



## **Beekeeping Basics - Certificate II**

### **Participants Learning Guide**

**RTE3415A Manage pests and diseases within a  
honeybee colony**

**RTE3407A Identify and report unusual disease or plant  
pest signs**



**Australian Government**  
**Department of Agriculture,  
Fisheries and Forestry**



**Australian Honey Bee  
Industry Council**

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Judith Nettleingham and Bruce White assert their moral rights to be identified as the authors of this publication.

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## What this learning guide covers

This learning guide will help you meet the requirements of two units of competency:

- *RTE3415A Manage pests and diseases within a honey bee colony*
- *RTE3407A Identify and report unusual disease or plant pest signs*

You may also wish to undertake the following additional units of competency that are also relevant to identifying and managing diseases and pests of honeybees:

- *RTC2706A Apply chemicals under supervision*
- *RTE3155A Manipulate honey bee brood*
- *RTC3704A Prepare and apply chemicals*
- *RTC3705A Transport, handle and store chemicals*
- *FDFOPTISP2A Implement sampling procedures*

## Resources you will need for this unit

For this unit of competency, you should have:

- Participants Learning Guide (this booklet)
- Participants Assessment Worksheets
- *Bee Agskills: A Practical Guide to Farm Skills*, NSW Department of Primary Industries 2007
- Australian Veterinary Emergency Plan (AUSVETPLAN)
- a beehive with active bees
- an experienced beekeeper
- tools and equipment:
  - protective clothing
    - bee veil
    - bee-proof overalls and gloves
    - ear protection
    - steel capped boots/shoes/gaiters

- sunhat
  - unperfumed sunscreen lotion
- bee smoker
- bee brush
- buckets and wheelbarrow
- water
- detergent
- glass slides, jars or cages for adult bee samples
- geographic positioning system (GPS) equipment
- compass and detailed locality maps
- hive tool
- hives
- loading and unloading equipment
- vehicle
- queen excluders (optional)
- smoker fuel
- post pack for sending samples
- marking pen to mark hives that maybe diseased or infested
- towel.

**The Participants Learning Guide** is designed to introduce the topics and to provide you with some practical and written activities which will allow you to develop both your knowledge and skills in each area.

**The Participant Assessment Worksheets** include activities that you will be completing as part of your formal assessment for this unit.

Please record as much detail as you can as your responses to these activities will form part of your assessment.

You will need to send the Participants Assessment Worksheets to your assessor. Check with your assessor to find out if they need you to submit this Participants Learning Guide as well.

**Important safety notes**

If this is the first time you are opening a hive, ask an experienced beekeeper to show you what to do and be on hand to help you in case you get into trouble.

If your work requires the use of load-shifting equipment, you must have the appropriate licensing/training/certification required in your state or territory.

## Introduction to this unit

### **In this learning guide, you will learn about:**

- assessing the health and condition of brood
- assessing the health and condition of adult bees
- identifying signs of unusual disease or a plant pest
- reporting signs of unusual disease or a plant pest.

### **Before you start this training, you should be confident about your skills to:**

- work safely around bees comply with OHS requirements, including manual lifting
- select and use appropriate personal protective equipment and beekeeping tools, including a bee smoker.
- prepare supplementary feeds
- record observations
- report signs of notifiable diseases
- requeen a colony
- take samples
- transport colonies
- observe
- recognise unusual disease or plant pest signs
- be able to follow procedures and instructions from government authorities.

### **You should know about:**

- mode of spread of pests/diseases and level of risk to beekeeping
- signs of endemic and exotic disease and pests of honey bees and treatments
- where relevant, non-allowable inputs for organic honey production
- required procedures to follow in notifying appropriate authorities
- where to access additional reliable information or personnel.

## **Why this task is important**

'Biosecurity' is the protection of people, animals and ecological systems against disease and other biological threats. Biosecurity is achieved through systems that aim to protect public health, animal and plant industries, and the environment, from the entry, establishment and spread of unwanted pests and diseases. (Australian Biosecurity CRC)

Even if your apiary is free from disease and pests, your bees may come into contact with pests and disease. Field bees forage over 2-3 km and can go up to 13.7 km and may come into contact with bees that are diseased or infested. They may bring these diseases or pests back to their hive and infect other hives in your apiary.

If left unchecked, disease and pests can kill your colonies by reducing the life span of bees and destroying their brood or combs. Ultimately, your apiary and your livelihood will be affected.

It is up to you to quickly detect the pests or diseases and do something about them.

Production losses will occur due to weakened colonies and the need to replace materials in some cases will also affect your productivity and profits.

A significant cost you must take into account is the significant time to inspect colonies for pests and disease and try to eradicate or manage the disease or pest in your colonies. You also need to weigh up the costs of increased checking and other preventative actions to keep your apiary free from disease and pests against the costs in time, money and lost income in trying to control or eradicate disease and pests once they are in your apiary. For most people, the choice is clear!

If you identify a pest or disease quickly, the amount of time can be reduced to control or eradicate the pest or disease. The time saved can be spent on productive hive management work on your colonies.

Bees are free- flying and drift, bees robbing hives can pick up pests or diseases so you owe it to fellow beekeepers within flight range of your bees to keep your bees healthy.

A number of pests and diseases are notifiable. This means that they have to be reported to the State or Commonwealth agencies responsible for bees as soon as you become aware of the possible problem. The following are notifiable pests and diseases in most states:

- Acarine *Acarapis woodii*
- Tropilaelaps mite *Tropilaelaps clareae*
- American foulbrood *Paenibacillus larvae*
- Bee louse *Braula coeca*
- Chalkbrood *Ascosphaera apis*
- Varroa mite *Varroa destructor*
- European foulbrood *Melissococcus pluton*
- Africanised honeybees *Apis mellifera scutellata*
- Asian honey bees *Apis cerana*
- Dwarf honey bee *Apis florea*
- Giant honey bee *Apis dorsata*
- Small hive beetle *Aethina tumida*

# 1. Background information about diseases and pests

## What is disease?

We have all had first hand experience of disease and we know that basically it is being unwell or sick:

A disease is a morbid condition of the body, or of some organ or part; illness; sickness; ailment. (Macquarie Dictionary)

When the body or any part of it is unable to perform its normal function, it is said to be diseased. This means that the term disease also covers conditions that we might think of as being an injury or damage, not just a disease such as influenza or TB.

We also know that we get different diseases by different means. These means are called the agents of disease. To understand how your bees have acquired a disease or to prevent them becoming diseased, it is helpful to look at the range of common agents of disease and see how the commonly-known diseases of bees fit into the various categories.

## Common agents of disease

The most common agents that cause disease come under the categories of:

- injury (for example, through being crushed or squashed)
- infectious agents (for example, bacteria and viruses)
- chemicals and poisons (for example, spray)
- parasites – internal and external
- specific inherited genetic faults (for example, inbreeding)
- nutritional imbalances and deficiencies (for example, lack of pollen).

## **Injury**

You can avoid injury to your bees by being careful when removing and replacing frames, supers and by securing your hives when transporting them.

## **Infectious agents**

Various kinds of micro-organisms can produce infectious disease if they gain access to a susceptible host animal – your bees.

## Categories of infective organisms

There are five main categories of infective organisms:

- bacteria, for example, American foulbrood
- viruses, for example, sacbrood or Black queen cell virus
- protozoa, for example, Nosema
- fungi, for example, chalkbrood
- prions, for example, mad cow disease or BSE (*bovine spongiform encephalitis*). Thankfully, beekeepers do not need to worry about prion disease!

