

## ASPECTS OF THE HISTORY AND BIOGEOGRAPHY OF THE BEE MITES *Tropilaelaps clareae* AND *T. koenigerum*

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### S u m m a r y

The paper deals with aspects of the two known brood parasites of honey bees from Asia, namely the tropical bee mites *Tropilaelaps clareae* Delfinado et Baker and *Tropilaelaps koenigerum* Delfinado-Baker et Baker.

These species of *Tropilaelaps* belong to the family *Laelapidae* (*Mesostigmata*). They feed on bee larvae and pupae causing brood malformation and the death of bees. *T. clareae* occurs on 5 species of bee - *Apis cerana*, *A. dorsata*, *A. florea*, *A. laboriosa* and *A. mellifera*.

*T. clareae* is known to have a wide distribution in Asia extending eastwards from Iran to Papua New Guinea. *T. koenigerum* on the other hand and as far as is known at present, has a more restricted distribution. Because of the great interest in *Varroa* and to a lesser extent *Acarapis woodi* Rennie, the importance of *Tropilaelaps* mites has not been sufficiently recognised. There is some concern that *Tropilaelaps* may become established on *A. mellifera* in temperate climates. *Tropilaelaps* mites therefore are an important potential threat to beekeeping in parts of the world other than South-East Asia.

**Keywords:** Asia, distribution, honeybees, parasites, *Tropilaelaps*.

### INTRODUCTION

Many mites are known to be associated with bees, some are free living, others commensals, or scavengers and some are parasites of adult bees or brood. The mites occurring on social bees have been reviewed by Chmielewski (1997/8, 1998) and the parasites which infest honey bees have been dealt with from an historical point of view by Baker (2000). Sammataro et al. (2000) have also reviewed the subject of parasitic mites on honeybees.

A number of mites are known parasites of bees. These include *Varroa* (*Varroa jacobsoni* Oudemans, *Varroa destructor* Anderson et Trueman, *Varroa rindereri* Guzman et Delfinado-Baker, *Varroa underwoodi* Delfinado-Baker et Aggarwal), *Euvarroa* (*Euvarroa sinhai* Delfinado et

Baker, *Euvarroa wongsirii* Lekprayoon et Tangkanasing), the acarine mite, *Acarapis* (*Acarapis woodi* Rennie, *Acarapis dorsalis* Morgenthaller, *Acarapis externus* Morgenthaller) as well as the tropical bee mites, *Tropilaelaps* (*Tropilaelaps clareae* Delfinado et Baker, *Tropilaelaps koenigerum* Delfinado-Baker et Baker).

*T. clareae* was first discovered in the Philippines and described by Delfinado and Baker (1961). A second species, *T. koenigerum*, was described for the first time in 1982 by Delfinado-Baker and Baker and was found by Gudrun and Nicolaus Koeniger in a collection of honeybee mites from Sri Lanka (Delfinado-Baker and Baker 1982).

Because an exchange of parasitic mites exists among *Apis* species, the introduced

European honeybee *A. mellifera* has become infested with the parasites from Asian bees. Twenty years ago, Burgett and Akwatanakul (1985) described *T. clareae* as, "a little known honey bee brood mite, whose destructive powers could be far greater than *Acarapis woodi* or even *Varroa jacobsoni*". *Varroa* has received enormous attention over the past three decades and as a result, the importance of other mite species parasitic on bees has been overshadowed. Also, because at present *Tropilaelaps* mites are only found in Asia, their threat has been largely overlooked in the west.

The importance of *T. clareae* and to a lesser extent, *T. koenigerum* is now being recognised by research groups, writers, beekeepers and by recent EU legislation. With the increase in world travel, bees have moved from one country to another and this together with the threat of global warming, means that tropical mites could become a major threat to the western world.

The Government Science Laboratory, Department for Environment, Food and Rural Affairs (DEFRA) in Britain have recently issued a new leaflet on *Tropilaelaps* as they regard this mite as a potential new threat to beekeeping.

Gliński (2004) gives details of the occurrence of *T. clareae* on the various bee species including hosts, their developmental stages and the countries where this parasite occurs. Woyke (1985) has questioned the risk of *Tropilaelaps* to apiculture in temperate zones.

## INFORMATION AND DISCUSSION ON THE *Tropilaelaps* MITES

### Description, identification and the structural differences between the two species

*Tropilaelaps* species are the fast moving mesostigmatid mites of the family *Laelapidae*. Both species and sexes have a body covered in numerous, short, spinelike setae and are reddish brown in colour. *Varroa* is rounder and flatter in shape.

The female mite deposits from one to four eggs on mature bee larvae. Development takes place within sealed brood cells and takes about a week to complete. This quick life cycle means that heavy populations can soon build up. Adult mites feed on and damage the brood. The mite, which is not parasitic on adult bees, leaves the hive and is phoretic on adult bees for some days. The adult bee therefore distributes the mite to other bees and hives. The issue of the time the adult mite can survive has raised the possibility of introductions via imported adult queen bees. However, Wilde (2000) having investigated the life span of adult *T. clareae* on adult bees, found that the mite can survive no longer than 74 hours on workers and queens and believes that it is therefore impossible to introduce the mite with imported queen bees from Nepal to Europe.

