Tropilaelaps: parasitic mites of honey bees

defra
Department for Environment
Food and Rural Affairs

About this leaflet

This leaflet describes the Asian bee mites *Tropilaelaps* spp., (*T. clareae* and *T. koenigerum*) that are potential new 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.

Tropilaelaps: parasitic mites of honey bees

Department for Environment, Food and Rural Affairs
Nobel House
17 Smith Square
London SW1P 3JR
Telephone 020 7238 6000
Website: www.defra.gov.uk

Further copies of this publication are available from:

Central Science Laboratory
National Bee Unit
Sand Hutton
York
North Yorkshire
YO41 ILZ
Tel: 01904 462510

This document is also available on the Defra and Central Science Laboratory websites.

Published by the Department for Environment, Food and Rural Affairs. Printed in the UK, February 2005, on material containing 80% post-consumer waste and 20% Elemental Chlorine Free pulp.

Product code PB4093

Introduction

What are Tropilaelaps mites?

There are currently two species of Tropilaelaps mites documented, *Tropilaelaps clareae* and *Tropilaelaps koenigerum*. Ongoing molecular research being carried out on this genus in Asia may identify other species. For ease, they will be referred to in this leaflet as Tropilaelaps.

They are serious parasitic mites affecting both developing brood and adult honey bees. Parasitisation by these mites can cause abnormal brood development, death of both brood and bees, leading to colony decline and collapse, and can cause the bees to abscond from the hive. The natural host of the mite is the giant Asian honey bee, *Apis dorsata*, but Tropilaelaps can readily infest colonies of *Apis mellifera*, the Western honey bee. It is also associated with other Asian honey bees, including *Apis laboriosa*, *Apis cerana* and *Apis florea*. The furthest west it has been found is in Iran close to the Pakistan and Afghanistan borders and the furthest east is Papua New Guinea. In 1982, *T. koenigerum* was reported as a new species of parasite infesting *Apis dorsata* in Sri Lanka. *T. clareae* has not been reported on the island. *T. koenigerum* has also been found in association with *A. laboriosa*, *A. cerana* and *A. mellifera* in Kashmir, and was recently detected in Nepal, Borneo and Thailand. Thought to be restricted to tropical or sub-tropical regions of Asia, their exact geographical range is unknown and is emerging.

Figures 1 & 2. Apis dorsata,* the natural host of *Tropilaelaps

At the time of writing, Tropilaelaps has not been found in the UK or the rest of Europe, but if it was introduced through imports of bees and became established, could potentially cause major economic damage and losses to beekeeping, and, as a consequence, to agriculture and the environment through disruption to pollination services.

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

Yes, Tropilaelaps is a statutory notifiable pest of honey bees. Beekeepers in England and Wales must report any suspected presence of the mite in their colonies to the CSL National Bee Unit. Beekeepers in Scotland and Northern Ireland should notify their appropriate government Department (see 'Useful addresses').

Tropilaelaps biology

Parasitic mite: *Tropilaelaps clareae, Tropilaelaps koenigerum*

Place of Origin: Asia

Natural Host: *Apis dorsata*

Characteristics: The mites are reddish brown, about 1mm long and 0.6mm wide, with a life cycle similar to that of varroa. The mites move freely and rapidly on combs, and rely on brood for feeding; the mouthparts are not capable of piercing the membranes of adult bees. Thought to be unable to survive in broodless colonies.

Damage: In colonies with high mite levels, Tropilaelaps causes damage similar to varroa, resulting in irregular brood patterns and stunted adults with deformed wings and shrunken abdomens. This 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.

The Mites

The females of *T. clareae* are light-reddish brown and about 1.0 mm long x 0.6 mm wide. The males are almost as large as the females but less sclerotised. *T. koenigerum* is slightly smaller than *T. clareae*, the adult female is 0.7 mm long x 0.5 mm wide, oval and light brown. Adult males are considerably smaller.

