Animal & Plant Health Agency

The National Bee Unit

Tropilaelaps

parasitic mites of honey bees

Pollination

Pollinating insects provide almost incalculable economic and ecological benefits to humans, flowering plants and wildlife. Pollination by bees and other insects is the first step in the flowering/ fruiting process resulting in the production of vegetables and fruits. This essential nutrition comprises approximately 35% of the human diet. The production of 84% of crop species cultivated in Europe depends directly on pollinators. 70% of the 124 main crops used directly for human consumption in the world are dependent on pollinators.

Honey bee foraging on Hazel

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This document is also available on BeeBase (National Bee Unit) website, www.nationalbeeunit.com

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About this leaflet

Tropilaelaps: parasitic mites of honey bees

This leaflet describes the Asian bee mites *Tropilaelaps* spp., (*Tropilaelaps clareae, Tropilaelaps mercedesae, Tropilaelaps koenigerum* and *Tropilaelaps* thaii), two of which are potential threats to UK beekeeping. The mites are native to Asia and have spread from their original host the giant honey bee, *Apis dorsata*, to the European honey bee *A. mellifera*. There is a serious risk of their accidental introduction into the UK. *Tropilaelaps* mites are notifiable pests under European Community legislation. All beekeepers should be aware of the details of the life cycle and how the mites can be recognised and controlled.

Acronyms

APHA	Animal and Plant Health Agency
BBKA	British Beekeepers' Association
BDI	Bee Diseases Insurance Ltd
Defra	Department for Environment Food and Rural Affairs
EFSA	European Food Safety Authority
EPS	Exotic Pest Surveillance
EU	European Union
GIS	Geographical Information Systems
IBRA	International Bee Research Association
IPI	Insect Pollinators Initiative
IPM	Integrated pest management
ISO	International Organisation for Standardisation
NBI	National Bee Inspector
NBU	National Bee Unit
OIE	World Organisation for Animal Health
RBI	Regional Bee Inspector
SA	Sentinel apiary
SASA	Science and Advice for Scottish Agriculture
SBI	Seasonal Bee Inspector
SHB	Small hive beetle
SIA	Statutory Infected Area
UK	United Kingdom
VMD	Veterinary Medicines Directorate
WBKA	Welsh Beekeepers' Association
WG	Welsh Government

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Help and advice

The National Bee Unit

The National Bee Unit (NBU) provides an integrated statutory and advisory service to beekeepers in England and Wales. It provides diagnostic, consultancy and research services to Defra, Welsh Government, the Scottish Government, commerce and beekeepers. The NBU is a recognised centre of excellence in the provision of advice and research in bee health. The Unit's laboratories are fully compliant with ISO 9001 quality schemes to ensure a high professional standard, and use as a base, the Office Internationaldes Epizooties (OIE) Manuals of Standard diagnostic tests for laboratory diagnosis. Most staff are trained practical beekeepers as well as scientists and are supported by teams of specialists across The APHA and Fera Science Limited.

The Unit has modern facilities, including laboratories with computer support through BeeBase (see next section), as well as 150 colonies and the apiary buildings to support them.

The NBU has a bee health inspection and advisory service operating in England and Wales, comprising a regional network of Inspectors. The head of field inspection services is the National Bee Inspector (NBI). Regional Bee Inspectors (RBIs) reporting to the NBI manage teams of Seasonal Bee Inspectors (SBIs) throughout England and Wales. As well as the statutory inspections and apiary surveillance programme, Bee Inspectors provide free advice and assistance to beekeepers on a range of bee health issues and run training courses for beekeepers on disease recognition, disease control and good husbandry, often in conjunction with local Beekeeping Associations. The NBU team delivers around 500 training events every year. Bee Inspectors also assist with field trials within the NBU's Research and Development programmes.

For further information contact the NBU, who will put you in touch with the appropriate Bee Inspector for your area, or visit the NBU's BeeBase website key contacts pages (http://www.nationalbeeunit.com/public/Contacts/contacts.cfm).

The NBU has broad research and development interests (current list outlined on BeeBase http://www.nationalbeeunit.com/index.cfm?sectionid=48). Our portfolio covers varroacide development, EU-wide colony loss surveillance, risk assessment and novel control methods for exotic pest threats (e.g. *Tropilaelaps*, Small hive beetle and Asian hornet), and the economics and biology of pollination. The NBU is a contributor within the Insect Pollinators Initiative (IPI) (www.bbsrc.ac.uk/pollinators), leading research into systems that model the epidemiology of disease to enable improved management in the future. We are also using advanced molecular techniques to identify specific bacterial strain types, which will add to our understanding of the spread of serious brood diseases. The NBU works in partnership with many Universities and Organisations both in the UK and overseas to achieve these shared research goals.

BeeBase

BeeBase is the NBU's award winning website. BeeBase contains all the apicultural information relating to the statutory bee health programme in England and Wales. In June 2010, the information for the Scottish inspections programme was also incorporated into BeeBase. BeeBase contains a wide range of beekeeping information, such as the activities of the NBU, the bee related legislation, pests and diseases information including their recognition and control, interactive maps, current research areas, publications, advisory leaflets (including this one) and key contacts. To access this information visit the NBU website (www.nationalbeeunit.com). Many beekeepers find this website to be a very useful source of information and advice. In addition to the public pages of the BeeBase website, registered users (see below) can view their own apiary records, diagnostic histories and details.

Why is it so important to register on BeeBase?