*T. clareae* is larger than *T. koenigerum*. The dorsal plate of *T. clareae* (Fig. 1) measures 880  $\mu\text{m}$  long by 512  $\mu\text{m}$  wide in the male and 976  $\mu\text{m}$  long and 528  $\mu\text{m}$  wide in the female. Corresponding figures for the dorsal plate of *T. koenigerum* are 570  $\mu\text{m}$  long by 364  $\mu\text{m}$  wide in the male and 684  $\mu\text{m}$  to 713  $\mu\text{m}$  long and 432  $\mu\text{m}$  to 456  $\mu\text{m}$  wide in the female.

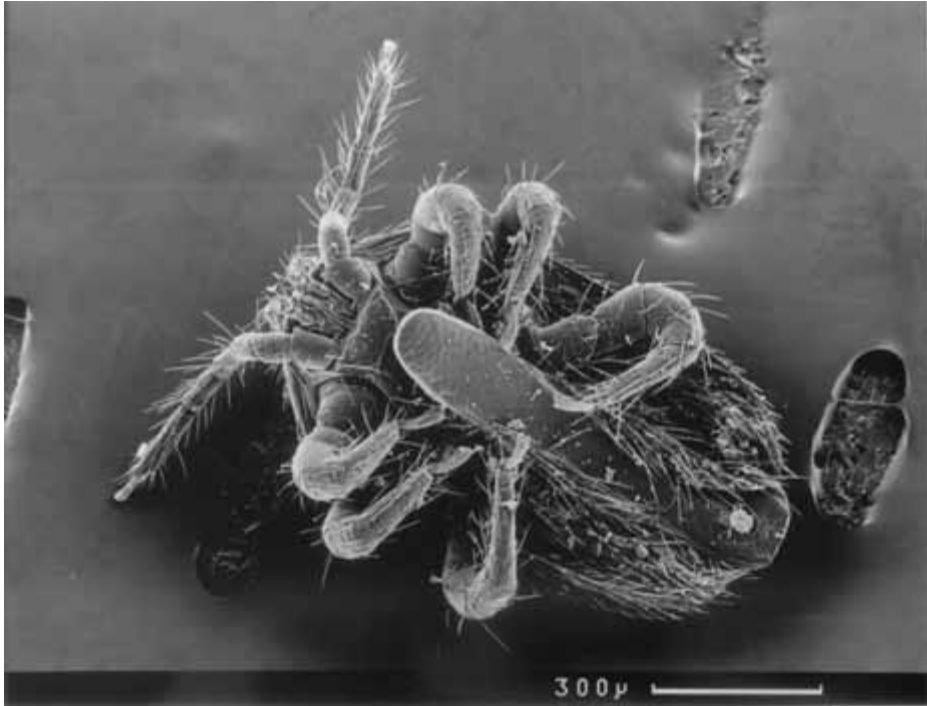
One of the obvious differences between the two species under the microscope is the shape and size of the moveable joint of the



**Fig. 1.** Scanning electron micrograph of a lateral view of *Tropilaelaps clareae* showing the dorsal plate, peritreme, stigma (spiracle) and the sites of attachment of the legs.



**Fig. 2.** Scanning electron micrograph showing the mouthparts of a male *Tropilaelaps clareae*. The movable digit of the chelicerae in the male appears as a long structure, coiled like a spring and lying between the pedipalps.



**Fig. 3.** Scanning electron micrograph of the ventral surface of a female *Tropilaelaps clareae*, showing the ventral plates (shields) - including the anal plate at the posterior end.

chelicera in the male, which acts as a spermatodactyl organ. In the male *T. clareae* this appears as a long “corkscrew like” coiled structure (Fig. 2) whereas in *T. koenigerum* the spermodactyl is shorter, not coiled and has a “pig-tail like” loop at the apex (Delfinado-Baker and Baker 1982).

The anal plate of *T. koenigerum* is pear shaped in both sexes whereas in *T. clareae* it is longer than wide, truncated anteriorly and posteriorly reticulate (Delfinado and Baker 1961). Figure 3 illustrates this.

The larval stage of *T. clareae* has been described by Krantz and Kitprasert (1990) and the nymphs of *Tropilaelaps* by Delfinado-Baker et al. (1985).

### Recognition of and damage to bees

An infestation can be detected by observing adult bees and brood or alternatively by examining hive debris.

Deformed bees with distorted abdomens, missing legs and stubby wings (Sammataro 2004) are features of an infested colony and the death of bee larvae can also reveal the presence of the mite. Brood malformation, bees which crawl rather than fly are other features in their recognition.

### Distribution and hosts

Although its exact geographical range is unknown, *T. clareae* is thought at present to be restricted to Asia but is widely distributed and has been recorded from Iran to Papua New Guinea. At the present time, *T. koenigerum* is known only from Borneo, Nepal, Sri Lanka and Thailand. A report from tropical Africa (Kenya) noted the presence of *T. clareae* (Kumar et al. 1993) but this record has not been confirmed. If true it could cause enormous damage in that continent (Matheson 1997). Although not the natural host of

either species of mite, *Tropilaelaps* can be easily distributed by the European honeybee, *A. mellifera* (Sammataro 2004).