Figure 3. T. clareae* on adult *Apis dorsata

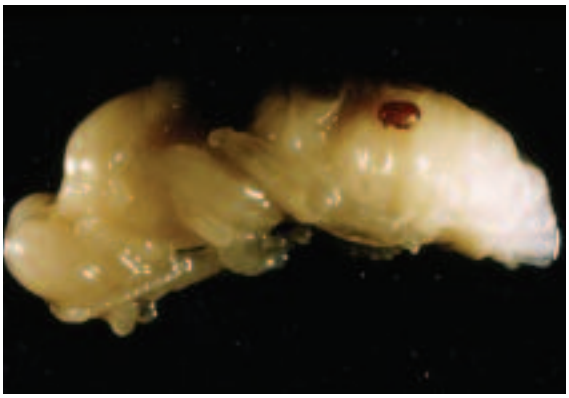

Figure 4. T. clareae* on pupa of *A. dorsata

Figure 5.* Electron micrograph of *T. clareae

Life cycle

The life cycle and parasitism of *A. mellifera* by Tropilaelaps 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 larvae where reproduction takes place within sealed brood cells, particularly those of drones. The mites can reproduce in both worker and drone cells, but as with varroa there is a preference for drone brood, but this is not as marked. Typically, the mother mite lays three to four eggs on mature bee larvae 48 hours after cell capping, about one day apart. The eggs hatch after around twelve hours, then the larva goes through nymphal stages (protonymph, deutonymph) before reaching the adult stage. Once hatched, all stages of both female and male mites feed on the haemolymph (blood) of the developing bee, causing damage through feeding by depriving the developing bee of essential nourishment required for growth.

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 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. With varroa infestations, immature females and the male mites die in the cell.

Unlike the varroa mite, Tropilaelaps cannot feed on adult bees because its mouthparts are unable to pierce the body wall membrane of the bees. The mites depend on the developing brood for food, and move from the adult bees to feed on the larvae as quickly as possible after emergence, so the phoretic stage is much shorter than that of varroa, and may only be between 1-2 days. Gravid female mites (carrying eggs) will die within two days unless they deposit their eggs. Tropilaelaps is therefore less well adapted for survival in hives where there are long broodless periods.

Figure 6. **Migratory beekeeping, for example to heather moors, has the potential to rapidly spread pests and diseases long distance. It is essential to check before moving that your bees are healthy**

Means of spread

Tropilaelaps mites are mobile and can readily move between bees and 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 of infested colonies of *Apis mellifera* to new areas by the beekeeper is the principal and most rapid means of spread.

The harmful effects of Tropilaelaps infestation

A. mellifera colonies heavily infested with either Tropilaelaps or varroa show similar damage. The infestation and feeding activities of the mites causes brood mortality and a reduction in 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. These include a shorter lifespan, lower body weight, with shrunken and deformed

wings and legs. These bees may be seen crawling at the entrance to the hive. 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 7*. Deformed pupa (*Apis dorsata*) from *T. clareae* infested colony**

Could Tropilaelaps survive in the UK?

Yes, although the brood requirements of Tropilaelaps are the limiting factors in its establishment in the UK. In areas of the UK that are warmer, for example in the south and east, where there is brood in colonies all year round, the mite will survive, even in very small areas of brood. As long as bees rear some brood the mites can survive, and as the amount of brood reduces, many adults enter single brood cells but do not breed. Tropilaelaps is unlikely to survive where there is complete brood interruption during the winter. Predictions are that climate will become warmer in the future. The warmer winter temperatures, with more colonies continually rearing brood, could increase the potential for Tropilaelaps spread and impact.

How to check colonies for Tropilaelaps

Distinguishing between species of Tropilaelaps and varroa is relatively straightforward, particularly with the help of a magnifying glass. Varroa mites are larger, crab shaped and wider than they are long, and they move relatively slowly. 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. It is 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.