## The start of infection

Infection occurs after the organism gains entry into the body system.

There are various means of entry including:

- direct contact – for example by contact between healthy and diseased bees
- airborne organisms, for example the spores of chalkbrood may be spread in this way
- ingestion of contaminated food or other material, such as collecting nectar containing toxic yeast;
- biting insects – for example Varroa mites;
- inheriting a disease or susceptibility to disease.

Whether the infection will develop into an epidemic will depend on the conditions current conditions, the amount of the infective agent present and the health and general condition of the susceptible population. The more resistant individuals in a population, the more the epidemic is slowed. However, if the pressure of infection is high enough, even these resistant individuals may succumb.

Human intervention may affect the course of the epidemic. Susceptible individuals and groups may be immunised to prevent 'catching the infection' and cases may be treated, for example by using antibiotics. Also the infected individuals or groups and any uninfected susceptibles may be isolated or quarantined/separated. Humans can also spread the infection.

Eventually an epidemic may burn itself out as the number of susceptible individuals falls below a threshold, or may smoulder on at endemic level until conditions are again conducive to another epidemic.

Intervention by quarantine and treatment will change the course of the epidemic. This is disease control. Preventive medicine anticipates and intervenes before the epidemic starts (e.g. to lower force of infection, increase resistance or immunity, change factors conducive to contact or transmission).

### Bacterial infections

Bacteria are microscopic, primitive single-celled organisms most of which are harmless. Some are beneficial. However some are pathogenic to animals. The best known bacterial infection of bees is American foulbrood.

Bacteria can be killed or their growth limited by antibiotics such as penicillin or tetracycline. Some antibiotics have a broad spectrum of activity against bacteria, while others are more specific in their action against a particular bacteria species. The only antibiotic used in beekeeping is oxytetracycline, used to control European foulbrood.

### Viral infections

A virus cannot live and multiply on its own and therefore relies on living body cells for survival. The resulting disease produced is due to the destruction or multiplication of cells which the virus has invaded. A virus is not affected by antibiotics, and so diseases caused by viruses are not effectively treated by administration of antibiotics. Sac brood is a well-known viral disease affecting bees.

### Protozoal infections

Protozoa are much larger than bacteria but still comprise a single cell. Many of the protozoa that cause disease require two hosts in order to complete the cycle. Some diseases caused by protozoa are slow, chronically debilitating diseases, like malaria in humans, while others are acute and severe, such as tick fever in cattle or coccidiosis in lambs. Nosema is a protozoal infection of bees.

### Fungal infections

Fungi (or moulds) vary both in size and cell structure. They have a low pathogenicity; that is, their ability to produce disease is limited. Chalk brood is a fungal disease.

## **Parasites**

A parasite is an animal or plant which lives on or in an organism of another species (the host), from the body of which it obtains nutriment. (Macquarie Dictionary)

Parasites may be internal (within the body) or external (on the body) of the host animal. Parasites may affect different stages of the life cycle of the host animal (or bee).

The Tracheal mite, Tropilaelaps and the Varroa mites are all parasites.

Parasites can cause disease in a number of ways. They can either directly damage the host animal or they can introduce infectious organisms into or onto the host. In these situations, the parasite is called a vector of disease.

If the parasites accumulate in large numbers in the host, they cause the animal to lose condition by competing directly, reducing the surface area, or by damaging the intestine wall to reduce the absorption of nutrients.

Parasitic diseases are particularly severe in young animals because they are more susceptible. They retard growth and lower resistance, thereby making the animal also more susceptible to other problems, including environmental stress, poor nutrition and infections.

## **Pests**

Honeybees are also affected by pests. Some of the more important pests are:

- Braula fly
- wax moth
- small hive beetle.

## **Endemic or emergency**

In Australia, diseases and pests often are categorised as either endemic or exotic. Endemic diseases are those that are widespread or common within Australia. Beekeepers and government agencies may seek to control the spread of these diseases but eradication is not considered possible. Some endemic pests and diseases may be notifiable.

Exotic pests and diseases are also known as emergency pests and diseases. These are not yet established in Australia and therefore every effort is made to keep them out! All emergency diseases and pests are notifiable. In this learning guide, we use the term 'emergency' rather than 'exotic'. An emergency animal disease or pest may be:

- a known non-endemic disease
- a variant non-endemic form of an endemic disease that can be distinguished by diagnostic methods
- a serious infectious disease of unknown or uncertain origin
- a known endemic disease occurring in such a severe outbreak form that an emergency response is required to prevent a large scale epidemic of national significance or serious loss of market access.

### **Legislation and notifiable pests and diseases**

In Australia, each state and territory has legislation and regulations that cover your responsibilities as an apiarist.

All emergency pests and diseases must be reported as soon as you suspect that you have found signs of them in your apiary.

Your state or territory will specify which endemic pests and diseases are notifiable.

Reporting and emergency response is covered in more detail later in this Learning Guide.

## 2. General principles for checking the health of your colonies

Observing the health and condition of your colonies is an essential part of beekeeping.

In the course of your routine work, you will have many opportunities to observe the health and condition of adult bees.

Each time you visit the apiary, check any weak colonies or dead ones and find out why they died. However, remember that often the strongest hive in the apiary may be the first hive to pick up a brood disease. Strong hives have more foragers and therefore more robbers to rob honey that may carry disease spores.

In addition, at least twice each year, you should examine all your colonies' brood by shaking the bees from the brood combs. The most suitable time to carry out brood inspections is on a clear sunny day in spring and autumn.

Identifying the signs of disease and pests requires good light and good eyesight. If you need glasses for reading, wear them inspecting brood and adult bees.

### **First steps:**

- make sure you are wearing suitable protective clothing – if you suspect that you are looking at signs of an emergency pest or disease, then you need to have clothing and footwear (or coverings) that can be decontaminated (or burnt)
- check tools and equipment required to open a hive, including equipment you will need to take samples for diagnosis of pests and diseases
- obtain a supply of water and detergent.
- check for any OHS hazards and take steps to minimise risk to yourself and others.

### **Hygiene between hives and apiaries**

- Always wash your gloves or hands between inspections each colony and change clothes between apiaries.

- Clothes should be put in a sealed plastic bag in case any pests are on the clothing.
- Never poke your hive tool into any suspect disease brood cell.
- If a brood disease is found in a colony, change the hive tool or get a flame burning in your smoker and place your hive tool into the flame so as to heat up your hive tool. The heat from the smoker will kill any bacteria virus or fungal spores or reproductive bodies.
- Make sure that your smoker is in a safe place and be careful not to burn yourself.

### **Identifying diseases**

Bees must be shaken off all brood combs so you can see every cell on the frame as a disease or pest may only be in one cell and if present you should be able to find it.

Shake the bees from the frame so the bees fall at the hive entrance or back into the box.

### **Specific diseases of the colony**

You must be able to identify the signs but remember more than one brood disease maybe present in the same colony.

At different stages of the brood cycle, brood may be showing a different symptom of the disease, for example, American foulbrood has four signs and if one is observed then the disease is present.

### 3. Prepare to check the brood

#### About brood

It is vital you know what healthy brood looks like.

Brood has three stages:

Egg - the queen lays one white egg in the middle of the base of the cell. She lays the egg upright, then over the next 72 hours the egg leans over to lie on its side on the base of the cell.

The egg stage lasts 3 days.

Larva - a healthy larva is pearly white in colour, glistens with a moist appearance and lies neatly coiled in the middle of the base of the cell.