As well as containing useful information on beekeeping, BeeBase is a vital tool in the control of bee disease and pests. Where statutory pests or diseases (for example, foulbrood) are confirmed, the NBU can use BeeBase to identify apiaries at risk in the local area and, as a result, target control measures effectively. By knowing where colonies are, we can help you manage disease risks in your apiaries. Risks include the incursion of serious exotic pest threats such as *Tropilaelaps mites* (and also the Small hive beetle). The more beekeepers who are registered, the more rigorous our bee health surveillance can be and, crucially, the better our chances of eliminating pests and diseases.

How to sign up to BeeBase

If you are not yet registered please visit the public pages of BeeBase where you can sign up online at: www.nationalbeeunit.com. Otherwise you can get in touch with the NBU office team who will be happy to help. You can email us at: nbu@apha.gsi.gov.uk or contact us by telephone on: 03003030094. By telling us who you are, you will be playing a very important part in helping to maintain and sustain honey bees for the future.

How do I know that my details will be secure?

All of the information that you provide for the purposes of registration on BeeBase is covered by the Public Service Guarantee on Data Handling (see Confidentiality page of BeeBase). In addition, all data will be handled according to rules stated in the Data Protection Act, 1998. All levels of access to BeeBase are protected in the same way as on- line banking. Your personal access is password- protected. When you first register you are allocated a temporary password, which is valid for your first visit only. You will then be prompted to set your own password. You need to ensure that your own password remains confidential. You will also be allocated a personal ID Number, which relates solely to you. As a personally registered beekeeper, once you have received an inspection visit, you can check your own record on BeeBase. If you wish, you can make use of the apiary records system to record your apiary visits. Your SBI, RBI, NBI and NBU staff will have access to your records, but no Inspector or NBU staff member will ever disclose to others that you have been inspected or any details about your bees or beekeeping without your consent. Although BeeBase includes public pages containing information such as disease, colony losses, leaflets, useful links and much more general information, the public has no access to your or other beekeepers' details.

Beekeeping Associations

In many areas, Beekeeping Associations operate disease training schemes and provide practical advice and advisory leaflets to members on bee disease recognition and management. Contact your local Beekeeping Association or bee health advisor for details (England - www.bbka.org.uk; Wales - www.wbka.com and the Bee Farmers Association – http://beefarmers.co.uk/).

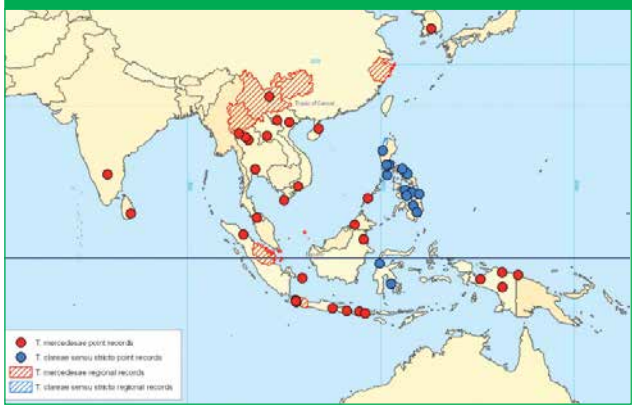
Figure 1: Fera Science Limited laboratory, Sand Hutton, York

Introduction to the *Tropilaelaps* mite problem

What are *Tropilaelaps* mites?

Tropilaelaps mites are damaging parasites of immature honey bees. Adult mites lay their eggs on honey bee larvae inside their brood cells. These hatch into mite larvae that feed on the haemolymph (blood) of developing bees, depriving them of essential nourishment required for growth. Recent molecular and morphological studies have shown that the mite genus *Tropilaelaps* (Acari: Laelapidae) contains at least four species: *Tropilaelaps clareae*, previously assumed to be ubiquitous in Asia, has been redefined as two species, *T. clareae sensu stricto* and *T. mercedesae*; *T. koenigerum* and a new species, *T. thaii*. Of these, only two are known to parasitise the European honey bee *Apis mellifera*. These are *T. clareae* (currently restricted to the Philippines) and *T. mercedesae* (widespread in Asia) For ease, they will be referred to in this leaflet as *Tropilaelaps*.

Figure 2. Distribution records of *T. clareae sensu stricto* and *T. mercedesae*



Geographic distribution

The natural geographical range of *Tropilaelaps* is currently largely confined to tropical/ sub-tropical zones, where these mites are responsible for very significant economic losses. Their geographic range has spread dramatically within the last 40 years. On behalf of Defra, the NBU has undertaken a 'non-native risk assessment' for *Tropilaelaps,* which considered the likelihood of arrival and establishment in Great Britain, and the impact that these mites could have as a result. You can read the full assessment on BeeBase (see http://www.nationalbeeunit.com/index.cfm?pageId=206). **At the time of writing *Tropilaelaps* mites have not been found in the UK or the rest of Europe, but if introduced through imports of bees and became established, they have the potential to cause major economic damage and losses to beekeeping and, as a consequence, to agriculture and the environment through disruption to pollination services.**

Host species

Primary hosts are the large Asian honey bee *Apis dorsata* and related species. However, *T. mercedesae* and *T. clareae* will readily parasitise the European honey bee *A. mellifera* (Table 1). European honey bees appear to be comparatively more susceptible to the effects of parasitism by *Tropilaelaps* because they lack the behavioural defences of Asian honey bees, which are able to remove heavily infested workers from their colony. Also, unlike *A. mellifera*, *A. dorsata* can bite and injure *Tropilaelaps* mites.

