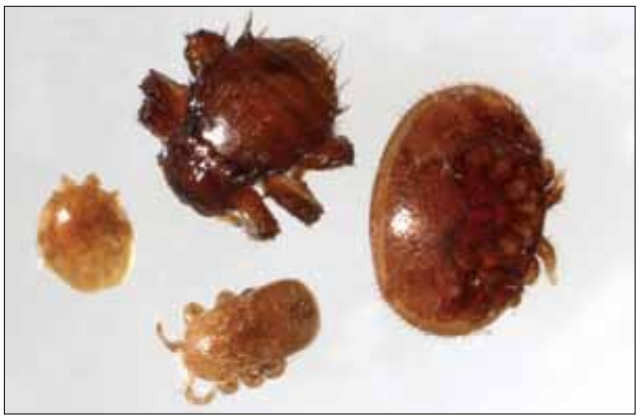
Kathy Keatley Garvey, UC Davis Department of Entomology

Varroa mite on a forager worker bee

## What can they be confused with?

Varroa mites could be confused with the Braula fly (*Braula coeca*) which is red-brown, 1.5 mm long, covered in spine like hairs and has six long legs. This pest is currently only present in Tasmania and is generally considered quite harmless. Varroa mites could also be confused with Pollen mites (*Mellitiphis alvearius*) which are light brown and are around 0.75 mm long and 0.75 mm wide. Pollen mites are not harmful to honey bees but are sometimes found in hives.

Varroa mites could also be confused with other exotic parasitic mites, most notably Tropilaelaps mites (*Tropilaelaps clareae* and *T. mercedesae*). If any mites are observed on adult honey bees or in the brood, call the Exotic Plant Pest Hotline immediately on 1800 084 881.



Food and Environment Research Agency (Fera), Crown Copyright

Braula fly (top), Varroa mite (right), Tropilaelaps mite (bottom) and Pollen mite (left)

## What should beekeepers look for?

Symptoms are dependent on the level of Varroa mite infestation, the level of brood within the colony and the potential of viral infections transmitted by the Varroa mites. Colonies with low infestation generally show very few symptoms. As Varroa mite infestation grows, it results in the significantly reduced weight of worker bees and drones, impaired flight performance and a lower rate of return to the colony after foraging, a reduced lifespan as well as deformed wings and abdomens. Colony symptoms, commonly called Parasitic Mite Syndrome (PMS), include a reduction in the adult honey bee population, loss of coordinated social behaviour, distorted and deformed honey bees, a scattered brood nest with dead or uncapped brood and rapid honey bee de-population in the colony.

## How do they spread?

Varroa mites can spread through drifting drones and worker bees as well as through swarms and absconding colonies. The transport and movement of hives, used beekeeping equipment, packaged bees and queen bees are also effective means of spread.

## Where are they now?

*Varroa destructor* is present in Europe, North America, South America, Africa, parts of Asia and New Zealand. The genotype of *Varroa jacobsoni* that parasitises European honey bee brood is currently only present in some regions of Papua New Guinea.

## How can beekeepers protect their hives from Varroa mites?

This pest is currently not present in Australia and there are strict quarantine requirements in place to protect the Australian honey bee industry.

**If you see any of these symptoms, or observe mites on your honey bees or in the brood, call the Exotic Plant Pest Hotline.**

Michael Stedman, PIRSA

Parasitic Mite Syndrome (PMS) symptoms caused by Varroa mites

Denis Anderson, CSIRO

Worker European honey bee with wing deformities as a result of Varroa infestation

**Other relevant fact sheets about Varroa mites:**

- Varroa mites (NSW DPI) – Primefact 861
- Varroa: an exotic parasitic mite of honey bees (Vic DPI) – Note Number AG1183
- Varroa mites (DAFF Qld)

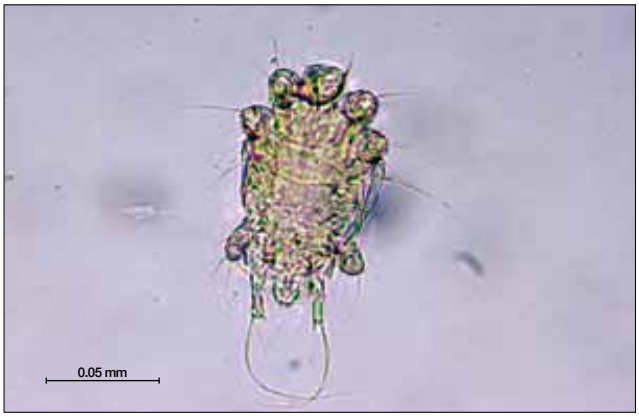
**EXOTIC PLANT PEST HOTLINE**
**1800 084 881**

EXOTIC PEST

# Tracheal mite

## What is Tracheal mite?

Tracheal mite (*Acarapis woodi*) is a microscopic, white coloured, internal mite of the honey bee respiratory system, capable of infecting queen bees, drones and worker bees. Tracheal mite infects and reproduces inside the tracheae (breathing tubes) of the honey bee and feeds on the honey bee's haemolymph (blood). Infection affects the honey bee's capacity to breathe, which results in weakened and sick honey bees which have a significantly reduced lifespan. If Tracheal mite infestation is combined with other stresses (disease, lack of pollen or nectar, etc.) it can lead to the death of the colony.

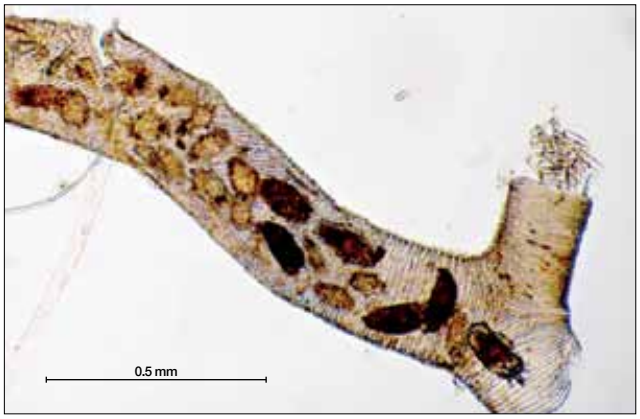



Simon Hinkley and Ken Walker Museum Victoria, PADIL

Tracheal mites are microscopic and only visible by dissecting the bee's trachea

## What can it be confused with?

General symptoms associated with Tracheal mite infestation such as population drop, honey bees staying in their hive and crawling and disoriented honey bees could be confused with other factors affecting honey bee colonies, such as a lack of pollen or nectar, pesticide use or various other pests and diseases.




Simon Hinkley and Ken Walker Museum Victoria, PADIL

As their name suggests, Tracheal mites live inside the air ways of honey bees

## What should beekeepers look for?

Tracheal mites are invisible to the naked eye and there are no reliable or diagnostic visible symptoms of infestation. Tracheal mites spend their whole life inside adult honey bees, except for mature female Tracheal mites, which have a mobile phase, and leave the host to attach to younger honey bees through bee to bee contact.

Despite this, serious Tracheal mite infestation does cause general colony symptoms such as large numbers of crawling honey bees at the entrance of the hive which are unable to fly, honey bees appearing disorientated, honey bees holding their wings at odd angles ("K wing"), large numbers of honey bees staying in the hive rather than foraging and, in extreme cases, the hive population dropping dramatically. The only accurate diagnostic method for Tracheal mite is laboratory diagnosis of the honey bee's tracheae.

Long Lane Honey Bee Farms

Honey bee showing signs of "K wing"

Honey bee colonies are more susceptible to Tracheal mite in cooler climates and during autumn and winter. Tracheal mites can spread easily when a colony is in close proximity to each other, such as a winter cluster, and can contribute to heavy winter losses. Always be aware of any unusually high winter losses.

## How does it spread?

Adult female Tracheal mites are picked up by younger honey bees and are spread within the hive through bee to bee contact. Tracheal mites can also spread to new areas through the transportation of infected colonies. Once in an area it can spread throughout an apiary through drone and worker bee drift between hives.

## Where is it now?

Tracheal mite is not present in Australia but is found in most other honey producing regions of the world, such as Europe, North America and parts of Asia.

## How can beekeepers protect their hives from Tracheal mite?

This pest is currently not present in Australia and there are strict quarantine requirements in place to protect the Australian honey bee industry.