The larvae grow rapidly and can be observed with a white fluid - royal jelly - surrounding the younger larvae.

The larvae stage for a worker is 8 days, for a queen 7 days and for a drone 11 days.

Pupa or sealed brood - brood cells from a healthy hive are sealed with a convex (raised) cap for both worker and drone brood. The capping is made from body hairs of worker bees and from wax taken from the cell wall. This makes the cappings a light brown colour and very different from the white cappings over honey.

All cappings in the same area should be complete, with no holes and of a similar colour, except when the larva is in the process of being capped.

The pupa stage for a worker is 10 days, drone 10 days and a queen 6 days.

## 4. Assess the health and condition of brood

You will be inspecting the brood to detect any variations from what you know healthy brood should look like.

When inspecting colony brood, all brood combs must be checked. A disease can be identified after starting in one cell and so all cells must be closely examined for variations from what you know to be healthy brood.

After you have shaken all the adult bees off the comb, hold the frame by the top bar with the light coming over your shoulder so the sun shines into the cells you are examining. You need to see the cell base, walls, larvae, pupae and cappings.

To improve the light and visibility in the cells, try holding the frame at an angle.

Examine each frame systematically in a regular pattern so that you check the whole frame.

### Checking eggs

If you see more than one egg in the cell base or walls of the cell, it indicates the queen is failing or laying workers may be present. This is not a pest or disease problem.

### Checking larvae

Disease or pests may be present if the larvae are:

- not white
- dull and dry looking
- in an unusual position in the cell edge or cell wall.

### Checking pupae

You may have a problem if the brood cappings:

- have holes in them
- are sunken
- vary in colour
- are scattered between uncapped cells.

## 5. Main diseases of brood

The most likely brood diseases you will encounter are:

- American foulbrood
- European foulbrood
- Sacbrood
- Chalkbrood.

### American foulbrood

Also known as American brood disease, AFB

Scientific name- *Paenibacillus larvae*

Type of disease – bacterial

Emergency or endemic? Endemic

Notifiable? Yes in most states/territories

#### Quick facts

This is by far the most serious honeybee brood disease in the world. Spores can remain viable for over 70 years. It is a notifiable disease in most states.

Inspect hives at least twice per year in spring and autumn. It can occur at any time of the year. If a hive dies out, check the brood combs for scales of this serious disease.

Diseased frames of brood have a 'pepper box' appearance.

You will see at once the disease has become established by the sunken, discoloured and perforated caps on the brood cells scattered amongst the healthy brood. Larvae that show signs of the infection after the cells are capped are stretched out along the lower vee of the cell walls from the top bar.

#### Spread

It can enter your apiary by:

- bees robbing a nearby infected hive
- exposed bee products honey, wax, propolis, pollen by bees robbing
- bees from an infected apiary drifting into your apiary

- purchasing queens, especially if the queen candy is not made of irradiated honey
- feeding diseased honey or pollen. Always irradiate honey and pollen before feeding.
- introducing into your apiary material that has not been checked for disease.

### Diagnosis

Occasionally death occurs after the larvae forms a pupa.

Worker bees investigate the dead brood by beginning to uncap the cell caps so some caps have holes in them; in other cases the bees have uncapped the cells so you can see the dead larvae and pupae.

Recently dead larvae or pupae are turning to a coffee brown and finally dark brown to black in colour. The remains of the dead larvae or pupae are moist, and if a match is placed into the dead brood it will rope or string out up to 25cm in length before breaking off. Very little odour is associated with this 'ropey' stage unless the weather is very humid.

The moist stage that occurs dries out to form a scale. The scale lies on the bottom of the cell walls. In the case of the pupae scales often the formed tongue can be observed. Scales can not be removed without breaking the cell walls.

Caps of the brood where disease symptoms occur behind the caps are darker than normal, often sunken to a concave shape, whereas normal brood caps are convex. Often the caps are perforated by the worker bees.

It is normal to see a lot of capped cells where this disease is present and the brood dies at the late larvae or pupae stages.

Confirm and report this disease by taking a sample and placing it on a microscope slide or a comb sample.

Send the samples to your state diagnostic laboratory for confirmation.

### Dealing with infected material

Infected material is either burnt or irradiated.

- Burning

State department apiary sections will give you instructions in general the hives are closed up at night the bees killed and then the material burnt in a hole in the ground and covered with 30cm of soil to prevent any robbing, the whole operation is carried out at night.

- Irradiation

Where material is sound it can be irradiated using gamma irradiation. The bees are killed at night after any excess honey has been extracted under direction and the dead bees are then buried. The material is strapped together and placed in plastic bags with the lids, bottoms, boxes and frames irradiated. The queen bee can be caged so all the brood hatches out prior to killing the bees and queen.

After irradiation the material is restocked with disease-free bees and queen.

### Compensation

NSW and Victoria have compensation schemes for American foulbrood for registered beekeepers who do the right thing.

### Control and treatment

All beekeepers should implement some sort of barrier system for this disease to limit its spread, by:

- only placing the same material on the same hive ( Hive is the barrier)
- placing the same material on only one load of bees (Load is the barrier)
- having more than one load as the barrier e.g. If you own 6 loads of bees and material is used on two loads, other material on the other two loads and other material on the last two loads. Six loads, three barriers.

Beekeepers often paint boxes different colours for each barrier or number boxes.

By using a barrier system you can reduce the spread and save time in inspecting. With care, this disease can be eradicated from an apiary.

## European foulbrood

Also known as European brood disease, EFB

Scientific name- *Melissococcus pluton*

Type of disease – bacterial

Emergency or endemic? Endemic

Notifiable? – Yes in most states/territories.

### Quick facts

The disease usually only occurs in larvae less than 48 hours old and they usually die when they are 4-5 days old. However, brood can die at any age and stunted adults with this disease can hatch.

It is most common in early spring when the colonies are growing rapidly, but it can occur at any time of the year when brood is present.

It is highly contagious.

Affected larvae are usually unsealed.

The disease causes high brood mortality and a reduction in the longevity of queens.

It is controlled through good beekeeping management and/or by using antibiotics.

You should examine all frames of brood, especially those with unsealed brood. Look closely at the mid rib of the combs for any discoloured larvae.

### How it spreads

European foulbrood is highly contagious and maybe present in a colony without showing signs. The bacteria multiply vigorously in the gut of larvae which have been given food contaminated with *Melissococcus pluton*. If these larvae survive and pupate, they discharge bacteria with their faeces and bacteria are then deposited in the bases and cappings of the cells. Some of these bacteria find their way to other larvae.

The disease can be spread by drifting bees, robbing infected hives, feeding infected pollen and honey. Spores can be found in water or infected material.

## Causes

Apparently sudden outbreaks often can be triggered by stress caused by poor nutrition, flora or climatic changes or when bees are subject to hot days and cool nights. Pollinating crops under nets can cause nutritional stress which may lead to an outbreak.

Other causes of stress that can lead to EFB outbreaks may be:

- working winter honey flows
- excessive movements of hives
- insecticide poisoning
- sudden expansion of the brood, resulting in insufficient nurse bees.

## Diagnosis

Signs to look for include:

- ‘peppered’ brood where many uncapped cells are mixed with normal capped cells
- cappings which are concave (sunken) and sometimes punctured
- young unsealed larvae (three to five days of age) in a ‘C’ shape around the cell walls
- dead larvae which are watery and pasty in appearance, and are yellow or brown/black in colour.
- ‘ropey’ brood (in old infections). If a match is placed into the dead material, it will ‘rope out’ about 15cm with several ropes before breaking off. The rope has a sour smell, very different to AFB rope. It is important to not spin the match to encourage the rope stage; a pasty consistency is also common.
- a slightly sour or sometimes rotten faecal odour.

