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New honeybee mite, *Blattisocius trigonae* sp. nov. (Acari: Laelapidae), phoretic on *Trigona iridipennis* (Apidae: Hymenoptera) from Tamil Nadu, India

Radhakrishnan V and Ramaraju K

Abstract
Stingless bee nests are immobile fixtures and potentially long-lived, much like trees in forests where meliponines live. The brood cells are spherical to ovoid, while food storage containers are small to large spheres. Several mite species are associated with stingless bees as phoretic and parasitic relationship. At present, new phoretic female mite, *Blattisocius trigonae* sp. nov. (Acari: Laelapidae) collected from *Trigona iridipennis* (Apidae: Hymenoptera) in Tamil Nadu, India is illustrated and described.

Keywords: Stingless bee, Brood cells, Phoresy, Parasite, *Blattisocius*

Introduction
Stingless bees are making their nest in hollow trunks, tree branches, underground cavities and store pollen and honey in large, egg-shaped pots made of beeswax mixed with various types of plant resin. The forager bees from nearby stingless bee colonies were found to be transmit the mites from infested colonies to other colonies. The isolation of the infested hive from meliponiary will prohibit the dispersion of the mites. The dispersion of mites from the infested colonies was previously reported from India [1]. The infestation of stingless bee hives by the mite *Carpoglyphus lactis* (L.) on *Trigona iridipennis* colonies in Tamil Nadu India [2]. Certain species of mites help bees to clean the nest, control other mite populations, or even eliminate pathogenic fungi [3]. The association of two genus of mite namely, *Fuscuropoda* (Uropodidae) and *Blattisocius* (Laelapidae) was with stingless bee colonies reported in Tamil Nadu, India [4]. New genus *Neohypoaspis* infestation on the nests of *Trigona fulviventris* and *Trigona hypogeal* were reported in Panama [5].
The parasitic mites were attacked both the adults and the brood, with a distinct preference for drone brood in honey bee colonies. They suck the blood from both the adults and the developing brood, weakening and shortening the life span of the ones on which they feed [6]. Parasitic mites (*V. destructor* and *T. clareae*) are major problem of *A. mellifera* colonies in Punjab, India. Parasitic mite, *Pyemotes* sp. were identified in intersegments of the queen bee and also found on pupal brood cells [7]. *Blattisocius patagiorum* Treat is an ascid mite found on the thorax of *Pseudospaelotis haruspica* (Grote) and other noctuid moths [8]. The infestation of *Pyemotes tritici* on nests of *Tetragonisca angustula* and *Frieseomelitta varia* causes death of entire colonies. The concentration of *Pyemotes tritici* was higher on the larvae and the pupae than on the adult bees and also found on inter-segmental areas of the adult bees, instead of being distributed over the entire body, as was the case on the larvae and pupae [9]. Only few studies are available on the infestation of mites in stingless bee colonies in Tamil Nadu and hence, the present studies were carried out to explore the Acari-Stingless Bee Association.

Materials and Methods
Numerous numbers of white coloured mites were found in large numbers in the dammer bee colonies. The mites were collected from the dammer bee nests found in the building cracks or crevices. It is presumed that these mites feed upon the debris of the colony.

Examination of host insects
Initially, the collected insect specimens were examined for the presence of mites under a Carl Zeiss Stemi 2000 stereozoom binocular microscope. Two methods *viz.*, individual examination and mass scale examination were followed depending on the availability of host insects both

in terms of number and volume [10]. After initial observation, the mites were carefully removed with a fine needle or forceps or camel hair brush and processed for permanent mounting.

Microphotography of mites associated with insects
After examination, the insect specimens containing mites were photographed with the help of image analyzer (GAIA Red software) and camera (Nikon F10).

Softening of tissues
Various chemicals were used to soften internal tissues of preserved mites with little or no damage to the exoskeleton. Generally, lactophenol is used and it was prepared with the following ingredients added in sequence.