Information is still incomplete; in some areas insufficient collecting has occurred and the reliability of reports depends on the accuracy of the observer (Matheson 1997) but the distribution of *T. clareae* is probably determined by the range of its natural host *A. dorsata*. The distribution of these mites needs further investigation in both Asia and Africa as well as in other parts of the world.

In Asia, five species of honeybee are known to act as hosts for *T. clareae* - *A. cerana*, *A. dorsata*, *A. florea*, *A. laboriosa* and *A. mellifera*. *T. koenigerum* described in 1982 as a parasite of *A. dorsata* has also been reported on *A. laboriosa*, *A. cerana* and *A. mellifera* in Kashmir. Delfinado-Baker et al. (1989) provide tables of the mites of honeybees in the Asia-Pacific region.

In the opinion of some authors (Woyke 2005), *T. clareae* can be found in *A. cerana* and *A. florea* colonies but is brought there only by accident.

Several papers have been published on the world distribution of honeybee parasites and diseases. The first world maps appeared in 1981 followed by updates (Nixon 1982, 1983) which included *Tropilaelaps* and then Bradbear (1988). More recently Matheson (1993, 1997) has charted and updated these earlier records. In 1997 he produced country records for honeybee diseases, parasites and pests. These indicate that the country records for species like *T. clareae* need continual updating because of the accuracy of reports, changes in the distribution and names of countries as well as new records for the tropical bee mites. Tables 1 and 2 summarize the current situation.

Table 1.  
Record of countries where  
*Tropilaelaps clareae* has been found  
(based on Matheson 1997).

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Africa
Kenya (unconfirmed)
Indian subcontinent
Afghanistan
Bhutan
India
Nepal
Pakistan
East of Indian subcontinent
China
Hong Kong
Indonesia
South Korea
Malaysia
Myanmar (formerly Burma)
Philippines
Taiwan
Thailand
Vietnam
Oceania
Papua New Guinea

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Table 2.  
Record of countries where *Tropilaelaps*  
*koenigerum* has been found.

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Indian subcontinent
Borneo
Kashmir
Nepal
Sri Lanka
Thailand

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It is likely that this list will increase as further collecting and identifications are made.

## Economic considerations – real and potential threats

So far neither of these parasites have been found in Europe. Because of the potential threat, changes in the legal status of *T. clareae* in EU countries has produced an amendment to legislation regarding the importing of bees and this includes the mite becoming a “notifiable” parasite. Any imports must be “certified” as free of *T. clareae* and if found, must be reported (Waite 2003).

Waite (2003), writing with regard to both the small hive beetle (*Aethina tumida*) and *T. clareae*, stated that, “Both pests have the potential to cause major damage to beekeepers in the UK (and of course other EU countries) although it is unknown just how badly the industry could be affected ... they pose a threat to apiculture throughout the continent and may cause greater damage in warmer countries”.

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## ROZTOCZE PSZCZÓŁ, *Tropilaelaps clareae* i *T. koenigerum*, W ASPEKCIE HISTORYCZNYM I BIOGEOGRAFICZNYM

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### S t r e s z c z e n i e

Przedmiotem studiów były historyczne i biogeograficzne aspekty rozprzestrzenienia się dwóch znanych pasożytów czerwiu pszczoł w Azji, a mianowicie tropikalnych gatunków roztoczy *Tropilaelaps clareae* Delfinado et Baker i *Tropilaelaps koenigerum* Delfinado-Baker et Baker.

Gatunki z rodzaju *Tropilaelaps* należą do rodziny *Laelapidae* (*Mesostigmata*). Żerują one na larwach i poczwarkach pszczelich powodując deformacje i śmierć pszczoł.

*T. clareae* występuje na 5 gatunkach pszczoł – *Apis cerana*, *A. dosata*, *A. florea*, *A. laboriosa* i *A. mellifera*. Jest on znany z szerokiego występowania w krajach Azji, od Iranu ku wschodowi do Papui Nowej Gwinei. Natomiast *T. koenigerum*, jak wynika z dotychczasowych danych, ma zasięg bardziej ograniczony i został stwierdzony na Borneo, w Kaszmirze, Nepalu, Sri Lance i Tajlandii.

W związku z dotychczasowym dużym zainteresowaniem *Varroa*, a także, lecz w ostatnich latach na nieco mniejszą skalę, *Acarapis woodi* Rennie, znaczenie roztoczy *Tropilaelaps* nie zostało jeszcze dostatecznie poznane. W warunkach ocieplającego się klimatu istnieje pewna obawa, że *Tropilaelaps* może przystosować się do *A. mellifera* również w klimacie umiarkowanym. Dlatego też roztocze tego rodzaju stanowią poważne potencjalne zagrożenie dla pszczelarstwa także i w innych niż południowo-wschodnia Azja częściach świata.

**Słowa kluczowe:** Azja, pasożyty, pszczoła miodna, rozprzestrzenienie, *Tropilaelaps*.