Some strains of bees remove the infected brood symptoms (the larvae, pupae and scales) so that all you see is patchy brood.

However, EFB can be confused with Kashmir bee virus and the only reliable diagnosis is by microscope slide or comb sample examined in a laboratory.

## Control and treatment

Good beekeeping management practices are the best control. Infected colonies can be treated with the antibiotic oxytetracycline (OTC).

Oxytetracycline hydrochloride (OTC) is the only recommended antibiotic. It is only available on prescription from a veterinarian. In NSW, Apiary Officers can issue an order to supply after diagnosing the disease or it has been diagnosed in a laboratory.

You will find clear instructions on the label about how to use OTC, including the withholding period for honey.

It is strongly recommended that you remove excess honey before administering OTC to avoid residues in the honey.

Only use OTC as dry powder 'feed' in the brood nest only.

The dose rate is related to hive strength e.g. 1 gram active ingredient per double 0.5 grams active ingredient for a single hive.

Never touch the OTC with bare hands as it can be absorbed into your system leading to potential health problems for you! Always wears gloves when applying.

Do not move the hives for a week after administering OTC so that the OTC can do its job.

## Management practices

Management practices to assist in the control of this disease include:

- requeening on a regular basis every 12 months
- replacing brood combs at least 2 to 3 years with new foundation combs
- reducing stress by only opening colonies on warm days and don't open super colonies
- keeping colonies on a good nutritional diet, high in protein pollen
- using strains of queens that less susceptible to EFB.

Some beekeepers treat (spot feed) only colonies showing symptoms and this is becoming a more common practice.

## Sacbrood

Scientific name- *morator aetatulas*

Type of disease – virus

Emergency or endemic? Endemic.

Notifiable? No.

### Quick facts

The virus occurs in brood and adult bees.

It is not considered a serious disease of bees, but symptoms can be confused with the serious disease American foulbrood and with Darling pea weed (*Swainsona* species) poisoning.

The disease can occur at any time but is more common in spring and summer.

The larva ends often turn a darker colour than the rest of the body. This is a distinguishing feature of this disease.

### Spread

The virus can be carried by adult bees and infection of larvae occurs when infected bees feed the larvae.

Drifting bees can spread the virus from hive to hive and moving brood from colony to colony or bees will spread the disease.

### Diagnosis

In heavy infections, the brood has a mottled appearance.

Cappings may be perforated.

The larva dies after it has been sealed, lying full length along the lower bottom vee of the cell, hence the confusion with AFB.

Bees uncap the cells to expose the larva that can be dull white, yellow or grey just after infection.

The larva ends often turn a darker colour than the rest of the body. Over time the whole body darkens to a dark brown-black colour, becomes swollen and sac-like with a tough skin filled with granular fluid. The larva is shaped like a canoe or a banana.

The sac stage is easy to remove with a match or by the bees. At times it may rope less than 10 mm with a number of thin threads, hence the confusion with AFB.

Scales are formed that can be easily removed by the bees or with a match without damaging the cell walls.

Send samples of adult bees and comb containing infected brood for diagnosis to your state laboratory.

### Control and treatment

No control recommended as hives usually recover without assistance.

Treatments to consider include::

- requeening
- migrating away from Darling Pea areas (in the event that you are not dealing with sacbrood)
- feeding sugar syrup of 2 parts sugar to 1 part water.

### **Chalkbrood**

Scientific name- *Ascosphaera apis*

Type of disease – fungal

Emergency or endemic? Endemic

Notifiable? In some states.

### Quick facts

This disease is not considered as serious as AFB or EFB but it can seriously reduce production.

Heavy infection can occur from time to time reducing hive strength and vigour.

Some strains of bees seem to be more resistant to this disease than others.

Unsealed larvae about 4 days old are the most susceptible.

Spores can persist in honey for up to fifteen years.

Chalkbrood can occur at any time of the year but can be most common in spring.

Inspect your combs at least twice a year.

## Spread

The ability to spread is fairly low, however spores can survive for many years.

The disease is spread by:

- bees robbing honey infected with spores
- drifting bees carrying spores in their honey sacs
- beekeepers interchanging material between healthy hives and diseased colonies

## Diagnosis

It is easy to identify by looking directly into the cells where you will observe white chalk-like dead brood called 'mummies'. Mummies are removed by workers and so you may see them at the hive entrance. They may also be found on the bottom board.

Infected larvae produce fine cotton-like threads of fungal material which swells to the size of the cell.

The mummies are either mottled white (if not covered with fruiting bodies) and black or fully black in colour (if covered with fruiting bodies).

Sending mummies to the laboratory can also confirm the disease.

## Control and treatment

There is no recognized control or chemical treatment. Fortunately, hives often recover by themselves.

Outbreaks can be reduced by hygienic apiary management practices such as:

- keeping hives on good nutrition
- keeping hives warm and dry by not over supering
- requeening with a strain of bees showing resistance to chalk brood
- sloping entrances forward so bees can easily remove mummies.

## **Other brood diseases**

These are much less common and include:

- Stone brood
- Kashmir bee virus

- Black queen cell virus

### **Stone brood**

Scientific name - *Aspergillus*, *A fumigates* and *A flavus*.

This fungal disease kills both brood and adult bees. A fungus erupts through the skin of the larvae and spreads over the larval surface. Most brood dies once the cell is sealed.

Infected larvae are hard and difficult to remove from the cells. The spores of the fungus on the larvae can be grey-green, yellow or black and can be so numerous they cover the comb.

There is no treatment but for practical purposes this disease is so rare that if good beekeeping is practiced the risk of finding it in your apiary is very low.

### **Kashmir bee virus**

This virus kills both brood and adult bees. Dead brood can have symptoms similar to EFB. It is not considered to be a serious risk in Australia.

As signs can be similar to European foulbrood, it requires laboratory diagnosis to confirm its presence.

### **Black queen cell virus**

This virus causes the death of queen larvae or pre-pupae after the cells are capped. Cells develop dark brown to black cell walls. Diseased larvae have a pale yellow appearance with a tough sac-like skin. This virus does not multiply in worker or drone larvae or in young adult bees.

It is the most common cause of death of queen bee larvae and is therefore a concern for queen breeders. Hives where this virus has been found should not be used for raising queens.

If you suspect that you have found signs of Black queen cell virus, then you will need to send samples of the larvae to a laboratory for identification. It is not a notifiable disease.

## **Other causes of abnormal brood**

If a queen bee runs out of sperm or is running out of sperm to fertilize the worker eggs those worker eggs laid in worker cells will produce live drones in which case the caps will be drone shaped.

Worker bees can also lay eggs and these turn into drones and after lay in worker cells often on the cell wall the caps are all drone shaped. Dead brood that has been chilled is also observed as the bees can't keep it warm being low on numbers often. This occurs when a hive has been queenless for a long period of time.

If the brood is poisoned it will also die.

Pollen that is collected by the bees and stored in the brood nest can be confused as a disease it can be any colour and is packed hard into the cells.

### Patchy Brood.

In some hives, 12 to 15% of the eggs may not hatch into adult bees. The brood remains white and is chewed out by the workers.

Pollen stored in between brood cells which gives the impression of patchy brood.