Figures 3 and 4. *Apis dorsata*, one of the natural hosts of *Tropilaelaps*

Potential impact on UK beekeeping

Table 1. Honey bee hosts utilised by different *Tropilaelaps* species

Key ☐ – known host; ☐ - not used as a host species

Species	*A. dorsata*	*A. laboriosa*	*A. mellifera*	*A. cerana*	*A. florea*	*A. breviligula*
T. clareae	host	host	host	host	host	host
T. koenigerum	host	host		host	host	
T. thall		host				
T. mercedesae	host	host	host			

Could *Tropilaelaps* reach the UK?

Yes. There is a significant risk that *Tropilaelaps* could be introduced into the UK, primarily through movement of honey bee stock i.e. queens and package bees, for the purposes of international trade. The UK has not permitted the import of colonies of bees or package bees from Third Countries (outside the EU) for many years. EU legislation now prohibits (with the exception of New Zealand) imports of package bees or colonies from Third Countries.

Import regulations are our main defence against the introduction of *Tropilaelaps* (and other very serious bee pests and diseases) from overseas to the UK. It is absolutely essential that all beekeepers abide by them. (See section 'Your responsibilities as a bee-keeper').

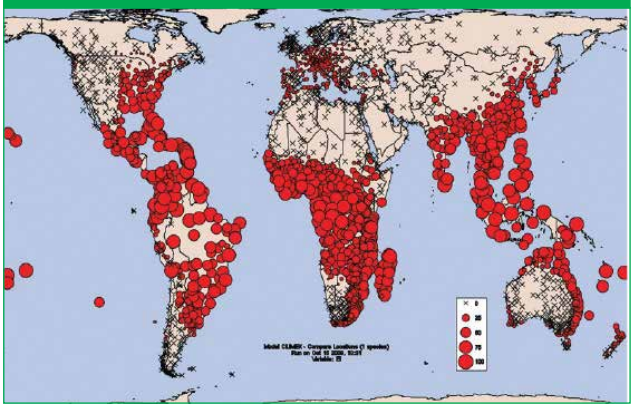
Limiting factors

Tropilaelaps cannot feed on adult bees because their mouthparts are unable to pierce the body wall membrane. As a result they are completely dependent on the softer developmental stages of their host species for food. All species of *Tropilaelaps* have an absolute requirement for year-round presence of brood within infected bee colonies in order to survive and spread.

Could *Tropilaelaps* survive in the UK?

Yes, although the brood requirements of *Tropilaelaps* are the limiting factor in its establishment in the UK. *Tropilaelaps* cannot stay alive during the winter where colonies are broodless. However, in areas of the UK that are warmer (for example in the south and east), where colonies have brood all year round, the mites would survive. As long as bees rear even a very small area of brood *Tropilaelaps* is able to persist inside the colony: If the amount of brood is reduced, many adult mites enter single occupied brood cells where they do not breed but continue to feed - thus 'lying low' until the brood re-expands within the hive.

Figure 5. CLIMEX map - Ecoclimatic indices for *Tropilaelaps* worldwide (i.e. all areas that are climatically suitable for *Tropilaelaps* based on mites known distribution)



Predictions are that the climate will become warmer in the future. Warmer winter temperatures and more colonies continually rearing brood, mean that in the UK the potential for *Tropilealaps* to spread and to impact on beekeeping are increasing.

Do I have to report *Tropilaelaps* if I find it in my colonies?

Yes, *Tropilaelaps* is a statutory notifiable pest of honey bees. This means that there is a legal requirement for any findings to be notified to regulatory bodies under EU legislation. Beekeepers in England and Wales must report any suspected presence of the mite in their colonies to the NBU. See 'Your responsibilities as a Beekeeper', on page 14. Beekeepers in Scotland and Northern Ireland should notify their appropriate Government Department (see 'Useful addresses').

Tropilaelaps biology

Parasitic mite: *Tropilaelaps clareae*, *Tropilaelaps mercedesae*, *Tropilaelaps koenigerum*, *Tropilaelaps thaii*.
Place of Origin: Asia
Natural Hosts: *Apis dorsata*, *Apis laboriosa*, *Apis cerana*, *Apis florae*, *Apis breviligula*. Only *T. clareae* and *T. mercedesae* parasitise *Apis mellifera* (Table 1).
Characteristics: Mites reddish brown, about 1mm long x 0.5mm wide. Life cycle similar to that of *Varroa*. Mites move freely and rapidly on combs, and rely on brood for feeding; mouthparts cannot pierce the membranes of adult bees. Thought to be unable to survive in broodless colonies.
Damage: In colonies with high *Tropilaelaps* levels, damage is similar to *Varroa*: irregular brood patterns; stunted adults with deformed wings and shrunken abdomens. May lead to absconding or colony loss.
Detection: Visually, by examination of hive debris or brood, or by application of a diagnostic 'knock-down' treatment onto hive inserts.