**If you observe any symptoms that you think may be caused by Tracheal mite, call the Exotic Plant Pest Hotline.**

**EXOTIC PLANT PEST HOTLINE**
**1800 084 881**

**Other relevant fact sheets about Tracheal mite:**

- Tracheal mite (NSW DPI) – Primefact 1092

EXOTIC PEST

# Tropilaelaps mites

## What are Tropilaelaps mites?

Tropilaelaps mites are native to Asia and parasitise the brood of the Giant honey bees of Asia. Two species of Tropilaelaps mites (*Tropilaelaps clareae* and *T. mercedesae*) are also able to parasitise European honey bees (*Apis mellifera*) and reproduce on their brood. If Tropilaelaps mites were to become established in Australia, they would cause significant losses to managed and feral honey bee colonies.

## What do they look like?

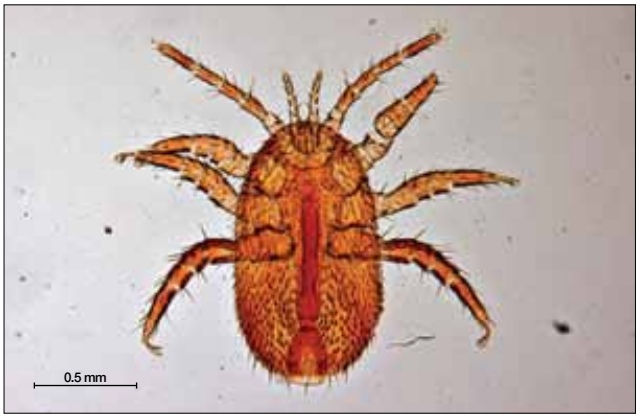
Tropilaelaps mites are active, red-brown mites which are around 1 mm long and 0.5-1 mm wide. They can be seen with the naked eye on both adult honey bees or in the brood.

Adult Tropilaelaps mites lay eggs in the brood cells of honey bee larvae and feed on developing honey bees. Infestation results in the transmission of honey bee viruses and causes the death of many pupae, resulting in an irregular brood, deformed honey bees with missing legs or wings and ultimately colony decline or absconding. Crawling honey bees and brood discarded at the entrance of a colony may indicate a colony heavily infested with Tropilaelaps mites.

## What can they be confused with?

Tropilaelaps mites could be confused with the Braula fly (*Braula coeca*) which is red-brown, 1.5 mm long, covered in spine like hairs and has six long legs. This pest is currently only present in Tasmania and is generally considered quite harmless. Tropilaelaps could also be confused with Pollen mites (*Mellitiphis alvearius*) which are light brown and are around 0.75 mm long and 0.75 mm wide. Pollen mites are not harmful to honey bees but are sometimes found in hives.

Tropilaelaps mites could also be confused with other exotic parasitic mites, most notably Varroa mites (*Varroa destructor* and *V. jacobsoni*). If any mites are observed on adult honey bees or in the brood, call the Exotic Plant Pest Hotline immediately on 1800 084 881.

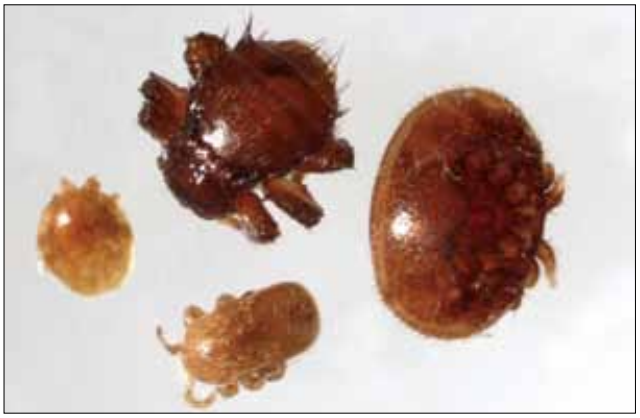



Ken Walker Museum Victoria, PADIL

Tropilaelaps mites are longer than they are wide

Denis Anderson, CSIRO

Tropilaelaps mites on European honey bee pupae, and a deformed honey bee resulting from Tropilaelaps mite infestation



Food and Environment Research Agency (Fera), Crown Copyright

Braula fly (top), Varroa mite (right), Tropilaelaps mite (bottom) and Pollen mite (left)

## What should beekeepers look for?

Observing Tropilaelaps mites on adult honey bees is difficult because only 3-4% of adult Tropilaelaps mites attach themselves to adult honey bees. When adult Tropilaelaps mites emerge from a brood cell, they almost immediately enter another brood cell within 24 hours, which makes it unlikely that they will be noticed until the level of infestation is quite high. As Tropilaelaps mite infestation grows, honey bees will develop symptoms such as stunted wings, missing legs, shrunken thoraces and other deformities. Nurse bees may also start removing infested brood and deformed honey bees and deposit them at the hive entrance.

## How do they spread?

Tropilaelaps mites can spread through the transportation of infested hives and adult honey bee drift. However, unlike Varroa mites which can potentially survive on adult honey bees for months, Tropilaelaps mites can only survive on adult honey bees for up to three days. Therefore, the level of Tropilaelaps mite spread is dependent on the level of brood within colonies.

## Where are they now?

*Tropilaelaps clareae* is currently only present in the Philippines, while *Tropilaelaps mercedesae* is present throughout regions of mainland Asia, including Papua New Guinea.

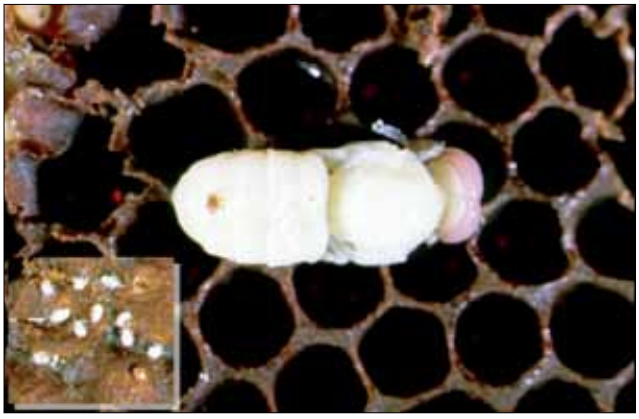
## How can beekeepers protect their hives from Tropilaelaps mites?

This pest is currently not present in Australia and there are strict quarantine requirements in place to protect the Australian honey bee industry.

**If you see any of these symptoms, or observe mites on your honey bees or in the brood, call the Exotic Plant Pest Hotline.**



Deformed pupae are a sign of Tropilaelaps mites





Pupa infested with Tropilaelaps mites

**Other relevant fact sheets about Tropilaelaps mites:**

- Tropilaelaps mites (NSW DPI) – Primefact 1105

**EXOTIC PLANT PEST HOTLINE**
**1800 084 881**

ESTABLISHED PEST

# American foulbrood

## What is American foulbrood?

American foulbrood (AFB) is a fatal microbial disease of honey bee brood caused by the spore forming bacterium *Paenibacillus larvae*. The disease is caused when young larvae ingest spores of the bacterium which germinate in the honey bee's gut. The brood usually dies at the pre-pupal or pupal stage.

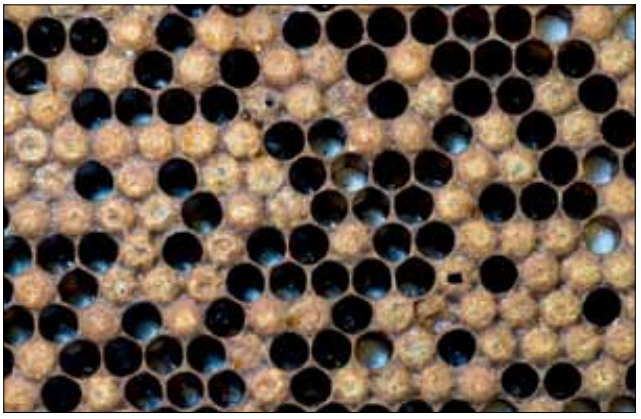
## What should beekeepers look for?

Brood combs should be thoroughly examined for AFB at least twice a year, preferably in spring and in autumn, although AFB can occur in hives at any time of the year. Beekeepers should remove each brood frame from the colony and look for symptoms such as an irregular brood pattern, sunken, darkened and greasy looking cappings as well as perforated cappings. Look closely, as early infections may only have as few as one or two larvae/pupae showing disease signs.

Brood infected with AFB generally die after the cells are capped and the affected brood becomes discoloured, changing from the healthy pearly white to a darker brown as the disease progresses. At this stage of infection beekeepers should conduct the ropiness test. Thrust a matchstick into the infected individual in the cell and if the semi-fluid remains are drawn out in a ropy thread it indicates the hive could be infected with AFB. After about a month, infected brood dry to a dark scale which adheres to the wall of the cell.