### Failing Queen

When a queen fails due to old age physical damage or poor mating her brood can become patchy.

If she lays unfertilized eggs in worker cells with a runt drone hatching from the cell some of the workers and die.

### Laying Workers

If a hive is queenless for a long period of time worker bees can start to lay eggs often several in the same cell or on the cell walls of the worker cells, some can mature into drones

### Starvation

If a hive is in a starving condition due to lack of nectar, honey or pollen or all three the bees often abscond from the hive leaving the brood to die.

It is usual in these circumstances to find dead adult bees dead in the cells with the back of there abdomen facing you.

### Chilling

Brood can be chilled if bees leave the outer edges of the brood on cold nights, if the beekeeper open hives in very cold weather or leave a frame out too long in cold weather while inspecting brood nests/

Chilled brood turns grey or black unsealed stages chill before capped stages.

### Over heating

This can be identified if you see larvae hanging out of their cells they also turn grey or black also the wax cells can be misshapen due to excess heat.

Cause by leaving a frame in the sun too long if bees can't control temperature or humidity or bees are heat when entrances are closed for moving.

### Poisoning

Bees can be poisoned when a crop within 4km is sprayed with a toxic pesticide they are foraging on. Mortality can be identified by large numbers of dead bees at the hive entrances and inside the hive. Legs dragged and wings unhooked. Brood is also often neglected and dies. Queen bees are often superseded by the colony if this occurs.

## 6. Diseases of adult bees

You must carefully examine adult bees all over their body to find signs of disease or pests. Catch and hold the bee, so all parts can be examined: head, legs, thorax and abdomen.

### Nosema

Scientific names - *Nosema apis* and *Nosema ceranae*

Type of disease – protozoa

Emergency or endemic? Endemic.

Notifiable? Depending on the export destination of either bees or honey.

The only way to identify Nosema is by the collection of adult bees and identifying the Nosema spores in a laboratory. Collect 20-30 sick or freshly dead bees from your hive entrance and send them to your state laboratory.

By far the most serious adult honeybee disease in Australia, Nosema can cause massive losses of adult bees.

Nosema is a protozoan single-celled organism that forms spores. It interferes with the digestive process of adult bees thereby reducing their life span. Infected bees produce less brood food and so brood rearing also is seriously affected.

The number of spores present per bee is used as a means of interpreting the severity of the disease in a colony.

*Nosema ceranae* was first detected in Australia in 2007. In apiaries *Nosema ceranae* is considered to be more severe than *Nosema apis* because adult bees disappear rapidly.

### Spread

Spores of Nosema organisms are carried by adult bees and are present on the surface of combs in hives at all times. The disease develops into a serious state when bees are stressed or have poor nutrition and is most common in spring.

### Diagnosis

The only way to diagnose this disease is to send a sample of 20-30 sick bees or freshly dead bees from the hive entrance to a laboratory for them to be microscopically examined.

### Management practices

Protein deficiency seems to play a significant role leading to *increased* Nosema levels in colonies working late autumn and winter honey flows or going into winter after an autumn drought that reduced pollen supplies. Working pollen flows before and after winter honey flows helps reduce spore levels of nosema.

### Climate

Climate can play a role. You can protect colonies from cold winds by placing colonies on the northern slopes of hills. Place apiaries in the sun all year round. Manipulate colonies in warm weather and don't over-spread brood

Don't over-super hives; only have sufficient boxes on the hives so all frames are covered with bees.

Have young queens in colonies.

Old combs harbour disease organisms so replace at least two brood combs per colony per year with comb foundation.

### Fumigation

Combs can be fumigated with commercial grade 80% acetic acid to kill spores in material 80% acetic acid is produced by adding one part by volume of water to four parts of glacial acetic acid

Supers to be fumigated are stacked outdoors. Pouring 150ml of 80% solution onto an absorbent material placed on the top bars of the frames in each super seal the stock with masking tape and leave for 7 days to fumigate before reuse, air the combs for 7 days.

### Warning

Acetic acid fumes will corrode frame nails and wire; it's highly corrosive to metal electric equipment, so fumigation should not take place where this is likely to be a

problem. Wear gloves, protective clothing breathing equipment, if splashed onto your skin wash off immediately.

### Heat Treatment

Heat will decontaminate Nosema infected material by heating to a temperature of 49oc and held at this temperature for 24 hours to destroy the spores Combs must be free of pollen and dry combs containing no honey.

## 7. Parasites of brood, adult bees and comb

### Tracheal mite

Also known as Isle of Wight Disease, Acarine Disease, or Acariasis

Scientific name – *Acarapsis woodii*

Emergency or endemic? Emergency

Notifiable? Yes

#### Quick facts

This mite is not known to exist in Australia, but is wide spread through the world. Acarine disease affects the bee's tracheal system (breathing) where the mites feed on the blood. The whole life cycle of the mite occurs in the bee's tracheal system, except when the mites migrate from bee to bee.

When observing a hive, you may see bees crawling and gathering at the hive entrance,; their wings may be at abnormal angles. You cannot see the mite with your naked eye.

However there are no reliable field signs and the mites can only be identified positively by microscopic examination of the tracheal systems of adult honey bees.

#### Effects

Bees infested die at an earlier age than normal populations and numbers of bees can decline rapidly in winter.

#### Spread

The mite is spread by the movement and drift of infected bees. The mite is only likely to enter Australia in an illegal importation of bees.

#### Action

Using jeweller's forceps, collect larvae from tunnels on the comb and place them in small containers of 70% alcohol.

If you suspect this parasite is present, report immediately to your state department of agriculture or Disease Watch Hotline 1800-675-888.

STOP all work on the bees and don't move any bees or move bees from the apiary in hives or on your clothing.

### **Tropilaelaps mite**

Also known as Asian mite

Scientific name – *Tropilaelaps clareae*

Emergency or endemic? Emergency

Notifiable? Yes

#### Quick facts

The *Tropilaelaps* mite can be seen with the naked eye on combs and adult bees. It is 0.96mm long and 0.55mm in width and brown in colour with eight legs. They are fast moving and the entire body is covered with short bristles or hairs

It is not known to exist in Australia but is found throughout South East Asia and in Papua New Guinea in association with the Asian and European honeybees.

The life cycle is spent in the brood cells where the mites can damage developing brood; they depend on brood to survive and can't live away from brood for more than a week.

Initial field signs are an irregular pattern of sealed brood, numerous newly-emerged adult bees at the hive entrance and deformed dead brood may be seen.

#### Spread

Typically spread by moving combs and bees and by bees drifting between hives.

#### Action

A minimum of 100 bees and 100 cells of capped brood should be collected from each hive. from each hive. Place the samples in a sealed container of 70% alcohol.

Report any suspect outbreaks to your state department of agriculture or Disease Watch Hotline 1800-675-888.

STOP all work and make sure no mites are on your clothing and don't visit other apiaries with the same clothing or equipment until it is cleaned.

## Varroa mite

Also known as Varroasis

Scientific name - *Varroa destructor* and *Varroa jacobsoni*

Emergency or endemic? Emergency

Notifiable? Yes

### Quick facts

There are two species, *Varroa destructor* and *Varroa jacobsoni*. Neither species have been detected in Australia and are considered a major threat to beekeeping.

The reddish mites can be seen with the naked eye on adult bees or in capped or uncapped brood cells; they have eight legs and are shaped like a scallop or clam shell. Female *Varroa destructor* mites are 1.1mm long and 1.7mm broad. *Varroa jacobsoni* females are smaller - 1.0mm long and 1.5mm wide,.