Figure 6. Female *T. mercedesae* dorsal view, seen under a Light Microscope

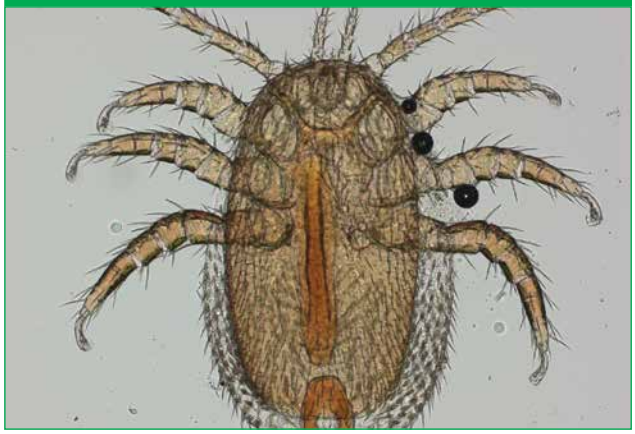
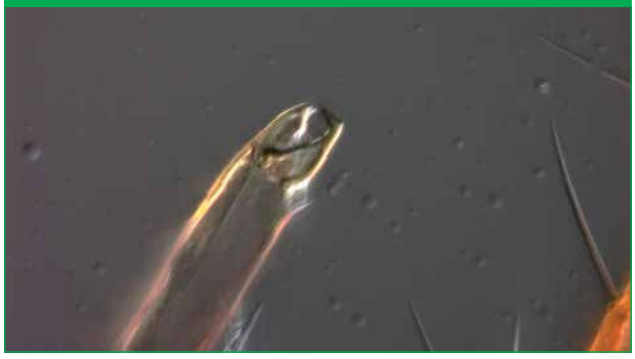


Figure 7. Female *T. mercedesae* anal and genital shields (under Light Microscopy)

The mites

To the untrained eye, all species of *Tropilaelaps* look very similar. Differences do exist between the external characteristics of *T. clareae* and *T. mercedesae*, for example in the shapes of their epigynial plates (hardened protective shields covering the female genitalia) or their pincer-like chelicerae (Figures 6-8), but you need a microscope to see these. Moreover, they are highly variable so unreliable for taxonomic reference. Common characteristics of adult *Tropilalelaps* include an elongated body shape and a light-reddish brown body colour. Females are about 1.0 mm long x 0.5 mm wide (*T. mercedesae* being larger than *T.clareae*). In both species, males are smaller than females and their bodies are less sclerotised (i.e. less hardened). The only sure way to distinguish between species is through molecular methods.

Figure 8. Female *T. mercedesae* – pincer-like chelicera (under Light Microscopy)



Figures 9. *T. clareae* on A. dorsata

Lifecycle

Although much remains to be learnt, the life cycle of *Tropilaelaps* as a parasite of *A. mellifera* is similar to that of *Varroa destructor,* although there are slight differences. *Tropilaelaps* has a higher reproductive rate than *Varroa* as it has a shorter life cycle. This is because they have a faster development time and a shorter phoretic phase (non-reproductive transport phase, time spent on the adult bees) between reproductive cycles. Consequently, when both types of mite are present in the same colony, *Tropilaelaps* populations build up far more rapidly than *Varroa*, by a factor of 25:1 in favour of *Tropilaelaps*.

Adult mites enter cells containing bee larvae – reproduction takes place within sealed brood cells. The mites can reproduce in both worker and drone cells, but show a preference for drone brood (although this preference is less marked than seen with *Varroa*). Typically, the mother mite lays 3-4 eggs, at daily intervals, onto mature bee larvae 48 hours after cell capping. Eggs hatch after 12 hours and larvae go through nymphal stages (protonymph, deutonymph) before becoming adults. Once hatched, all stages (nymphs and adults) of both female and male mites feed on their haemolymph (blood) of the developing bee hosts.

Tropilaelaps' development from egg laying to the adult stage takes approximately 6 days. When the adult bee emerges, both adult male and female mites and the original invading mother mite all exit the cell to search for new hosts. Up to 14 adult mites and 10 nymphal stages of mite have been recorded in a single cell. In contrast, with *Varroa* infestations, immature females and the male mites die in the cell.

Since (unlike *Varroa*), *Tropilaelaps* depends on the developing brood for food, they must move from the adult bees to feed on the larvae as quickly as possible after emergence. As a result, their phoretic stage is much shorter than that of *Varroa* (may be only 1-2 days). Gravid female mites (pregnant/carrying eggs) will die within 2 days unless they deposit their eggs. *Tropilaelaps* is therefore less well adapted for survival in hives where there are long broodless periods.

Figure 10. *T. clareae* on pupa of *A. dorsata*

Figure 11. High magnification micrograph of *T. clareae*

Means of spread

Tropilaelaps mites are mobile and can readily move between bees within the hive. However, to move between colonies they depend upon adult bees for transport through the natural processes of drifting, robbing and swarming. Mites can spread slowly over long distances in this way. They are also spread within apiaries through distribution of infested combs and bees through beekeeping management. However, movement by the beekeeper of infested colonies of *A. mellifera* to new areas is the principal and most rapid means of spread. Before moving your bees it is essential to check that they are healthy.

Figure 12. Migratory beekeeping, for example to heather moors, has the potential to rapidly spread pests and diseases over long distances

Figure 13. Checking colonies are free from disease before preparing them for migration

The harmful effects of *Tropilaelaps* infestation

Apis mellifera colonies heavily infested with either *Tropilaelaps* or *Varroa* show similar damage. The infestation and feeding activities of the mites cause brood mortality and reduce the lifespan of any adult bees that survive the parasitised brood stage. Individual bees infested during their development that survive to emergence may show signs of physical or physiological damage as adults. Signs include a shorter lifespan, lower body weight and shrunken, deformed wings and legs (Figure 14). These bees may be seen crawling at the entrance to the hive. As with *Varroa* mites, *Tropilaelaps* has been associated with infection and spread of deformed wing virus. Other signs include: irregular and poor brood patterns with patches of neglected brood and perforated cappings (due to worker bees attempting to clean out sick or dead larvae). In severe infestations up to 50% of the developing brood may be killed (in some infested colonies there may be so much dead brood that you will notice the smell of decaying pupal and larval remains). At this stage colonies may abscond and so aid the spread of the mite.