## What can it be confused with?

AFB can be confused with European foulbrood (EFB). The majority of EFB infected larvae die before capping and appear coiled in their cells, unlike AFB where the majority of infected larvae die after capping. However, when EFB infected brood die at older stages they can be confused with AFB.

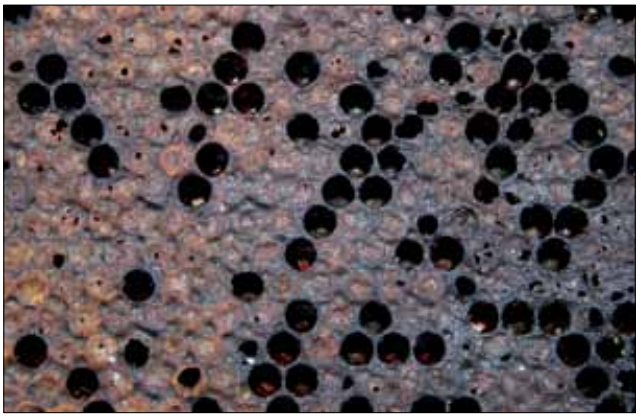


Doug Somerville, NSW DPI

Initial infection of AFB showing a few cells which are sunken and have chewed through cappings

Food and Environment Research Agency (Fera), Crown Copyright

A common test is to insert a matchstick into the dead brood and if there is a 'rope' AFB could present



Doug Somerville, NSW DPI

Advanced infection of AFB showing a large area of sunken, dark and chewed through cappings

Another potential difference between AFB and EFB is that when the ropiness test is conducted, by placing a matchstick into the affected brood, AFB infected brood could be drawn out in a longer ropy thread than EFB infected brood. However, when *Paenibacillus alvei* (a common secondary invader in EFB) is present it may also cause some extra ropiness which makes EFB infected brood resemble AFB infected brood. Laboratory diagnosis is the only accurate means to differentiate AFB from EFB.

## How does it spread?

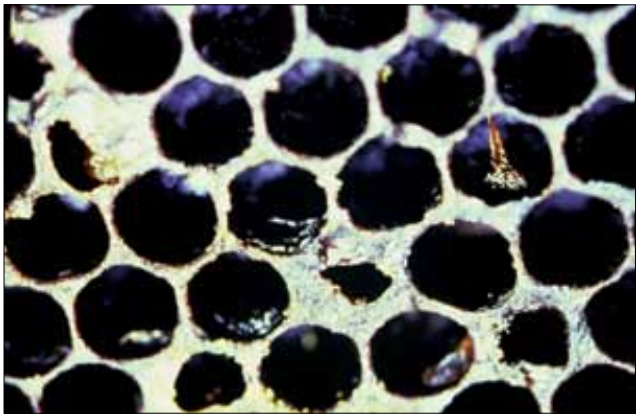
The main methods of AFB spread are through the interchange of infected combs and hive components, by feeding colonies infected honey or pollen, by honey bees robbing honey from infected hives or from extraction sites, as well as by honey bees drifting from infected colonies into neighbouring colonies. The spores of the bacterium are very infectious to larvae less than 24 hours old and can remain dormant for over 50 years.

## Where is it now?

AFB is present throughout Australia; however, it has not been reported or confirmed in the NT.

## How can beekeepers protect their hives from American foulbrood?

Beekeepers should always check brood combs at least twice a year for early signs of AFB. Brood combs should be replaced every 3-4 years as old brood combs can act as a reservoir of the bacterium. To greatly minimise the spread of AFB throughout hives, beekeepers should put in place a barrier management system and clean hive tools and apiary equipment between hives and apiaries. If AFB is found in a hive, thoroughly clean all hive tools, gloves and apiary equipment before inspecting other hives or another apiary. When AFB is detected, contact your local department of agriculture, kill the infected colony and either irradiate or burn infected hive parts in a pit and cover the remains.



Michael Hornitzky

AFB infected cells showing brood drying to a dark scale on the side of the cell, and one scale having a 'tongue' can sometimes be observed

Food and Environment Research Agency (Fera), Crown Copyright

Black scale with a tongue is sometimes visible at the bottom of the cell after the larva has died and dried out

**AFB is a reportable disease in every state and territory of Australia. Always consult your local department of agriculture if you think your hives are infected with AFB, or when moving hives, honey bee products or apiary equipment interstate.**

**Other relevant fact sheets about AFB:**

- American Foulbrood (NSW DPI) – Primefact 209
- Diagnosis of American Foulbrood Disease of Honey bee brood (Vic DPI) – Note Number AG1426
- American Foulbrood Disease (Tas DPIPWE) – Agdex 467

ESTABLISHED PEST

# Asian honey bee (Java genotype)

## What is the Asian honey bee?

The Asian honey bee (AHB), *Apis cerana*, is found throughout the tropical, sub-tropical and temperate zones of south-east and mainland Asia. This wide distribution has led to variations, commonly known as genotypes or strains, particularly between the temperate and tropical AHB.

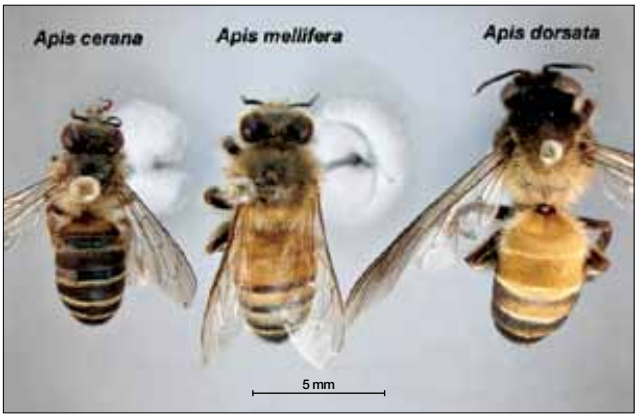
Although there are numerous strains or genotypes of *Apis cerana*, this fact sheet will specifically focus on the AHB that is present in Cairns (Queensland). The AHB found throughout the Cairns region of Queensland is *Apis cerana* Java genotype. This genotype cannot be managed for honey production and pollination services due to its frequent swarming and tendency to abscond. The AHB produces less honey than the European honey bee (EHB), *Apis mellifera*, and also commonly robs the EHB of their honey stores. It also has the potential to become a major competitor for nectar, pollen and nesting sites in the natural environment.

## What does it look like?

The AHB is approximately 10 mm long and looks like a slightly smaller version of the EHB.

## What can it be confused with?

The AHB could be confused with the EHB, which is present throughout Australia in both managed and feral honey bee colonies. However, the AHB is slightly smaller, has a darker abdomen, is slightly less hairy and has a more erratic flying pattern than the EHB. The AHB also differs to the EHB by having a distal abscissa of vein M in the hind wing, as well as its drone brood containing pin hole sized pores on the top of the cell, which become prominent within a week of hatching from the cell.

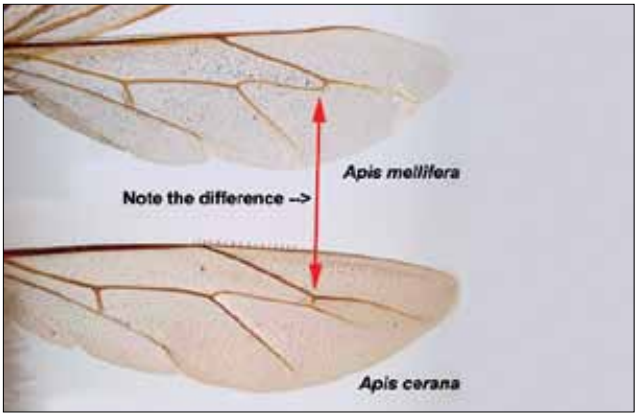



Ken Walker Museum Victoria, PADIL

Asian honey bee (left) compared to the European honey bee (middle) and the Giant honey bee (right)

Denis Anderson, CSIRO

AHB worker bees




Ken Walker Museum Victoria, PADIL

Hind wing venation difference between the EHB and the AHB

## What should beekeepers look for?

Beekeepers should look for AHB nests and swarms. The AHB is a cavity nesting honey bee and therefore prefers enclosed openings such as tree hollows. The AHB can also swarm and nest in urban and disturbed environments. In Cairns (Queensland), the AHB has been found in cavities such as letterboxes, walls of buildings, compost bins and on machinery. AHB nest and swarm sizes can range anywhere from 200–10,000 honey bees.

## How does it spread?

The AHB can spread naturally through swarming and absconding. AHB colonies can produce up to 10 swarms per year and have been reported to travel up to 10 km from the original colony. Reproduction, nest disturbances, pest and disease pressure or even a lack of nectar or pollen can cause the AHB to swarm or abscond.