Lactic acid	- 50 ml
Phenol	- 25 ml
Distilled Water	- 25 ml

Normally, the delicate soft bodied mite specimens need very short exposure period to lactophenol than the heavily sclerotized mites (48-72 h with slight warming). Larger specimens were punctured to allow easy entrance of lactophenol into the body cavity. Blood-engorged mites or mite containing large amounts of pigments were punctured and gently squeezed so as to remove much of these substances. Additional material was squeezed out after immersion in lactophenol for 24-48 hours. Immersion of dried or brittle mite specimens in lactophenol for 48 hours at room temperature restores treated specimens to a condition from dried or freshly collected insects.

Mounting and preparation of permanent slides
Before mounting the specimens in an appropriate medium, the lactophenol treated mite specimens were cleaned 2-3 times in distilled water until the cloudy interface of lactophenol and water disappeared. Permanent slide preparations are desirable for building up a readily accessible reference collection as well as providing an alternative to temporary micro slide preparation for routine identification. Hoyer's medium was used for preparing permanent slides and it consists of the following components [11].

Distilled water	- 50 ml
Gum arabic (Crystals)	- 30 g
Chloral hydrate	- 200 g
Glycerine	- 20 g

Labeling of slides
The scientific value of an insect specimen depends to a larger extent on the information regarding the date and locality of its capture. All the permanent slides were provided with two labels, one on either side of the slide. Information on the right-hand side includes date of collection, host insect, locality and accession number and the left-hand side includes mite family, genera, species and collector's name. Details are written using a black/ green gel pen (0.5 mm) or Rotring pen. All slides were given a serial collection number for identification of the specific slide.

Microphotography of permanent slides
The permanent slides were placed under a phase contrast microscope and the photographs were taken using image analyzer and camera for easy identification up to family level.

Drawing of mite specimen and Taxonomic observation
Drawing of mite structure paves way for identification of the genus and family characters. Aim of acarological drawing is accuracy rather than artistry, and simple line drawings often serve better than elaborately shaded. Using a Carl Zeiss Phase Contrast Microscope (Model: Axiostar Plus), all the mite specimens on permanent slides were closely examined for taxonomic identification. The dorsum, ventrum, legs, gnathosoma and other striking characters were drawn using a drawing tube. In this study, Zeiss drawing tube is used, which fits into the light path between the eyepiece and objective lens of a microscope. It contains a system of prism and mirrors so arranged that, by looking through it, both the object under the microscope and the paper on which the drawing is to be made and traced exactly the image could seen through microscope. This is the ideal method of making drawings of mites attached to the insects. Elaborate projection can be obtained that will give magnifications ranging from 10 X to 100 X up to several hundred folds increase. Drawing was initially done on a tracing sheet with a pencil and inking was performed by means of rotring isograph (0.1mm to 0.6 mm). Then, the measurements of the important taxonomic structures of mite specimens were made with the help of a calibrated ocular micrometer and expressed in microns. Identification and fixing of the systematic position was undertaken with the help of all the available literatures. In the description, all the measurements made in this study have been reported in microns. Morphological and structural terminologies used in the description of various mite families are given in the appendices.

Voucher slides
The voucher specimens of this species in this paper have been retained in the collection and curated by Radhakrishnan as mentioned in the deposition of type material in Department of Agricultural Entomology, Acarology Lab, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India.

Abbreviations
Different abbreviations used in the description are as follows: aGe- anterior genital selerite; pGe - posterior genital selerite; αl, α2, α3 - enclosed angles of pGe; b - anterior margin of ge; I - length of genital sclerite; s1 and s2 - lateral margins of pGe; ap - apodeme; Co- Coxa; Tr - trochanter; Fe - femur; Ge - genu; Ti - tibia; Ta - tarsus; TiTa - tibiotarsus; sol - solenidion; about the same length < - shorter than; > - longer than; = the same length.

Measurements
All the terminology followed [12] in this studied. All the measurements are given in micrometers (µm).