Figure 14. Deformed *A. dorsata* pupa from *T. clareae* infested colony

How to detect and control *Tropilaelaps*

How to check colonies for *Tropilaelaps*

Distinguishing between *Tropilaelaps, Varroa* and other mites is relatively straightforward, particularly with the help of a magnifying glass. *Varroa* mites are larger, crab-shaped and wider than they are long (Figures 15a and b), and they move relatively slowly. The bee-louse, *Braula coeca* (a wingless fly that lives harmlessly on adult bees (Figure 16)), can be distinguished by its more rounded shape and its six legs, which are readily visible on both sides of its body. Another mite that beekeepers need to be able to recognise is *Melittiphis alvearius* (Figure 16). This is a predatory species that preys on scavenger mites that occur in bee hives, doing no harm to either bees or brood. The body of *Tropilaelaps* is elongated and it is a fast-running mite, moving rapidly across the brood combs, often catching the eye of the observer and therefore easier to spot than *Varroa*. *Tropilaelaps* mites also 'hide' in brood cells rather than on adult bees, which makes diagnosis of an infestation easier. Adult female mites may be seen walking rapidly out of the cells and along the face of the comb; immature mites are pale and remain motionless when feeding on their hosts in the brood cells.

As the life cycles of *Varroa* and *Tropilaelaps* are similar, the main detection methods used for finding *Varroa* can be readily applied to *Tropilaelaps*. Regular collection and examination of floor debris and hive inserts, examination of the bees and brood (e.g. uncapping brood) and the use of a proprietary acaricide as a diagnostic tool are the best approaches for identification of infestations; see the Table on page 10 for more details of techniques. These methods are now familiar to UK beekeepers from years of experience of monitoring *Varroa*.

Figure 15a and 15b. Dorsal (15a) and ventral (15b) views of *V. destructor* (left) and *T. clareae* (right)

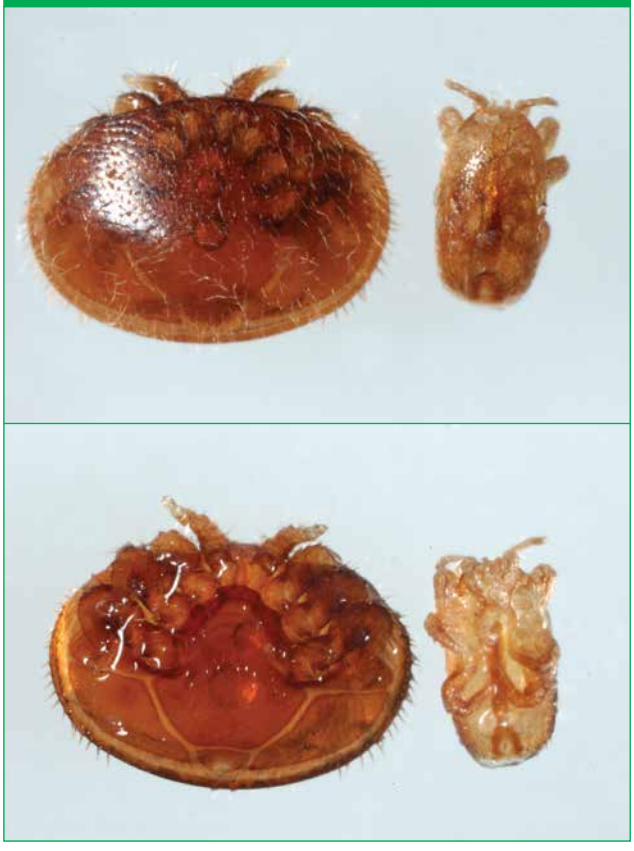
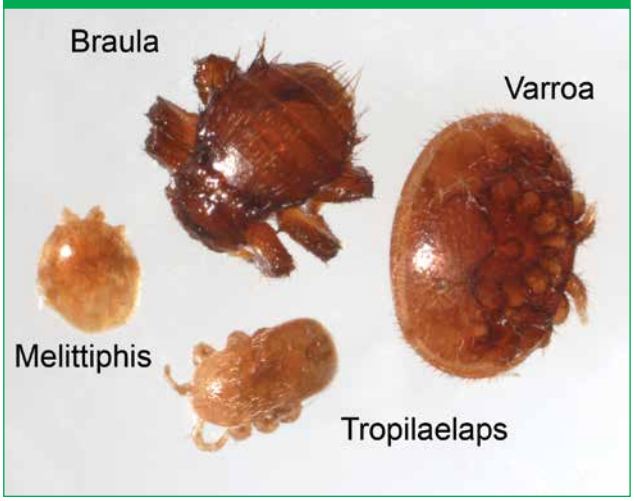