The AHB is a proven hitchhiker on a variety of modes of transport and can spread over large distances into new areas on boats, trains, trucks and on shipping cargo.

## Where is it now?

The AHB originated in Java (Indonesia) and has since spread throughout Irian Jaya, Papua New Guinea and the Solomon Islands. In 2007 the AHB was detected in the Cairns region of Queensland and has since been found at Mareeba and Lake Eacham, and as far south as Innisfail. It has not been found outside this region in Australia.

## How can beekeepers protect their hives from the Asian honey bee?

Currently, the only method of control is to find the AHB nest and destroy it. If you find, or think you have found the AHB it should be reported to your local department of agriculture immediately.

Department of Agriculture, Fisheries and Forestry, Queensland

AHB swarm in a letterbox

Ben Oldroyd, University of Sydney

AHB drone brood with pin hole sized openings

**The AHB is a reportable pest in all states and territories of Australia, including the Cairns region of Queensland where it is currently present. Consult your local department of agriculture if you think you have seen the AHB.**

**Other relevant fact sheets about AHB:**

- Asian honey bees (NSW DPI) – Primefact 1093
- Overview of the Asian honeybee (DAFF Qld)
- Asian honey bee transition to management program – Plant Health Australia

ESTABLISHED PEST

# Black queen cell virus

## What is Black queen cell virus?

Black queen cell virus (BQCV) is caused by the *Black queen cell virus* (*Cripavirus*). BQCV causes mortality in queen bee pupae, with dead queen bee larvae turning yellow and then brown black. The disease is most common in spring and early summer. It is believed that infection with BQCV may be transmitted by *Nosema apis*, a microsporidian parasite of the honey bee that invades the gut of adult honey bees.

## What should beekeepers look for?

Infection with BQCV causes queen bee pupae to turn yellow and the skin of the pupae to become sac-like. At latter stages of infection, the dead queen bee may change to brown-black. The walls of the queen bee cell also become a darker, brown-black colour. BQCV is often associated with *Nosema apis* infection. If Nosema disease is present within a queen bee breeding operation, it is always useful to look for signs of BQCV on a regular basis.

## What can it be confused with?

BQCV can potentially be confused with Sacbrood virus as the pupae show the same symptoms of yellow colouration, the skin becoming plastic-like and the dead pupa becoming a fluid filled sac. However, as its name suggests, BQCV usually affects queen bee pupae, while Sacbrood virus mainly affects developing worker bee larvae.

## How does it spread?

BQCV is thought to be transmitted by nurse bees when they feed larvae infected brood food. The virus may remain viable in larval remains, honey or pollen for up to four weeks. *Nosema apis* infection in a colony may be another transmission route of BQCV. Honey bees drifting between hives, contaminated water and equipment can also spread BQCV.



Worker bees on a queen bee cell



Sacbrood disease affected larvae; BQCV causes the queen bee pupae to display similar symptoms



When breeding queen bees, look for signs of BQCV in queen bee cell starters

## Where is it now?

BQCV is present throughout Australia; however, it has not been reported or confirmed in the NT.

## How can beekeepers protect their hives from Black queen cell virus?

BQCV is usually able to be controlled in most colonies with appropriate nutrition, young queen bees with populous hives, comb rotation every 3-4 years and the placement of hives in a warm and sunny position over the autumn, winter and spring periods. This will help keep colonies strong, remove extra stresses and also reduce the potential of Nosema disease infection.

Beekeepers should maintain good apiary hygiene and be aware of the symptoms of BQCV or Nosema infection within any queen bee breeding operation. If a beekeeper is a queen bee breeder and believes cell starters or nucleus hives are infected with BQCV, they should not be used for raising queen bees, or sold or distributed. This will help stop the spread of infected queen bees to other hives and regions.

If BQCV is detected in a queen bee breeding operation, it is recommended that the beekeeper contact their local department of agriculture and request to send in a sample for laboratory diagnosis.

**BQCV is present in every state and territory of Australia, except for NT where it not has been reported or confirmed.**

**Other relevant fact sheets about BQCV:**

- Viruses of honey bees (NSW DPI) – Primefact 997

Sam Malfroy

Queen bee cages

ESTABLISHED PEST

# Braula fly

## What is Braula fly?

The Braula fly lives in honey bee colonies and attaches itself to honey bees where it feeds on nectar and pollen at the honey bee's mouth and on material secreted by the host. The pest is not considered a serious threat to commercial beekeeping as it does not damage or parasitise any stage of the honey bee life cycle. However, its presence may reduce the egg laying capacity of queen bees and could potentially make the detection of external parasitic mites difficult.

## What does it look like?

The Braula fly is a small (0.9 mm wide by 1.5 mm long) wingless fly. It is red-brown, covered in hairs and has six legs. The Braula fly lay small eggs (0.84 mm by 0.42 mm) throughout the hive, however, only the eggs deposited on capped honey comb will hatch. The hatched larvae tunnel under the cappings leaving narrow tracks about 1 mm wide across the surface of the comb. This tunnelling gives the comb a fractured appearance, a key characteristic of Braula fly presence.

## What can it be confused with?

Braula fly could be confused with the exotic parasitic Varroa mites (*Varroa destructor* and *V. jacobsoni*) and Tropilaelaps mites (*Tropilaelaps clareae* and *T. mercedesae*). Adult female Varroa mites are oval, flat, red-brown, and 1 mm long and 1.5 mm wide. Tropilaelaps mites are active, red-brown mites which are around 1 mm long and 0.5-1 mm wide.

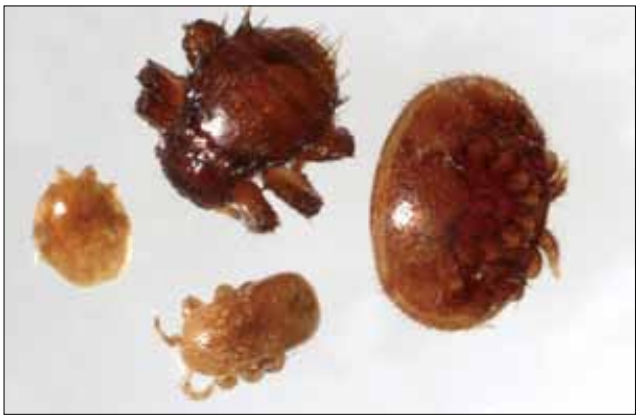
Braula fly could also be confused with Pollen mites (*Mellitiphis alvearius*) which are light brown and around 0.75 mm long and 0.75 mm wide. Pollen mites are not harmful to honey bees but are sometimes found in hives. If any mites are observed on adult honey bees or in the brood, call the Exotic Plant Pest Hotline immediately on 1800 084 881.


Simon Hinkley and Ken Walker Museum Victoria, PADIL

Braula fly is small and wingless

Kelly Ventura

Braula fly is covered in long hairs and has long legs



Food and Environment Research Agency (Fera), Crown Copyright

Braula fly (top), Varroa mite (right), Tropilaelaps mite (bottom) and Pollen mite (left)

## What should beekeepers look for?

Braula fly have a preference to attach to queen bees, but have also been observed on drones and worker bees as well. As a result of this preference, queen bees should be thoroughly and regularly checked. Beekeepers should also look through harvested comb honey, as Braula fly larvae can tunnel through honey cappings, damaging the appearance and marketability of any comb honey produced.

## How does it spread?

Braula fly can spread through swarming or absconding honey bee colonies and drifting honey bees. Braula fly can also spread through the interchange of hive components from apiary to apiary, as well as the movement of hives. The larvae can also be spread by the removal and transport of infected comb honey.

## Where is it now?

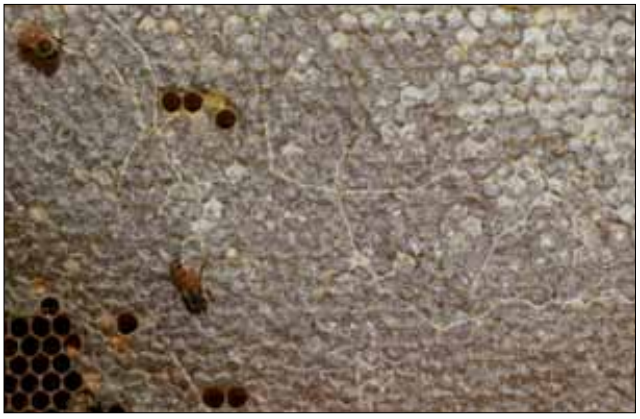
Braula fly are only found in Tasmania and are not present on mainland Australia.