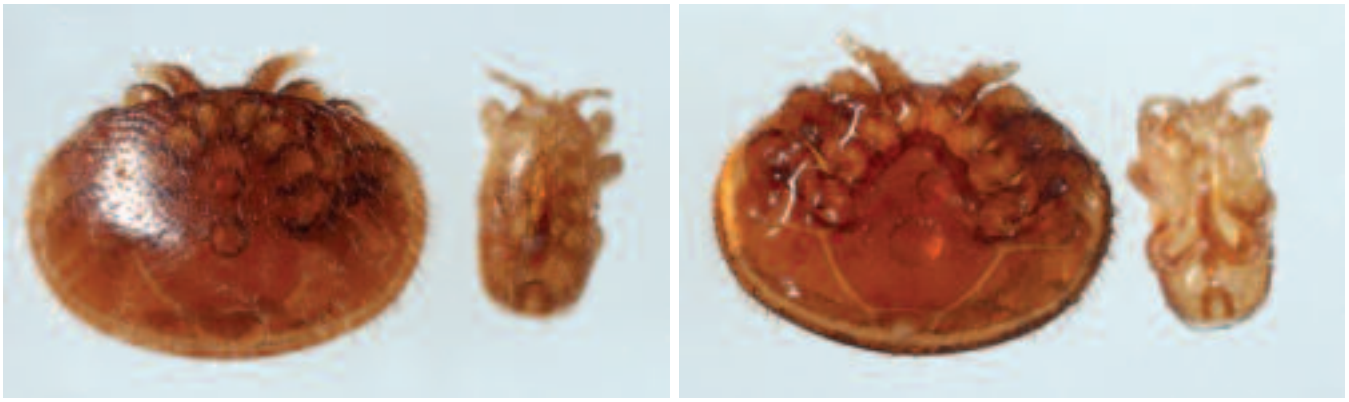

***Figure 8.* Dorsal and ventral views of *Varroa destructor* (left) and *Tropilaelaps clareae* (right)**

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 tables below for more details of the techniques. These methods are now familiar to UK beekeepers from years of experience of monitoring varroa.

Table 1. Methods of detection

A. Monitoring natural mite mortality	Pros and cons
1. Maintain the colony on a mesh floor (commonly known as a varroa floor) with a collecting drawer underneath. 2. Remove floor debris regularly during the summer. 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
B. Brood uncapping	**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. (Fig 9). 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
C. 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 9*. Uncapping drone brood to check for the presence of mites. They will be clearly seen against the white background of the pupae**

Control

The fundamental aim of mite control is to keep the 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 Defra 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.

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 areas where the mite is present, methods such as queen caging, the use of artificial swarms and comb trapping, to create breaks in the brood, should be effective to reduce numbers of mites.

Surveillance

The National Bee Unit (NBU) inspectorate carries out surveillance for exotic bee pests such as the small hive beetle and Tropilaelaps, targeting "At risk" apiaries, e.g. around ports and container freight terminals. Beekeepers are strongly encouraged to monitor their hives for Tropilaelaps as part of routine colony management. Debris samples submitted to the NBU laboratory are routinely screened for exotic pests. These are either in the form of debris samples or hive inserts collected and sent to the Bee Unit by Appointed Bee Inspectors (ABIs) (statutory samples) or beekeepers (voluntary samples) throughout England and Wales.

Should Tropilaelaps be discovered in England or Wales, emergency measures would be implemented. The essential aspects of these are communication, assessment of the extent of infestation, eradication and containment or control. The approach taken for control would depend highly upon the extent of the infestation; if restricted, an eradication method could be used. Otherwise, a containment scheme would be implemented. Similar arrangements should apply in Scotland and Northern Ireland.

What should you do?

It is difficult to predict the impact of Tropilaelaps on beekeeping if it was introduced to the UK. However, it must be considered a significant threat that could have serious consequences for the UK 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 it may appear 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, the small hive beetle 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 found 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 done with varroa. If you find anything suspicious contact the National Bee Unit or your local Bee Inspector for advice. All suspect samples should be sent to the NBU for identification – together with your name, address and apiary details (sampling forms and details are available on the NBU website).

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 local Bee Inspector or the National Bee Unit, or take a look at the NBU website www.nationalbeeunit.com.

Further help and advice

National Bee Unit

The National Bee Unit is part of the Defra Central Science Laboratory, a research agency. Established in 1946, it has a long history in practical beekeeping and bee health, providing research, diagnostic, consultancy and extension services to government departments, commerce and beekeepers, in the UK and overseas.

Current research interests include European foul brood control, varroacide development and molecular methods for bee disease diagnosis using real time TaqMan PCR. The NBU's network of Regional and Seasonal Bee Inspectors provides an inspection service for statutory pests and diseases, advice and assistance to beekeepers year round, and training courses in disease control and bee husbandry.