Figure 16: *Tropilaelaps* compared to *Braula coeca*, *Varroa* and *Melittiphis*



Method: Monitoring natural mite mortality ('mite drop')	Pros and Cons
1. Maintain the colony on a mesh floor (commonly known as a *Varroa* floor) with a collecting drawer underneath and sticky board (white card coated with Vaseline or other sticky substance (Figures 17 and 18). 2. Remove floor debris regularly during the summer and check every 5 - 7 days. 3. If there is a lot of debris (e.g.after winter) mites will be very difficult to find. Mix the debris with methylated spirit in a large container. Most dead mites will float to the surface whereas wax and propolis particles will sink.	✓ capable of detecting very few mites ✓ can give a good idea of infestation level ✓ colony is not disturbed × needs additional equipment × monitoring takes several days × encourages wax moths if debris accumulates
Method: Brooduncapping	**Pros and Cons**
1. Select an area of sealed brood (drone or worker) at an advanced stage (pink-eyed), as this is least likely to disintegrate when removed. 2. Slide the prongs of a honey uncapping-fork under the cappings, parallel to the comb surface, and lift out the pupae in a single scooping motion (see Figure 19). The younger mite stages are whitish and may be almost motionless while feeding on their hosts' bodies, as their mouthparts and front legs are fixed to the cuticle of the bee host. Mature mites, which are darker, are easily seen against the pale bodies of the pupae.	✓ quick and easy to use ✓ can be used during routine colony inspections ✓ gives instant indication of infestation level × unlikely to detect a very light infestation × results are approximate
Method: Using proprietary acaricides	**Pros and Cons**
1. Use a purpose-made mesh floor, or a sticky card or plastic insert to cover the existing hive floor, with a 3 mm mesh to stop bees removing dead mites. 2. Apply the acaricide treatment, following the label instructions. 3. Look for dead or dying mites on the floor after 24 hours.	✓ sensitive, capable of detecting very few mites ✓ gives a good idea of infestation level at same time as treatment × dependent on chemical use

Figure 17: Monitoring for *Tropilaelaps* – checking mite drop

Figure 18: Monitoring for *Tropilaelaps* – Mite floor with insert covered in hive debris

Figure 19. Uncapping drone brood to check for the presence of mites. If present, they will be clearly seen against the white background of the pupae

Control methods for *Tropilaelaps*

The fundamental aim of mite control is to keep their population at all times below the 'economic injury level' where harm is likely. A combination of both veterinary medicines (acaricides or varroacides) and biotechnical methods can be used to control *Tropilaelaps*.

'Acaricides' are medicines that kill mites. These are applied either in the feed, directly on adult bees, as fumigants, contact strips or by evaporation. Many of the same acaricides used for *Varroa* are also likely to be effective against *Tropilaelaps*. Although currently there are no products specifically approved for the control of *Tropilaelaps* in the UK, in the event of the mite being discovered contingency plans would be implemented and emergency approvals sought from the Veterinary Medicines Directorate (VMD) to use varroacides against *Tropilaelaps*.

'Biotechnical Methods' use bee husbandry to reduce the mite population through physical means alone. Many of the effective methods involve trapping the mites in combs of brood, which are then removed and destroyed. (See also our 'Managing *Varroa*' leaflet on BeeBase).

Tropilaelaps is considered relatively straightforward to control using husbandry methods that simulate broodless periods. The inability of *Tropilaelaps* to feed on adult bees, or to survive outside sealed brood for more than a few days, is a weakness in the mites' life cycle, which can be exploited to control it. In particular, in areas where the mite is present, methods such as queen caging, the use of artificial swarms and comb trapping methods, to create breaks in the brood, should be effective to reduce numbers of mites.

National Surveillance for *Tropilaelaps*

National Bee Unit apiary surveillance for exotic threats

Tropilaelaps is not thought to be present in the UK but, since 2003, the NBU and its appointed Inspectors have increased statutory surveillance programmes to monitor for the arrival of *Tropilaelaps* and other exotic pest threat. These exotic pest surveillance (EPS) inspections represent 10% of the annual statutory programme (See also the 'Small hive beetle' advisory leaflet or visit the NBU website www.nationalbeeunit.com).

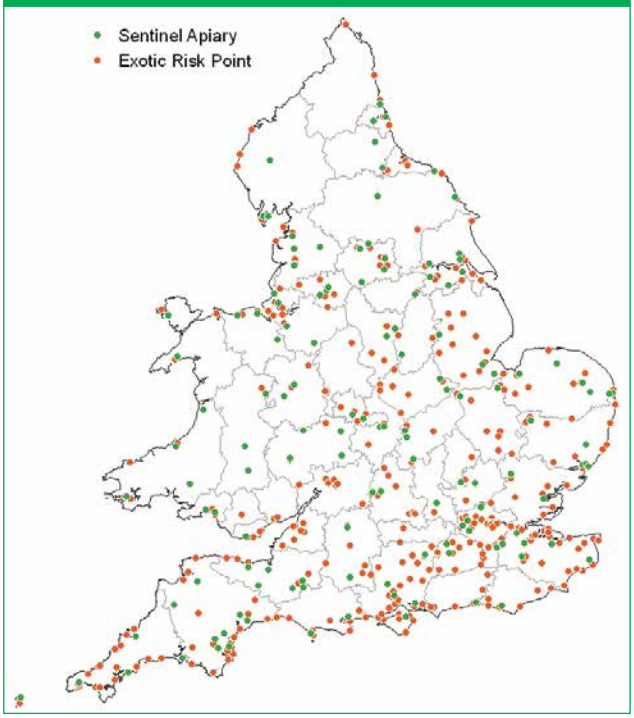
The NBU uses Geographical Information Systems (GIS) to prioritise this programme and target apiaries identified as 'at risk'. For instance, apiaries situated close (<10km) to civilian and military airports; close to freight depots and ports of entry; apiaries belonging to bee importers and surrounding apiaries, and if *Tropilaelaps* is found here, apiaries containing bees moved from declared infested areas. A map of these risk points is available to view on BeeBase – see also Figure 20.

The only chance for eradication will be early interception, so by targeting inspections to these areas we have a better chance of succeeding.

Inspectors submit debris samples or hive inserts collected from 'at risk' apiaries to the NBU to be screened for the presence of *Tropilaelaps* (and the Small hive beetle (SHB)). Diagnostic tests include 'alcohol floatation' (which separates mites from colony debris on the basis that chitinous material floats) and light microscopy. Whole mite specimens are sent to Fera's Entomology team for identification of species. Whenever necessary we can also use targeted molecular techniques, capable of detecting *Tropilaelaps* mites even in very small and damaged samples.