## How can beekeepers protect their hives from Braula fly?

Braula fly has not been shown to cause a weakening of honey bee colonies. However, beekeepers specialising in comb honey production may need to consider control measures if the Braula fly becomes a problem during peak production periods. Control measures include freezing comb honey for at least 48 hours which will kill all life stages of the Braula fly. The normal practice of extracting honey is another effective means to control the larval stage of the Braula fly.

Lindsay Bourke

Numerous Braula fly on the thorax of a queen bee



NSW DPI

Fractured appearance of honey comb from burrowing Braula fly larvae

**Braula fly is only present in Tasmania. It is a reportable pest on mainland Australia. If Braula fly is observed in any state or territory of Australia, other than Tasmania, contact your local department of agriculture immediately.**

**Other relevant fact sheets about Braula fly:**

- Braula fly (NSW DPI) – Primefact 649

ESTABLISHED PEST

# Chalkbrood disease

## What is Chalkbrood disease?

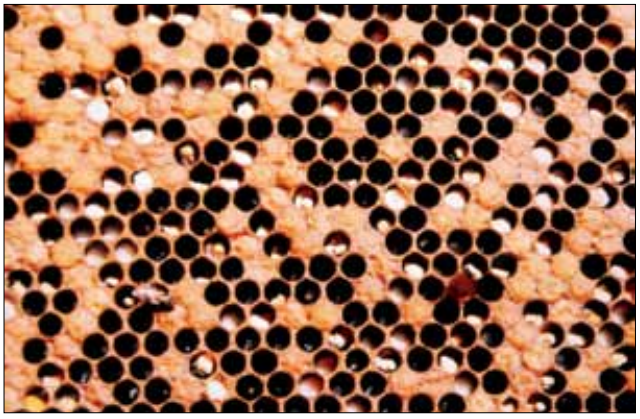
Chalkbrood disease is caused by the fungus *Ascosphaera apis*. Spores of the fungus can be eaten by honey bee larvae and germinate in the honey bee's gut, ultimately causing the larvae to die of starvation. Chalkbrood disease is present throughout Australia and its incidence is generally higher when the colony is under stress due to cool wet weather or poor nutrition. It is more common in the spring when the brood nest is rapidly expanding and a smaller honey bee adult workforce cannot maintain brood nest temperature.

Brood combs should be regularly checked for signs of pests and diseases

## What should beekeepers look for?

Infected hives show a scattered brood pattern with perforated cappings. Larvae infected with Chalkbrood disease usually die after capping and the fungus grows to fill the cell. The larval body dehydrates creating diagnostic 'mummies' – hard, shrunken and chalklike. The fungal mycelium infiltrating the larval tissue and fruiting gives it a white-grey colour.

The cappings of dead larvae may be chewed away by the honey bees and the mummies removed to the hive entrance, or dropped to the bottom board.





Comb infected with Chalkbrood disease showing a scattered brood pattern with mummies in cells

## What can it be confused with?

Chalkbrood disease symptoms of scattered brood with perforated cappings could be confused with either American foulbrood (AFB), European foulbrood (EFB) or Sacbrood virus. However, the presence of mummies in the cells, the hive entrance and bottom boards, together with no ropy thread when conducting the ropiness test, would suggest Chalkbrood disease is the cause.



Dead larvae in cells that have turned white due to fungal growth

## How does it spread?

Chalkbrood disease can be easily spread between hives through the drifting behaviour of drones and worker bees, as well as the robbing behaviour of worker bees. Once inside a hive, fungal spores are quickly spread throughout the hive from mummies. It can also be transferred between apiaries on contaminated equipment, pollen and in water. The Chalkbrood spores may remain viable for 15 years.

## Where is it now?

Chalkbrood disease is present throughout Australia; however, it has not been reported or confirmed in the NT.

## How can beekeepers protect their hives from Chalkbrood disease?

Beekeepers should replace diseased combs which can act as a reservoir for Chalkbrood disease spores, as well as cleaning away mummified larvae from the bottom boards and around the entrance of the hive. These activities will remove the main source of infection within a hive, and prevent the spread of the disease. Hives should also be placed in a well-ventilated, dry area with the sun facing the entrance of the hive to reduce conditions that favour the disease.

Honey bee stocks differ in susceptibility to Chalkbrood disease, so beekeepers should replace the infected colony's queen bee with one supplied by a reputable breeder. This variation in susceptibility is due to differences in the hygienic ability of the honey bees to uncap and remove diseased brood. By selecting queen bees or obtaining honey bees from hives that show this trait, the effects of Chalkbrood disease can be reduced.

**Chalkbrood disease is present in every state and territory of Australia, except for NT where it has not been reported or confirmed.**



Mummies on the hive floor



Mummies are moved from the infected cells or hive floor by nurse bees to the hive entrance

**Other relevant fact sheets about Chalkbrood disease:**

- Chalkbrood (DAFF Qld)
- Chalkbrood disease of honeybees (NT DOR) – Agnote K11
- You can also download the RIRDC report *Biological Control of Chalkbrood by Anti-Fungal Bacterial Symbionts of Bees* by M. Nayudu and S. Khan (2009)

ESTABLISHED PEST

# European foulbrood

## What is European foulbrood?

European foulbrood (EFB) is a brood disease caused by the bacterium *Melissococcus plutonius*. Larvae of all ages are susceptible to infection and become infected after ingesting contaminated food. The bacterium then multiples in the gut of the larvae and competes for larval food, resulting in the larvae dying of starvation. The incidence of EFB is generally higher when the colony is under stress such as in spring, when the weather can be cool and wet or when nutrition is poor.

## What should beekeepers look for?

Brood combs should be thoroughly examined for EFB at least twice a year, in spring and in autumn. Beekeepers should remove each brood frame from the hive and look for symptoms such as an irregular brood pattern with a mottled appearance. Infected larvae die in a coiled or twisted position, and change from the healthy pearly white to yellow and then to brown. Beekeepers should specifically look at unsealed brood because infected larvae usually die before their cells are capped.

At this stage of infection beekeepers should conduct the ropiness test on older dead brood. Thrust a matchstick into the infected individual, and if the semi-fluid remains are drawn out in a ropy thread it indicates the hive could be infected with EFB. In older dead brood, a strong ammonia-like smell may also be present.

## What can it be confused with?

EFB can be confused with American foulbrood (AFB). The majority of EFB infected larvae die before capping and appear coiled in their cells, which is in contrast to AFB where the majority of infected larvae die after capping. However, when EFB infected brood die at older stages they can be confused with AFB.

Food and Environment Research Agency (Fera), Crown Copyright

Spotted brood pattern is an indicator of EFB

Food and Environment Research Agency (Fera), Crown Copyright

Central cells are infected with EFB and are curled upwards and off coloured

Doug Somerville, NSW DPI

Infection of EFB in its early stages showing infected larvae turning yellow

Another potential difference between AFB and EFB is that when the ropiness test is conducted by placing a matchstick into the affected brood, AFB infected brood is usually drawn out in a longer ropy thread than EFB infected brood. However, when *Paenibacillus alvei* (a common secondary invader in EFB) is present it may also cause some extra ropiness which makes it resemble AFB infected brood. Laboratory diagnosis is the only accurate means to differentiate EFB from AFB.

## How does it spread?

EFB can be spread within an apiary and between apiaries by the interchange of infected combs and hive components, feeding hives infected honey or pollen, honey bees robbing honey from infected hives or from extraction sites, as well as by honey bees drifting from infected colonies into neighbouring colonies. EFB is highly infectious and can remain viable for several years.

## Where is it now?

EFB is present in all states and territories in Australia, except for WA and NT.

## How can beekepers protect their hives from European foulbrood?

Beekeepers should always try to keep strong colonies with a young and healthy queen bee, as well as replacing brood combs every 3-4 years as these can act as a reservoir for the bacterium. Brood combs should be checked at least twice a year for early signs of EFB. To greatly minimise the spread of undetectable levels of EFB throughout loads of hives, put in place a barrier management system and disinfect hive tools and apiary equipment between hives and apiaries.