DNA fingerprinting has shown there are more than 25 different gene types of Varroa on Asian honey bees but only two occur on European honey bees.

Varroa spend most of their life cycle inside sealed brood cells, preferring drone brood. *Varroa jacobsoni* do not breed in European honeybee brood but *Varroa destructor* will reproduce in the brood of *Apis mellifera*.

### Spread

The mites can't fly and are spread by infested bees drifting to healthy colonies, by mites changing bees while foraging on blossoms or by beekeepers moving material or infested brood combs from healthy hives to disease colonies. Each mite can live up to eight months.

### Diagnosis

Samples of infected brood and adult bees should be collected and placed in sealed containers of 70% alcohol and reported to your state department of agriculture or the Disease Watch Hotline 1800-675-888. CSIRO Entomology has the DNA technology to identify Varroa and Asian mites

Any reddish-brown insect seen in your colonies should be sent for positive diagnosis.

## Management

As they are not known to exist in Australia, management is aimed at surveillance. Carefully check adult bees by catching and examining them for the presence of mites. Closely examine the head, between the thorax and abdomen and under the body segments. Regularly carry out sugar shaking to detect all mites found in colonies.

## 8. Other problems

### **Braula coeca**

Also known as bee louse or bee fly.

Scientific name – *Braula coeca*

Emergency or endemic? Emergency

Notifiable? Yes

#### Quick facts

It is a wingless fly about 1.5mm long that can be seen with the naked eye. The fly is a scavenger that attaches itself to the hairs of the bee. It is reddish in colour and has six legs.

In Australia, it is only found in Tasmania and is notifiable on the mainland. Braula do very little damage to honeybee colonies but can damage comb honey making it unsaleable.

The females lay eggs under honey cappings. The resulting larvae can be observed in tunnels under the capping where they consume honey and pollen. The larvae can be identified pupating. They hatch within three weeks and can be observed as adults on adult bees or the queen or scavenging food from the mandibles of adult bees.

For identification collect hive debris from inside the hive, adult bees and honeycomb containing eggs, larvae and adult stages of Braula.

#### Spread

Typically the fly is spread by drifting bees and the interchange of honey comb.

#### Diagnosis

In comb honey, the larval stage leaves tunnels just under the capped honey. The queen bee often attracts a lot of Braula as she is fed by the bees and is the most permanent member of the colony.

#### Management

Queen bees and escorts from Tasmania to the mainland must be examined on the mainland by an apiary officer before going to the beekeeper.

## Africanised Honeybee

Scientific name – *Apis mellifera scutellata*

Emergency or endemic? Emergency

Notifiable? Yes

This is a hybrid bee infamous for its very aggressive behaviour.

Africanised honey bees are similar in appearance to other races of *Apis mellifera* present in Australia.

Colonies of Africanised bees in the field:

- are unduly nervous
- display a high propensity to sting
- have smaller worker bees
- often nest in the open.

Workers fly directly into the hive entrances, whereas other races of *Apis mellifera* land at the entrance first.

### Diagnosis

Collect young bees off brood if possible or block the entrance and catch field bees, avoid irritating the colony.

Catch up to 50 bees with a minimum of 10 from each suspected colony, place the bees in alcohol. A second sample of 20 frozen bees should also be collected.

The collected samples can be analysed for Africanised characteristics in a laboratory using measurements or DNA technology.

They are a notifiable pest and if you come across very aggressive colonies they should be reported to your state department of agriculture or the Disease Watch Hotline 1800-675-888.

## Asian bees

Scientific names:

Asian honey bee - *Apis cerana*

Giant honey bee - *Apis dorsata*

Dwarf honey bee - *Apis florea*

Emergency or endemic? Emergency

Notifiable? Yes

These are all tropical species closely related to the European honeybee *Apis mellifera*.

These Asian species exhibit traits that make them unsuitable for commercial management. It is also possible for them to be introduced serious exotic pests such as the Acarine, Varroa and Tropilaelaps mites into the races of *Apis mellifera* used in Australia

The three species do not interbreed with *Apis mellifera*.

Asian races have been detected on the Australian mainland and have been destroyed.

Fortunately the incursions were detected before the populations of bees could establish

### Diagnosis

*Apis cerana* nest in hollow trees, caves and in cavities in buildings and have several combs.

*Apis dorsata* have as a nest a single large comb which has been found suspended under a branch or eaves of houses or even the roof of car parking areas. Several nests occurred in the same tree, eave or parking area roof.

*Apis florea* nests in a small comb suspended underneath a branch or twig of a low shrub.

Positive identification is by cell size and adult bees.

### Action

Collect samples of adult bees and place in alcohol or freeze them for diagnosis in a laboratory. All are notifiable pests so report sightings to your state department of agriculture or the Disease Watch Hotline 1800-675-888.

## 9. Common pests in and around hives and or stored combs

The following are common pests that may prey on your bees or which you may find inconveniently around your hives:

- ants and spiders
- bees eating birds
- cane toads
- European wasps
- mice
- small hive beetle
- wax moth
- snakes.

### Ants

Ants can cause a problem in apiaries in drier inland areas.

Small black ants and meat ants often affect bees, mainly during times of food shortage. Ants will attack bee hives, taking stored brood and adult bees. At times they may cause weak hives to abscond.

Small numbers of hives can be protected by placing them on stands with their legs in sump oil, or by wrapping rags soaked in oil, grease or diesel around the legs.

Some beekeepers distract meat ants from hives by placing a road kill, dead kangaroo near the meat ants' nest. The ants then feed on the kill and leave the bees alone. In some areas where meat ants occur black ants are not present.

If chemical control is the only option you must get the property owner's permission, as many have quality assurance programs in place for crops and stock. Effective chemical ant control can be achieved by using cartridges that only allow in ants and can be placed under hives as a bait station. Contact your local apiary officer for up to date chemical control of ants. Chemicals that kill ants also kill bees.

### Spiders

Two species are common round bee hives:

- black hive spider
- red back spider.

Both species eat bees and the venom of both these spiders can have a severe effect on humans.

Spiders should be killed when they are found and their webs cleaned up. Care must be taken when hand-loading beehives and lifting boxes using hand holes as the spiders can be found under bottom boards, in hand holes of supers and in empty equipment.

### **Bee eating birds**

Bee eating birds and wood swallows are often observed catching bees in flight or at hive entrances around apiaries. Queen bees on mating flights are often taken.

If the problem becomes too great move the apiary as these birds are protected and killing them is illegal.

### **Cane toads**

These pests are a major problem where they occur and managed hives are kept.

If you are in a cane toad infested area, you must protect your bees as cane toads eat bees day and night at the hive entrance, causing serious losses of field bees.

The best form of protection is to place hives on stands 45cm above the ground.

### **European Wasp**

This wasp loves brood, adult bees and honey and tends to attack weak colonies in an apiary. This can provoke the honey bee colonies to become more aggressive than if the wasps were not present.

Try and find the wasp nest and kill it.

### **Mice**

These rodents damage stored combs and combs in weak hives where they can gain access. Store combs and make vermin proof. Make hive entrances mice proof.

## **Small hive beetle**

The Small Hive Beetle (*Aethina tumida*) occurs in NSW and Queensland and needs humidity to reproduce. This pest is becoming a serious problem in coastal areas. In inland areas they have trouble reproducing in sufficient numbers to cause trouble.