It is recognised that selection and inspection of 'at risk' apiaries is based on the current understanding of the most likely routes for entry and may mean that the surveillance programme can inadvertently miss unexpected introductions. However, the inspection programme is adjusted to take account of improved knowledge of the means of spread and dispersal of these pests.

Figure 20: BeeBase map showing 'at risk' and sentinel apiary locations in England and Wales



Sentinel Apiaries

EPS is an important first line defence, but we do not work alone in our ongoing campaign to keep exotic pests at bay. Since 2010, a selected group of beekeepers in England and Wales have been specifically monitoring their colonies for exotic pest species on behalf of the NBU. These 'sentinel apiary' (SA) holders represent a valuable additional front-line defence against exotic pest incursion. There are fifteen SAs in each of the eight beekeeping regions (i.e. 120 in total across England and Wales), which are in both 'at risk' and random areas to maximise the likelihood of detection (Figure 20). Hives within the SAs are regularly examined by the beekeepers, according to specific monitoring protocols. Twice in each season samples of hive debris are submitted to the NBU where they are tested for the presence of *Tropilaelaps* (and SHB). The establishment of SAs marks an increase in the level of surveillance for exotic pests, improving the chances for early interception and successful eradication.

Keeping an eye out for *Tropilaelaps*

Keeping an eye out for exotic pests, including *Tropilaelaps*, must be a routine part of colony management. In addition to apiary inspections for statutory bee diseases, the NBU provides advice and assistance to beekeepers on a range of bee health topics and good husbandry, and runs training courses for beekeepers on disease recognition and control, usually in conjunction with local Beekeeping Associations. These include how to look for and recognise *Tropilaelaps*.

Contingency Planning

On behalf of Defra and the Welsh Government, the NBU has produced a Contingency Plan for exotic pests and disease of honey bees (http://www.nationalbeeunit.com/index.cfm?page Id=206). This is an operational document that details the response to an exotic pest or disease outbreak in England and Wales. Similar arrangements should apply in Scotland and Northern Ireland. Although the Contingency Plan is generic, it focuses on the two notifiable pest species in the UK, *Tropilaelaps* and SHB. The essential elements of Contingency Planning are communication, assessment of the extent of infestation, eradication and containment or If an exotic species is suspected, a Statutory Infected Area (SIA) will be declared. The size of the initial SIA will depend on the extent of the outbreak and the pest or disease concerned. Based on current knowledge of the dispersal of SHB (by means of their own flight), and *Tropilaelaps* (transported on honey bees), the area will cover a minimum 16 km radius around the suspect apiary or premises where the mites have been found. Movement restrictions will be placed on all apiaries within the SIA restricting removal of colonies, queen bees, bee pests, used beekeeping equipment, hive debris, all unprocessed hive products, including honey and raw beeswax or any other thing which is liable to spread mites, within, into or out of the SIA. Restrictions will take immediate effect and will remain in force while the NBU completes emergency apiary searches.

Emergency searches of apiaries around the first find will be completed very quickly to decide whether the pest can be eradicated or whether the mites are already established.

Any approach taken for the control of *Tropilaelaps* in the UK would depend highly upon the extent of the infestation; if restricted, an eradication method could be used. Otherwise, a containment scheme would be implemented. Further details of proposed actions are available in the Contingency Plan.

What should you do?

It is difficult to predict the impact *Tropilaelaps* would have on beekeeping if mites were introduced to the UK. However, it must be considered a significant threat that could have serious consequences for our beekeeping industry, particularly in conjunction with the other pests and diseases we already manage. Beekeepers should prepare for the possibility of its arrival. It is important that they make themselves aware of the main features of *Tropilaelaps* and the possible risks and make surveillance and monitoring for the mites a routine part of their beekeeping programme.

Although we may think that *Tropilaelaps* is a long way off and will not affect the UK, experience elsewhere has shown how easy it is for a pest to be moved into an area where it was not previously indigenous; prior to 1996, SHB was unheard of for most of the world's beekeepers. In the event that *Tropilaelaps* is introduced into the UK, the early detection of the mite is essential for control and containment measures to be implemented and allow for any eradication attempt. If *Tropilaelaps* is not found until after it is established and widespread, then beekeepers will need to learn how to live with the mite and control it, just as we have with *Varroa*. If you find anything suspicious, contact the NBU or your local Bee Inspector for advice. All suspect samples should be sent to the NBU for identification.

Your responsibilities as a beekeeper

If you are going to import queens or bees make sure that you do so only from countries permitted under current legislation and from reputable producers. Do not be tempted to import bees illegally – the risks are just not worth it. If you have any queries or need advice or further information contact your Inspector or the NBU, or take a look at the NBU website (www.nationalbeeunit.com).

Sending suspect mite samples to the NBU

Suspect *Tropilaelaps* adults or larvae should immediately be sent to the NBU for examination. Inside the package, use a sealed container, such as a plastic tube or stiff cardboard box. Please provide as many details as possible – your name and address, the date, the apiary name and location (including, where possible, the Ordnance Survey map reference). Do not send live mites in the post. Kill them first by keeping them in a freezer overnight (or by putting them in 70% ethanol). A simple to use sampling form is available to download directly from the NBU website (www.nationalbeeunit.com on the honey bee pests and diseases pages).

Your responsibilities as a beekeeper

Despite our wishes and efforts to the contrary, sooner or later *Tropilaelaps* could arrive in the UK. It is important that beekeepers prepare for this possibility.