Healthy larvae are white coloured (left), unhealthy/dead larvae are a darker, yellowish colour (centre)



After two to four weeks, infected larvae may dry up to form a scale at the bottom of the brood cell

**EFB is a reportable disease in every state and territory of Australia. Always consult your local department of agriculture if you think your hives are infected with EFB, or before the interstate movement of hives, honey bee products or apiary equipment.**

**Other relevant fact sheets about EFB:**

- European foulbrood and its control (NSW DPI) – Primefact 1000
- European foulbrood disease (Tas DPIPWE) – Agdex 481

ESTABLISHED PEST

# Greater and Lesser wax moth

## What are wax moths?

There are two species of wax moth, the Greater wax moth (*Galleria mellonella*), and the Lesser wax moth (*Achroia grisella*). Both species are pests of active hives, however they most commonly cause damage to unattended combs in storage, especially in areas that are dark, warm and poorly ventilated. Both species will eat beeswax, particularly unprocessed wax, pollen, remains of larval honey bees, honey bee cocoon silk and enclosed honey bee faeces found on walls of brood cells.

## What do they look like?

The Greater wax moth is a small grey coloured moth with some mottling on its wings and about 13-19 mm long. The Lesser wax moth has similar colouration but is only 10-13 mm long.

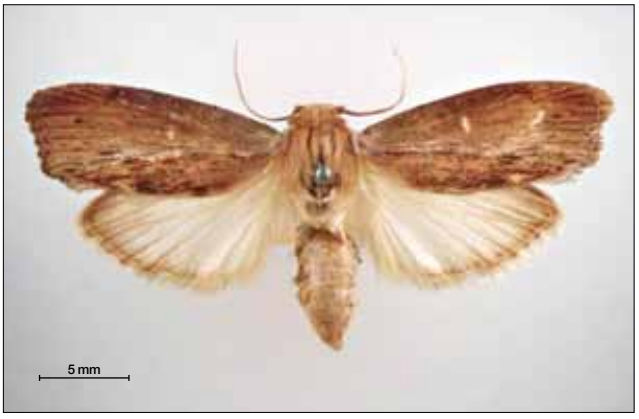
Eggs are laid by the adult wax moths in dark cracks and crevices around the hive or in unattended combs. The resulting larvae burrow and eat into the combs, leaving behind webbing and tunnels of silk. Fully grown larvae spin dense and tough white silk cocoons that are commonly found firmly attached to the frame or hive body. The cocoon is cemented into a boat shaped cavity that the larvae chew in the wood. This damage persists in equipment long after the wax moth emerges. Once the cocoon is spun, the larvae change to the pupal stage, and then develop into an adult wax moth.

## What can they be confused with?

Wax moth larvae are similar to Small hive beetle larvae, however there are two simple distinguishing characteristics between the two pests. Firstly, Small hive beetle larvae cause the honey to ferment and the hive to become 'slimed out', which is not present when only wax moth are present. Secondly, wax moth larvae leave behind webbing mass and tough white cocoons on the frames and hive body, which are not present when only Small hive beetle larvae are present.


Simon Hinkley and Ken Walker Museum Victoria, PADIL

Lesser wax moth: note wings are spread for identification purposes, they would usually be closed over body




Simon Hinkley and Ken Walker Museum Victoria, PADIL

Greater wax moth: note wings are spread for identification purposes, they would usually be closed over body

Susan Ellis, USDA APHIS PPQ, www.Bugwood.org

Greater wax moth larva

## What should beekeepers look for?

Beekeepers should look for tunnels of silk throughout combs, cocoons stuck to frames and hive body parts as well as a disintegrating comb which is caused by larvae burrowing in the comb. Beekeepers should also specifically look through weak, stressed or queenless colonies, as well as unattended combs as these are the most susceptible to wax moth infestation.

## How do they spread?

Wax moths mainly fly at night and are able to fly between hives and cause new infestations. The pest can also be spread between apiaries by the movement of infested hives.

## Where are they now?

Both species of wax moth are present in all states and territories of Australia.

## How can beekeepers protect their hives from wax moths?

The honey bees themselves are the best method of protection against wax moth. Beekeepers should always try to keep strong colonies with a high bee-to-comb ratio and a young and healthy queen bee, as well as replacing brood combs every 3-4 years. Beekeepers should also keep their apiary clean from weak or stressed colonies, dead out colonies, or old unattended combs which provide a perfect breeding environment for wax moth.

Beekeepers should store empty combs, supers and any wax moth affected material that has been cleaned to be reused in low temperature control rooms. Cool rooms maintained at 10°C will prevent wax moth reproduction and living larvae from becoming active.

Kathy Keatley Garvey, UC Davis Department of Entomology

Wax moth larvae and webbing in stored combs

Chantal Forster

Wax moth cocoons stuck onto frames

**Greater and Lesser wax moth are present in every state and territory of Australia.**

**Other relevant fact sheets about wax moth:**

- Wax moth (NSW DPI) – Primefact 658
- Wax moth: a pest of combs and honey bee products (Vic DPI) – Note Number AG1101
- Wax moth and its control (DAFWA) – Farmnote 252

ESTABLISHED PEST

# Nosemosis

## What is Nosemosis?

Nosemosis, or Nosema disease, is caused by two species of microsporidian parasites (a type of spore forming fungus) called *Nosema apis* and *Nosema ceranae*. Both species can infect worker bees, queen bees and drones. Both species produce spores which are ingested by adult honey bees through contaminated water or food, through food exchange with other honey bees or from cleaning contaminated combs. The spores then germinate in the mid-gut of the honey bee and infection may result in shortened adult honey bee life and reduced colony health and performance.

Food and Environment Research Agency (Fera), Crown Copyright

Hives should be regularly checked for signs of pests and diseases

## What do they look like?

*Nosema apis* causes general symptoms such as crawling honey bees with swollen and greasy abdomens and dislocated wings, honey bees crawling onto and around the hive entrance, dysentery within and around the hive, a reduction in queen bee egg laying ability and her possible supersedure, as well as the rapid dwindling of colony strength and heavy winter losses. *Nosema ceranae* causes similar symptoms; however, none of the dysentery or crawling honey bee behaviour usually related to *N. apis* infection has been reported for *N. ceranae*. Signs of Nosemosis are more evident when nutrition is poor and weather conditions are cold and wet.

Food and Environment Research Agency (Fera), Crown Copyright

Nosema spores in mid-gut of a honey bee

## What can they be confused with?

There are no reliable field diagnostic symptoms associated with Nosemosis, and many of the general symptoms associated with the disease could be confused with symptoms caused by other honey bee pests, diseases and/or disorders.

D.Broberg, www.flickr.com/photos/dbroberg

Honey bees defecating at the entrance of the hive can be a symptom associated with *N. apis* infection

## What should beekeepers look for?

Beekeepers should look for colony symptoms such as a declining population, poor honey production, reduced brood production, dysentery in and around

the entrance of the hive, poor survival over winter and worker bees crawling around the hive with swollen and greasy abdomens.

## How do they spread?

Nosema spores are passed from infected honey bees to non-infected honey bees through contaminated water or food, through food exchange with other honey bees or from cleaning contaminated combs. It is also spread through bees removing waste material, specifically faeces from within and around the entrance of the hive. The spores are long lived and can quickly spread throughout the hive. Nosemosis can also be spread between colonies by using contaminated equipment and through the drifting behaviour of worker bees and drones.

## Where are they now?

Both species of Nosema (*N. apis* and *N. ceranae*) are found in all states and territories of Australia, except for *N. ceranae*, which has not been confirmed or reported in WA.

## How can beekeepers protect their hives from Nosemosis?

Good management practices such as appropriate nutrition, young queen bees with populous hives and comb rotation every 3-4 years will keep colonies strong and remove possible causes of stress. Beekeepers should place their hives in a warm and sunny position over the autumn, winter and spring periods allowing the colony to regularly forage and defecate outside of the hive to prevent the accumulation of Nosema spores in faeces deposited in the hive. Beekeepers should always ensure that any hive equipment that may have been infected with Nosema spores is decontaminated before and after use.