The larval stages damage combs and can drive a colony to abscond. Combs of honey removed from colonies with small hive beetle must be extracted within two days to prevent potential larval damage.

Control is by the use of traps filled with oil and placed on the bottom board or between combs to drown the adult beetle.

Research is being undertaken to find a safe effective chemical control for this pest

### Diagnosis

The larval stage is pearly white, up 2cm long, and can be observed in the combs where they feed on pollen and often congregate in large masses on the bottom board.

They pupate in the soil.

The beetles are black in colour as adults when they emerge from the soil; they are reddish colour for a couple of hours. The adults are broad and flattened, about 5mm long and 3mm wide, fast moving and run away from the light.

The beetles can be identified by an entomologist in a state department of agriculture and are a notifiable pest in most states.

## **Wax moth**

There are two main species:

- the greater wax moth *Galleria mellonella*
- the lesser wax moth *Achromia gisella*.

Wax moth larval stages are most active in warmer weather attacking the structure of unprotected combs and eating pollen. Wax moths are present in all beekeeping areas.

The larval stage hatches in 5-8 days at a temperature of 33°C-35°C.

Wax moth larvae tunnel through the wax consuming stored pollen and pupal cases for brood combs.

Old dark brood combs are very attractive; white combs contain less nourishment for wax moth larvae.

After about 28 days, depending on temperature, the wax moth larvae pupates.

### Control

General hive and apiary hygiene is important in reducing populations of wax moth in the apiary. Be sure to clean up all wax pieces, old combs and pollen.

Strong colonies keep wax moth under control.

Do not over-super hives.

Keep bottom boards clean.

Remove any dead hives or hives that have died out.

### Storage of combs to protect them from wax moth infestations.

Small numbers of combs can be stored in a super above a strong hive as a temporary measure.

Alternatively, they can be placed in plastic and stored in a refrigerator or deep freezer.

For larger numbers of frames, you may need to use a specially-equipped cool room.

No reproduction will occur if combs are stored in a cool room below 40°C.

Temperature control can be used to kill wax moth adults, larval stages and eggs as follows:

<b>Cold</b>	<b>-7°C</b>	<b>4-5 hours</b>
	<b>-12°C</b>	<b>3-0 hours</b>
	<b>-15°C</b>	<b>2-0 hours</b>
<b>Heat</b>	<b>46°C</b>	<b>1-3 hours</b>
	<b>50°C</b>	<b>40 minutes</b>

Ensure the temperature will reach all parts of the frames.

High temperatures will soften wax because bees wax melts at 62°C and combs start to collapse above 55°C.

With cold or heat, reinfestation can occur if rooms are not sealed. Cool rooms are very popular and are left running all the time.

### Chemical control

Comb can be fumigated with Phosphine. Phosphine is a highly toxic gas released from tablets or pellets containing aluminium phosphide or magnesium phosphide. The gas kills all stages of the moth.

Read the label instructions on how to use this product.

A room used for fumigation must not be part of an inhabited building.

Warning signs must be displayed, indicating fumigation is taking place. Phosphine is not allowed or registered for fumigation of combs containing honey for human consumption.

Make sure the product you use is registered for wax moth control. You may need to do a fumigation course to use this product

### Other controls

Bacteria and sex attractants are not registered for wax moth control in Australia.

Gamma radiation will also kill all stages but is not cost-effective for this purpose.

### **Snakes**

While more of a pest of beekeepers rather than a pest of bees, snakes can be found around bee hives. As they hide under bottom boards, care must be taken when strapping and loading hives to avoid being bitten.

## 10. Confirming a suspicion of disease or infestation

### Sampling for brood disease

While brood disease have characteristic symptoms, diagnosis on the basis of field symptoms can be confusing and inconclusive. It is possible for more than one brood disease to be present in the same colony.

Therefore the only positive means of diagnosis is to have the sample examined in a laboratory.

The following information is provided as general guidance. However, you will need to contact your state apiary section for their instructions about taking and preparing the sample and where and how to send it for laboratory diagnosis.

When you prepare the sample, ensure you include the following information:

- your name
- address
- contact phone number and work number
- the hive the sample was collected from
- the signs of disease you observed
- what you think the disease is.

### Sampling methods

Two sampling methods can be used:

- smear
- comb sample

#### Smear preparation

- use a separate glass microscope slide for a sample from each colony
- clearly mark the hive and label the slide with a pencil or felt pen
- select 6-10 larva showing the disease symptoms
- remove them with a match or toothpick and place the larvae on the slide
- pulp the larvae using the tooth pick or match on the slide

- using the side of the tooth pick or match smear the milky material from the larvae over one side of the slide. Any excess pulped material and the match or tooth pick is placed back into the hive the sample has been taken from.
- allow the slide to air dry in the open but not in direct sunlight
- wrap the slides so they are protected from breakage
- post to the designated laboratory for diagnosis.

#### Comb sample preparation

- cut out a piece of brood comb about 150 mm x 100 mm containing examples of disease symptoms
- cut the comb from the hive using a sharp knife. Make sure you don't spill any honey. Wash and clean the knife.
- do not enclose any honey in the sample
- pack the sample in a strong box to prevent it being crushed. An Australia Post video cassette post pack is ideal. Wrap in newspaper, not plastic or cling wrap.
- post the sample early in the week as samples can deteriorate. Fresh is best.

## 11. Protecting your apiary

### How are diseases spread?

Knowing how disease and pests of honeybees might be spread is the first step to preventing this from happening.

- Disease can be spread from apiary to apiary. Ways this can occur are:
  - Introducing an infected hive or hive material into your healthy apiary.  
Check all new hives for disease and pests before placing them your apiary.  
If you buy second hand material know its disease free. If you are not sure, have it irradiated.
  - Bees from your healthy apiary might be robbing diseased hives or honey.  
This can also happen within your apiary where bees for a healthy hive are robbing an infected hive. Try and find out the health of apiaries within 3 km of your apiary and of all the hives within your apiary to manage the risk.
  - Swarms  
Swarms can carry disease. A swarm should be isolated for two months so that its disease status can be checked before introducing into your healthy apiary.
  - Queen bees  
While purchasing queen bees is a minor disease or pest risk, ensure the queen breeder irradiates the honey used in the queen candy.
- Disease can be spread within your apiary. This can happen when:
  - Extracting equipment is contaminated.  
Extracting equipment can spread bacterial disease unless it is washed out after each extraction. Check the disease and pest status of all hives before starting to extract honey.
  - Bees are fed diseased honey or pollen.

Ensure all honey and pollen feed is irradiated.

- Disease is spread within the apiary by drifting of bees between colonies.

Drifting can be reduced by painting hives different colours so that bees recognise their own hives.

- Accidental interchange of healthy and diseased material between colonies by the beekeeper.

Always know the health status of material before moving it to other colonies.

### **How can you prevent disease and pests spreading?**

There are a number of simple actions that you can take that may reduce the risk of disease or pests being introduced in your apiary.

#### Practice good apiary hygiene

You must sterilize your hive tool and wash your gloves, hands and smoker bellows after you have been working with any hives that you suspect may have disease or pests.

#### Barrier system

To reduce work load and restrict spread of all pests and diseases beekeepers should set up a Barrier system to keep material on the same hives a full description is given in RTE3415A Manage Pests and Diseases within you're a honey colony

#### Registration of hives

Most states have a registration system for beekeepers. It is in your interest to make sure your registration details are correct and up to date. Once a serious pest or disease is found in an another apiary, the State Government apiary section may contact you if you have bees within flight range of the outbreak.