Beekeeping Associations

In many areas beekeeping associations operate local disease control schemes and provide practical advice to members on bee disease recognition and control. Contact your local beekeeping association for details.

The Bee Health Advisory Panel

CSL hosts a panel of independent beekeeping experts, including representatives from national associations. The aim of the panel is to keep the official bee health programme under review, suggest improvements to it and to recommend research and training likely to be of direct benefit to beekeepers.

Useful addresses

CSL National Bee Unit (NBU)
Central Science Laboratory National Bee Unit, Sand Hutton, York, North Yorkshire, YO41 1LZ
Tel: 01904 462510 Fax: 01904 462240 Email: nbu@csl.gov.uk
Web: www.nationalbeeunit.com

Department for Environment, Food and Rural Affairs (Defra)
Horticulture and Potatoes Division, Eastbury House, 30/34 Albert Embankment, London SE1 7TL
Tel: 020 7238 1047
Web: www.defra.gov.uk
Bee health pages: www.defra.gov.uk/hort/bees.htm

Welsh Assembly Department for Environment Planning and the Countryside (DEPC) Animal Identification Branch
Penrallt, Caernarfon Divisional Office, Gwynedd, Wales, LL55 1EP
Tel: 01286 662012 or Tel: 01286 662027
Web: www.wales.gov.uk

Scottish Executive Environment Rural Affairs Department (SEERAD)
Pentland House, 47 Robb's Loan, Edinburgh, Scotland EH14 1TY
Tel: 0131 2443377
Web: http://www.scotland.gov.uk

Scottish Agricultural Science Agency (**SASA**),
82 Craigs Road, East Craigs, Edinburgh EH12 8NJ
Tel: 0131 244 8863 Fax: 0131 244 8940
Email: info@sasa.gsi.gov.uk
Web: www.sasa.gov.uk

European Union *(website for details of European Community legislation in force)*
Web*:* http://www.europa.eu.int/eur-lex/en

European Commission
Web: http://europa.eu.int

Department of Agriculture and Rural Development, Northern Ireland (DARDNI)
Dundonald House, Belfast BT4 3SB, Northern Ireland
Tel: 02890 525112
Web: www.dardni.gov.uk

Agriculture and Food Science Centre
Newforge Lane, Belfast, Northern Ireland
Tel: 02890 255288

Defra Veterinary Medicines Directorate (VMD)
Woodham Lane, New Haw, Surrey KT15 3LS
Tel: 01932 336 911
Web: www.vmd.gov.uk

The Stationery Office (*European Community and UK Legislation*)
51 Nine Elms Lane,
London SW8 5DR
Telephone 020 7873 9090
Web: www.hmso.gov.uk

British Beekeepers' Association *(county and local beekeeping associations)*
National Beekeeping Centre, Stoneleigh Park, Stoneleigh, Warwickshire,
United Kingdom CV8 2LG
Tel: 02476 696679
Web: www.britishbeekeepers.com

Welsh Beekeepers Association *(county and local beekeeping associations)*
General Secretary, Pentrebwlen, Llanddewi brefi, Tregaron, Ceredigion, SY25 6PA

Scottish Beekeepers Association *(county and local beekeeping associations)*
Web: www.scottishbeekeepers.org.uk

Bee Farmers' Association
Web: www.beefarmers.co.uk

International Bee Research Association *(library and beekeeping information services)*
18 North Road,
Cardiff, Wales
CF10 3DT
Tel: 029 2037 2409
Web: www.ibra.org.uk

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

Acknowledgements

This leaflet was written by Selwyn Wilkins and Mike Brown of the CSL National Bee Unit on behalf of Defra Horticulture and Potatoes Division. Cover photograph and figures 7 and 8 by Central Science Laboratory, photographic department.

Figures 1 and 2 by Claire Waring

Figure 3 by Zachary Huang, http://photo.bees.net/gallery

Figures 4 and 5 by Elizabeth Waghchoure-Camphor

Figures 6 and 9 by Mike Brown, National Bee Unit.

PB 10780

Nobel House
17 Smith Square
London SW1P 3JR

www.defra.gov.uk