***Nosema apis* is a reportable pest in Qld and Vic. *Nosema ceranae* is a reportable pest in WA where it has not been confirmed or reported. Both species of Nosema (*N. apis* and *N. ceranae*) are reportable for NSW.**

D.Broberg, www.flickr.com/photos/dbroberg

Dysentery around the hive entrance

Michael Plein

Dysentery within a hive

**Always consult your local department of agriculture before the interstate movement of hives, honey bee products or apiary equipment.**

**Other relevant fact sheets about Nosema disease:**

- Nosema disease (NSW DPI) – Primefact 699
- Nosema disease of honey bees (Vic DPI) – Note Number AG0300
- You can also download the RIRDC report *Nosema Disease: Literature review and three year survey of beekeepers: part 2* by M Hornitzky (2008)

ESTABLISHED PEST

# Sacbrood virus

## What is Sacbrood virus?

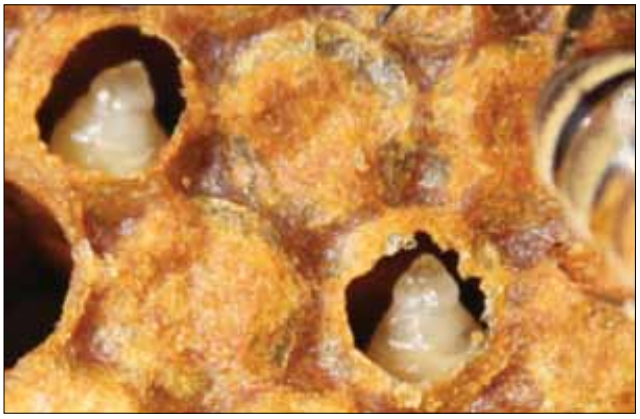
Sacbrood virus is caused by the *Sacbrood virus* (*Iflavirus*) which affects worker bee larvae thought to be infected by consuming contaminated water, pollen or nectar. Infected larvae die shortly after capping and become a fluid filled sac. Infected brood are found scattered amongst healthy brood and the cappings may be discoloured, sunken or perforated. Sacbrood virus may remain viable in dead larvae, honey or pollen for up to four weeks.

## What should beekeepers look for?

Beekeepers should look for symptoms of Sacbrood virus such as an uneven brood pattern with discoloured, sunken or perforated cappings. Infected larvae change from a healthy pearly white, to yellowish, then grey-brown and finally dark brown-black. Darkening begins at the head of the dead larva and spreads to the rest of the body. The skin of the dead larva also changes into a tough plastic-like sac, which is filled with fluid. The larva dies with its head characteristically raised in a banana shape toward the top of the cell and stretched out on its back in the cell. Nurse bees usually uncap the cell exposing the dead larvae.

## What can it be confused with?

Brood symptoms of Sacbrood virus can be confused with other brood diseases such as European foulbrood (EFB) and American foulbrood (AFB). To identify which disease is causing the problem, the ropiness test can be used. In this test, a matchstick is put into the larval remains and if the fluid is drawn out in a ropy thread, it indicates that the hive is infected with either EFB or AFB. If no ropy thread is drawn out and the larval remains are in a plastic like sac, which is raised in a banana shape with darkening at the head of the dead larva, then it is evidence of Sacbrood virus.

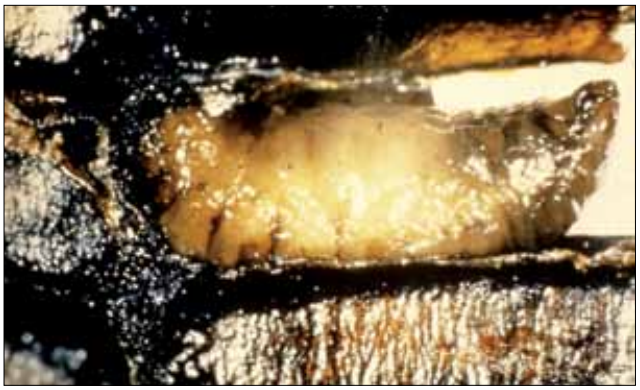


Rob Snyder, www.beeinformed.org

Nurse bees usually uncap cells exposing the Sacbrood virus affected larvae

Rob Snyder, www.beeinformed.org

Larva affected by Sacbrood virus with its head raised in a banana shape and stretched out on its back in the cell, with healthy larvae around



Food and Environment Research Agency (Fera), Crown Copyright

Infected larva in cell showing the change in colour and the mouthparts turning black and pointing upwards

## How does it spread?

Nurse bees transmit Sacbrood virus when they feed larvae with infected brood food. Sacbrood virus may remain viable in larval remains, honey or pollen for up to four weeks. Honey bees drifting between hives, contaminated water and equipment can also spread Sacbrood virus.

## Where is it now?

Sacbrood virus is present throughout Australia; however, it has not been reported or confirmed in the NT.

## How can beekeepers protect their hives from Sacbrood virus?

Honey bees are usually able to control Sacbrood virus in most colonies through hygienic behaviour and the ability to detect and remove infected larvae. However, Sacbrood virus can become severe when combined with other stresses, such as a shortage of nectar or pollen, unfavourable climatic conditions, a poor queen bee or infestation with other pests or diseases.

Beekeepers can protect their hives by removing infected brood combs and taking other management measures to restore colony strength, such as providing food and adding to the worker bee population.

Honey bee stocks can also differ in susceptibility to Sacbrood virus, so beekeepers should replace the infected colony's queen bee with one supplied by a reputable breeder. This variation in susceptibility is due to differences in the hygienic ability of the honey bees to uncap and remove the infected brood. By selecting queen bees or obtaining honey bees from hives that show this trait, the effects of Sacbrood virus can be reduced.

Rob Snyder, www.beeinformed.org

Infected larva in cell that has become dark brown-black

Food and Environment Research Agency (Fera), Crown Copyright

Body of a Sacbrood virus affected larva that has become a fluid filled sac

**Sacbrood virus is present in every state and territory of Australia, except for NT where it has not been reported or confirmed.**

**Other relevant fact sheets about Sacbrood virus:**

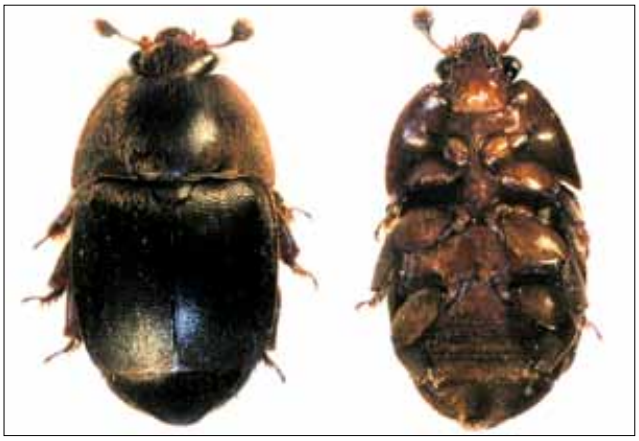
- Brood disease: Sacbrood (PIRSA)

ESTABLISHED PEST

# Small hive beetle

## What is Small hive beetle?

Small hive beetle (SHB) (*Aethina tumida*) is a small (0.5 cm long 0.3 cm wide) brown-black beetle with clubbed antennae. The larvae of SHB cause the majority of damage to honey bees by burrowing into combs, eating brood, honey and pollen. Whilst feeding, the larvae also carry a yeast (*Kodamaea ohmeri*) which contaminates the honey, causing it to ferment. Heavy infestations cause the hive to become 'slimed out' and may cause the colony to die or abscond. In Australia, SHB has the greatest impact in the warm and humid coastal strip between Victoria and North Queensland.

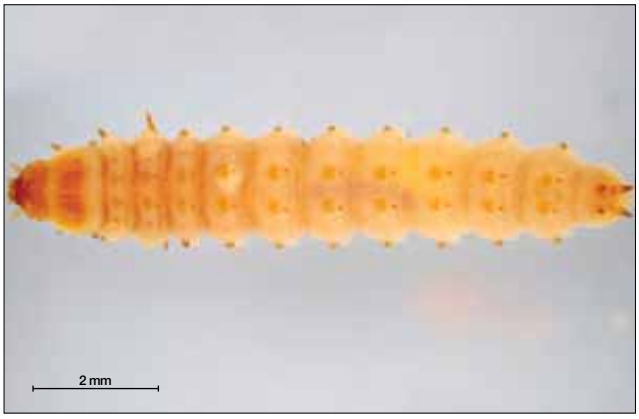


James D Ellis, University of Florida

Adult SHB are brown-black with clubbed antennae

## What does it look like?

Adult SHB are brown-black. The eggs are tiny (about 1 mm long) and are pearly white. In strong colonies, eggs are laid in the crevices of the hive, while in weak colonies eggs are laid directly on brood comb. Larvae are white, 10 mm long with three pairs of prolegs near the head. Once they mature, larvae leave the hive and burrow into the ground surrounding the hive to pupate.