#### Branding

Once registered some states will require you to place a registration number and maybe name and address on your hives. This is for a disease or pest trace.

### Hive movement

Some states require you to keep a record of hive movements that also assist in tracing disease.

### Disposal of hives

Some states require information on why you sold hives and who too .

Hives must be kept in moveable frames so you can inspect the combs for disease and parasites

### Exposed honey

It is illegal to expose honey to robber bees if it is diseased, they can transmit the disease.

### Health certificates

Most states require health certificates issued by state apiculture section to move honey, beehives, queen bee, hive products and used beekeeping equipment between states. There is no movement allowed into Western Australia except for heat treated honey.

All queen bees, live bees and products must be accompanied by a health certificate if being exported. Queen candy is to be irradiated as well as pollen feed to bees as they can both carry spores of brood diseases. Most states have the following list of notifiable diseases under various acts.

Check with your state the legislation covers bee diseases.

### **Reporting a notifiable disease or pest**

You must also report notifiable disease to your state apiculture section, some diseases may not require treatment but are made notifiable so exports can proceed as some countries export of queens, honey, packages and apiary products require certain diseases to be notifiable before exports can proceed.

Check with your state what diseases are notifiable as this may change from time to time.

Currently (May 2008) the following diseases, pests and parasites of honeybees are included on the National Notifiable Animal Disease list:

- Tracheal mite (*Acarapis woodii*)

- *Tropilaelaps mite (Tropilaelaps clareae)*
- *Varroa (both Varroa destructor and Varroa jacobsoni)*
- *American foulbrood (Paenibacillus larvae)*
- *Small hive beetle (Aethina tumida)*

Biosecurity has recommended that European foulbrood and nosema be considered for addition to the list.

It is an offence to keep bees that are infected with a notifiable disease unless the bees are being treated by a method approved by an officer of an apiary section in a state department.

Disease watch hot line 1800-675-888 - use this number to report all exotic pests and diseases.

The Disease watch hotline is a toll free telephone number that connects callers to the relevant state or Territory officer to report concerns about any potential emergency disease situation. Anyone suspecting an emergency (exotic) disease or pest outbreak should use this number to get immediate advice and assistance.

### **Australian Veterinary Emergency Plan (AUSVETPLAN)**

This is a series of technical response plans that describe the proposed approach to an emergency disease or pest being detected in Australia.

Honeybee pests and diseases included are:

<i>Tropilaelaps clareae</i>	Category 2
<i>Varroa destructor</i>	Category 2
<i>Varroa jacobsoni</i>	Category 4
<i>Braula coeca</i>	Category 4 (except Tasmania)
<i>Acarapis woodii internus</i>	Category 4
<i>Apis cerana</i>	Category 4

Exotic bee species (Asian honey bees, Africanised honey bees) are not covered under the EAD Response Agreement. However this does not stop the lead agency and honeybee industry in the affected state/territory from mounting a response.

Category 2 diseases are emergency animal diseases that have the potential to cause major national socio-economic consequences through very serious international trade losses, national markets disruptions and very severe production losses for the beekeeping industry that are involved. Category 2 also includes diseases that may have slightly lower national socio-economic consequences. For this category, the cost will be shared 80% by governments and 20% by the beekeeping industry.

Category 4 diseases are diseases that could be classified as being mainly production loss diseases. While there may be international trade losses and local market disruptions, these would not be of a magnitude that would be expected to significantly affect the national economy. The main beneficiaries of a successful emergency response to an outbreak of such a disease would be the beekeeping industry. For this category, the cost will be shared 20% by government and 80% by the industry.

Training for beekeepers is provided at workshops conducted by Animal Health Australia so they can assist if an incursion of the pests or diseases occurs.

The full AUSVETPLAN is available on the internet at <http://www.animalhealthaustralia.com.au>

## Final activities and assessment

Now that you have completed all the activities in this Learning Guide, take some time to practice examining brood and adult bees under commonly encountered working conditions.

When you are ready, you can complete the assessment tasks that are listed in the Participants Assessment Workbook for this unit of competency.

## Useful references

*Bee Agskills: A Practical Guide to Farm Skills*, 2007, NSW Department of Primary Industries

*The Bee Book: Beekeeping in Australia*, 2nd edition, 2005, Peter Warhurst and Roger Goebel, Queensland Department of Primary Industries and Fisheries available from <https://www.publications.qld.gov.au/>, or phone 1800 801 123.

Animal Health Australia

<http://www.animalhealthaustralia.com.au/> (any particular pages or documents?)

Australian Biosecurity Cooperative Research Centre

<http://www1.abcrc.org.au/>

About Australia's Animal Health System

<http://www.daff.gov.au/content/output.cfm?ObjectID=A7FBAD3A-7E14-4663-B7A5D1BFD4B5847A>

Australian Department of Agriculture, Fisheries and Forestry - Pests and Diseases

<http://www.daff.gov.au/content/output.cfm?ObjectID=D7A08354-52B3-4CFC-AEEA99C268C4DC7E&contType=outputs>

New South Wales Department of Primary Industries – Animal health, disease and pests <http://www.agric.nsw.gov.au/reader/an-health>

Endemic bee diseases, Exotic bee diseases, Chalkbrood – set of three DVDs.

Northern Territory Department of Primary Industry, Fisheries and Mines – Animal Biosecurity

[http://www.nt.gov.au/dpifm/Primary\\_Industry/index.cfm?header=Animal%20Biosecurity&newscat1=Biosecurity%20and%20Product%20Integrity](http://www.nt.gov.au/dpifm/Primary_Industry/index.cfm?header=Animal%20Biosecurity&newscat1=Biosecurity%20and%20Product%20Integrity)

Queensland Department of Primary Industries and Fisheries – Animal industries – health, pests and diseases

[http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/27\\_127\\_ENA\\_HTML.htm](http://www.dpi.qld.gov.au/cps/rde/xchg/dpi/hs.xsl/27_127_ENA_HTML.htm)

Victoria Department of Primary Industries – Animal health

<http://www.dpi.vic.gov.au/dpi/nrenfa.nsf/LinkView/772AFDC5FD5791084A2568BD00810992CCCB356A6EA3B5FECA256EDD008183EA>

South Australia Primary Industries Resources SA – Biosecurity and Standards – Animal Health

<http://www.pir.sa.gov.au/pages/agriculture/annhealth/anhealth.htm:sectID=1717&tempID=11>

Tasmanian Department of Primary Industries and Water – Animal and poultry diseases

<http://www.dpiw.tas.gov.au/inter.nsf/ThemeNodes/EGIL-5ESUAT?open>

Western Australia Department of Agriculture and Food – animals and animal products

[http://www.agric.wa.gov.au/servlet/page?\\_pageid=449&\\_dad=portal30&\\_schema=PORTAL30&p\\_reference\\_path=798\\_IKMP\\_NAVIGATION\\_PORTLET\\_260&p\\_start\\_url=&p\\_home\\_url=&p\\_show\\_menu=&p\\_login\\_url=&p\\_topic\\_id=20027&p\\_topic\\_name=0AAP0&p\\_no\\_summpage=N&p\\_apname\\_img](http://www.agric.wa.gov.au/servlet/page?_pageid=449&_dad=portal30&_schema=PORTAL30&p_reference_path=798_IKMP_NAVIGATION_PORTLET_260&p_start_url=&p_home_url=&p_show_menu=&p_login_url=&p_topic_id=20027&p_topic_name=0AAP0&p_no_summpage=N&p_apname_img)