- Make sure your details are recorded on BeeBase. It is extremely important that all beekeepers register on BeeBase. If we don't know where at risk colonies are located, then our chances of effectively monitoring for the arrival of *Tropilaelaps*, or achieving control in the event of an invasion are seriously jeopardised. This is the responsibility of the beekeeper. To register as a beekeeper, please visit www.nationalbeeunit.com.
- Make sure you only import bees through the proper channels and with appropriate health certification. Do NOT be tempted to import bees illegally.
- Make sure you understand the essential details of the mite's lifecycle, and how to recognise them; in particular how to distinguish between *Tropilaelaps* and *Varroa* (and other mites).
- Be vigilant – you should keep an eye out for *Tropilaelaps* when you examine your bees – this should become part of routine colony management. If the mites do enter the UK, early detection will allow control action to be targeted promptly where it is most needed and help reduce the spread of this pest throughout the country.
- Aim to stay informed and up to date on the spread and emerging biology of *Tropilaelaps* mites and the methods used to control them overseas. If *Tropilaelaps* does enter the UK, you will need to be ready to start to deal with it. The NBU will provide regular updates to beekeepers as part of its bee health advisory work.

Tropilaelaps and the law

Tropilaelaps is a statutory notifiable pest under both EU and UK legislation. Beekeepers are permitted to import honey bees from a very limited number of countries outside the EU. Import regulations are our main defence against the introduction of these mites (and other very serious bee pests and diseases) from overseas to the UK, and it is absolutely essential that all beekeepers abide by them. Contact the NBU, or your appropriate government agriculture department for details of the import regulations. This information is available on the NBU website (www.nationalbeeunit.com).

Useful addresses

National Bee Unit (NBU)
National Agri-Food Innovation Campus,
Sand Hutton, York YO411LZ
Tel: 0300 3030094
Fax: 01904 462240
Email: nbu@apha.gsi.gov.uk
Web: www.nationalbeeunit.com

Office of the Chief Veterinary Officer
Department for Environment and Sustainable Development
Hill House Picton Terrace
Carmarthen SA31 3BS
Tel: 01267 245007
Web: www.wales.gov.uk

Scottish Government
Pentland House 47 Robb's Loan
Edinburgh,
Scotland EH14 1TY
Tel: 01312 446178
Web: www.scotland.gov.uk

Science and Advice for Scottish Agriculture
SASA, Roddinglaw Road
Edinburgh, Scotland EH12 9FJ
Tel: 01312 448890
Fax: 01312 448940
Email: info@sasa.gsi.gov.uk
Web: www.sasa.gov.uk

European Union
(website for details of European Community legislation in force)
Web: http://eur-lex.europa.eu/homepage.html

Department of Agriculture & Rural Development, Northern Ireland (DARDNI)
Dundonald House,
Belfast BT4 3SB
Northern Ireland
Tel: 02890 24488
Web: www.dardni.gov.uk

Agri-Food and Biosciences Institute (AFBI)
Newforge Lane,
Belfast, BT9 5PX
Web: http://www.afbini.gov.uk

Defra Veterinary Medicines Directorate (VMD)
Woodham Lane, New Haw,
Addlestone,
Surrey KT15 3LS
Tel: 01932 336911
Web: https://www.gov.uk/government/organisations/veterinary-medicines-directorate

Office of Public Sector Information
(European Community and UK Legislation)
Web: http://www.legislation.gov.uk/

British Beekeepers' Association
(county and local beekeeping associations)
National Agricultural Centre,
Stoneleigh,
Warwickshire, CV8 2LG
Tel: 08718 112282
Web: www.bbka.org.uk

Welsh Beekeepers' Association
Web: www.wbka.com

Scottish Beekeepers' Association
Email: secretary@scottishbeekeepers.org.uk
Web: www.scottishbeekeepers.org.uk

Bee Farmers' Association of the United Kingdom
Web: www.beefarmers.co.uk

International Bee Research Association
(library and beekeeping information services)
Unit 6, Centre Court, Main Avenue,
Treforest, CF3 5YR
Tel: 02920 372409
Web: www.ibrabee.org.uk

Ulster Beekeepers' Association
Web: www.ubka.org

World Organisation for Animal Health, Office International des Epizooties (OIE)
Web: www.oie.int

Bee Diseases Insurance Ltd (BDI)
Registered Office
National Beekeeping Centre, NAC Stoneleigh Park, Warwickshire, CV8 2LG Tel: 08718 112337
Web: http://www.beediseasesinsurance.co.uk/

Overseas information

NSW Department of Agriculture, Australia
Web: http://www.dpi.nsw.gov.au/agriculture/livestock/honey-bees/pests-diseases#Other-pests-and-diseases

Department of Agriculture and Fisheries, Australia
Web: http://www.agriculture.gov.au/pests-diseases-weeds/bees

Department of Entomology, University of Georgia, USA
Web: http://www.ent.uga.edu/bees/

Government of South Australia
Web: http://pir.sa.gov.au/biosecurity/animal_health/bees

USDA Bee Research Laboratory
Beltsville, Maryland, USA
Web: http://www.ars.usda.gov/main/site_main.htm?modecode=20-22-05-00

Bee Health extension
Web: http://www.extension.org/bee_health

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Anderson D.L., Robert J.M.K. (2013) Standard methods for *Tropilaelaps* mites research. In: Dietemann V., Ellis, J.D., Neumann (Eds) The COLOSS BEEBOOK (II): standard methods for *Apis mellifera* pest and pathogen research. Journal of Apicultural Research 52(4): http://dx.doi.org/10.3896/IBRA.1.52.4.21

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