Ken Walker Museum Victoria, PADIL

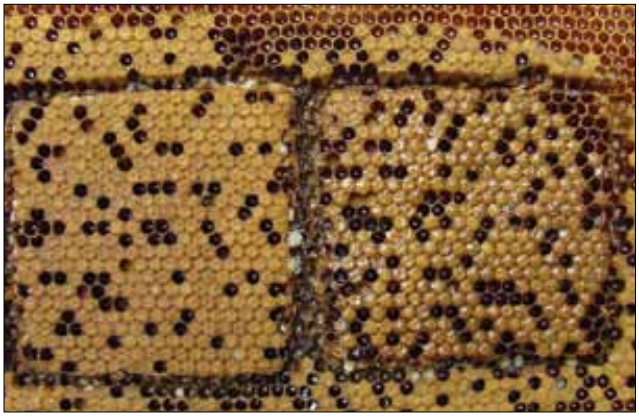
Larvae of SHB are pearly white and about 10 mm long

## What can it be confused with?

SHB larvae look similar to wax moth larvae. To distinguish between the two pests, SHB cause the honey to ferment and the hive to become 'slimed out', while wax moth larvae leave behind webbing mass and tough white cocoons on frames.

## What should beekeepers look for?

Beekeepers should look for the adult SHB in the darker parts of the hive. Adult SHB avoid light and will seek refuge quickly when the hive is inspected. Inspect underneath the hive lid, as well as the brood box and bottom board. Weak and stressed colonies with a low bee-to-comb ratio are considered the most susceptible.



Kieth Delaplane, University of Georgia

Cells infested with SHB (right) show a slimy appearance when compared to healthy unaffected cells (left)

Also look for larvae on frames in the brood box and in the above honey supers. The larvae cause the majority of the damage by burrowing into combs, eating brood, honey and pollen. Whilst feeding, the yeast species (*K. ohmeri*) that the larvae carry contaminates the honey, causing it to ferment, which makes the honey look greasy and slimy and weep out of the cells.

## How does it spread?

SHB can spread by beekeepers moving infested hives to non-infested areas. SHB is also a strong flyer and can fly up to 7 km to find new hives and colonies. The SHB is believed to be attracted to new hives by honey bee colony odours and slumgum.

## Where is it now?

SHB is present throughout NSW, Qld, Vic, ACT and in parts of SA and WA. It has not been recorded in NT or Tas.

## How can beekeepers protect their hives from Small hive beetle?

To protect hives against SHB it is critical to maintain strong, healthy colonies with a young productive queen bee and a high bee-to-comb ratio. Beekeepers should maintain good hygiene practices in the hive (e.g. remove debris on bottom boards, remove burr comb etc.) to reduce areas where SHB can hide and breed. It is also important to maintain good hygiene practices around the apiary (e.g. remove beeswax scraps, old combs and dead colonies etc.) which can attract SHB. Cool rooms maintained at 15°C or less for excess supers and combs will prevent the adult SHB laying eggs and will minimise SHB larvae activity.

**Please Note:** The SHB larvae carry a yeast species (*Kodamaea ohmeri*) that poses a threat to immuno-compromised people. Be aware of the risk of handling and cleaning SHB slimed honey bee equipment and take precautions.

Jessica Lawrence, Eurofins Agroscience Services

Adult SHB are about 2-3 times smaller than honey bees

Nick Annand, NSW DPI

Heavy infestation of larvae on comb produces a slimy appearance

**SHB is a reportable pest in every state and territory of Australia. This includes NT and Tas where it is currently not present, as well as WA and SA where it is only present in restricted areas. Always consult your local department of agriculture before the interstate movement of hives, honey bee products or apiary equipment.**

**Other relevant fact sheets about SHB:**

- Small Hive Beetle (PIRSA) – FS03/06
- You can also download the RIRDC report *Small Hive Beetle Biology – Producing Control Options* by N. Annand (2011)

# Glossary



| Term | Definition |
|---|---|
| **Abscond** | When the entire colony of honey bees abandons the hive because of pests, diseases or other adverse conditions. |
| **Apiary** | Colonies of honey bees, hives and other equipment assembled in one area or location for beekeeping operations; also known as a bee yard. |
| **Biosecurity** | A set of measures designed to protect honey bees from the entry and spread of pests at a national, regional and individual property or apiary level. |
| **Brood** | Immature honey bees that have not yet emerged from their cells. Brood can be in the form of eggs, larvae, or pupae of different ages. |
| **Brood box** | Usually the bottom box of the hive used for rearing honey bees. |
| **Colony** | A colony of honey bees that consists of worker bees, drones, queen bee and developing brood living together as a social unit in one hive, or other dwelling. |
| **Comb (honey comb)** | A structure of beeswax built by honey bees in an array of hexagonal cells for storing nectar, honey, pollen and/or brood. |
| **Drifting** | The process by which honey bees join a hive other than their own, often due to loss of direction or hives placed too close together. |
| **Drone** | Male honey bee. |
| **Endemic** | Pests that are present in regions of Australia. |
| **Established** | Pests that are established throughout Australia, or regions of Australia. |
| **Feral bees** | Honey bees that are not managed by a beekeeper and live wild in the environment. |
| **Frame** | A construction of wood or plastic containing wax or plastic foundation and used in hives. |
| **Hive (bee hive)** | A series of boxes, including a brood box and supers, used for housing a colony of honey bees. |
| **Hive tool** | A flat metal device with a curved scraping surface used to open hives and pry apart and scrape frames. |
| **Migratory beekeeping** | The moving of colonies of honey bees from one locality to another during a single season to take advantage of multiple honey flows. |
| **Package bees** | A quantity of adult honey bees (1.5-2 kg), with or without a queen bee, contained in a screened shipping cage with a food source. |
| **Pollination** | The transfer of pollen from the anthers to the stigma of flowers. |
| **Queen bee** | A female honey bee with a fully developed reproductive system responsible for the egg laying in a colony. |
| **Queen excluder** | A metal or plastic screen used to confine the queen bee to the brood box. |
| **Requeening** | The replacement of the queen bee in the hive with another (usually younger) queen bee. |
| **Robbing** | The stealing of nectar or honey by honey bees from other colonies which happens more often during a nectar dearth. |
| **Smoker** | Device used to blow smoke on honey bees to calm them and thus reduce stinging of the operator. |
| **Super (honey super)** | A separate box that contains frames and is placed on top of the brood box. It is part of the hive body and used for the storage of surplus honey for harvest. |
| **Supersedure** | The natural replacement of an established queen bee by a queen bee newly reared by the colony in the same hive. |
| **Surveillance** | The collection, collation, analysis, and dissemination of pest and disease data. |
| **Swarm** | A large number of worker bees, drones and usually the old queen bee that leaves the parent colony to establish a new colony. |
| **Wax (bees wax)** | Wax secreted from glands on the underside of the worker bee abdomen and moulded by honey bees into honey comb. |
| **Worker bee** | A female honey bee. |

Funding for the printing and postage of 12,000 copies of the Biosecurity Manual for the Honey Bee Industry to every registered beekeeper in Australia has generously been provided by the Wheen Bee Foundation and the Federal Council of Australian Apiarists' Associations (FCAAA) through its member bodies. PHA acknowledges this contribution on behalf of the Australian honey bee industry, as well as both organisations' commitment to biosecurity best practices and their efforts in keeping Australia's honey bees healthy.

THE WHEEN BEE FOUNDATION

### The Wheen Bee Foundation

The Wheen Bee Foundation is a not-for-profit public company that has been created as a result of a generous bequest from well-known honey bee identities, the late Gretchen and Frank Wheen. Its broad purpose is to support research aimed at keeping Australia's honey bees healthy to ensure efficient pollination of our food crops and a viable beekeeping and pollination dependent industries. For more information about the Wheen Bee Foundation visit **www.wheenbeefoundation.org.au**

THE FEDERAL COUNCIL OF AUSTRALIAN APIARISTS' ASSOCIATIONS

### The Federal Council of Australian Apiarists' Associations (FCAAA)

The Federal Council of Australian Apiarists' Associations (FCAAA) was formed in 1933 and is the national representative body of the principal state beekeeping associations. Consider joining your relevant state beekeeping association listed below to support, and to play a role in, the Australian honey bee industry.

New South Wales Apiarists' Association Inc. (NSWAA)

Queensland Beekeepers Association (QBA)

Victorian Apiarists' Association Inc. (VAA)

Tasmanian Beekeepers Association (TBA)

South Australian Apiarists' Association Inc. (SAAA)

Western Australia Farmers Federation Inc. Beekeepers Section

### Biosecurity Online Training (BOLT)

Plant Health Australia's BOLT system provides free access to e-learning modules related to plant biosecurity to all stakeholders. A BOLT training module that complements this manual has been developed for the Australian honey bee industry to assist beekeepers in recognising biosecurity threats. This module, Honey Bee Biosecurity, covers key areas such as how to inspect hives, how to identify established and exotic honey bee pests, methods of early detection of Varroa mites and how to report suspect honey bee pests. BOLT training modules are open to anyone, and can be accessed through **www.phau.com.au/training**.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