Results and Discussion
Blattisocius trigonae sp. nov. Female
(Figs. 1 - 4)

Female dorsum
Body oval in shape, white in colour when alive, measuring 400 long, 230 wide. Dorsal shield covered with faint transverse striae with 39 pairs of simple setae, almost subequal (15-40), setae Z_5 and J_5 of the same length 28, J_1 setae 40 in length, longer than others. Setae z_1 (15) seems to be the shortest. Setae vs 20 long.

Venter
Presternal area covered with transverse striae, sternal shield smooth, longer (80) than wide (73), with 3 pairs of simple setae (23) (St_1 to St_3). The distance between St_1 and St_2 is 60

and St_2 to St_3 is 35. Epigynial shield truncate posteriorly 57 long and 71 wide. Ventrianal shield nearly triangular, covered with transverse striae; measuring 118 long and 65 wide with two paranal and an adanal setae. Two pairs of metapodal plates are present and the diameter is 13 and 2.5. The distance between two metapodal plates is 155. Peritreme short lies between coxae III and IV; 13 pairs of setae are present on the ventral surface of the body.

Legs

Legs are smaller in size. Leg I to IV measures, 280, 240, 235 and 284 long, respectively.

Leg chaetotaxy

Leg I: 0-4-10-12-12-22; leg II: 2-5-10-10-8-14; Leg III: 2-4-7-9-8-14 and Leg IV: 1-5-5-10-8-17.

Gnathosoma

Gnathosoma 185 long and 57 wide. The tritosternum well developed with a short base and bifid, 73 long. Cheliceral fixed digit slightly shorter than movable digit, bearing 2 teeth and a short pilus dentilis.

Types

A holotype adult marked on the slide INDIA: Tamil Nadu, Coimbatore. 23.XI.06.

Eg: *Trigona iridipennis* (Apidae: Hymenoptera), Coll. V. Radhakrishnan, (No: 290/5). Sixteen paratype slides with collection data same as that of holotype.

Diagnosis

This new species resembles [13], but differs by the following characters. Only two paranal and an adanal setae present in the new species in contrast to anal shield with three pairs of setae in addition to two paranal and adanal setae in *Blattisocius apis*. Tritosternum is simple in the new species in contrast to serrate in *B. apis*.

The new species differs various characters and the details are as follows

***Blattisocius trigonae* sp. nov.**	**Blattisocius capsicum Basha and Yousef [13]**	***Blattisocius apis* Basha and Yousef [13]**
Dorsal setaeUR with 4 setae	Dorsal setae UR with 7 setae	Dorsal setae UR with 6 setae
Sternal shield longer (80) than wide (73)	Sternal shield wider (112) than longer (88)	Sternal shield longer (109) than wide (74)
Ventrianal shield measuring 118 long and 65 wide	Ventrianal shield measuring 110 long and 73 wide	Ventrianal shield measuring 162 long and 95 wide
Chaetotaxic formulae of legs I, II, Ill, IV respectively as follows : : femora (10-10-7-5), genua (12-10-9-10); tibiae (12-8-8-8)	Chaetotaxic formulae of legs I, II, Ill, IV respectively as follows : : femora (12-11-6-6), genua (13-11-9-9); tibiae (13-10-8-10)	Chaetotaxic formulae of legs I, II, Ill, IV respectively as follows : femora (12-11-6-6); genua (13-11-9-9); tibiae (13-10- 8-10)

Relationship to the host

The white coloured mites are found in large numbers in the dammer bee colonies.

The mites were collected from the dammer bee nests found in the building cracks or crevices. It is presumed that these mites feed upon the debris of the colony. The exact nature of association between these two organisms is not known clearly. Based on the preliminary studies, it is presumed that the bees act as a phoretic agents of the mites. Further, in depth studies are needed to confirm the exact nature of the association with stingless bee colony.

Etymology

The mite species is named after the type host species.

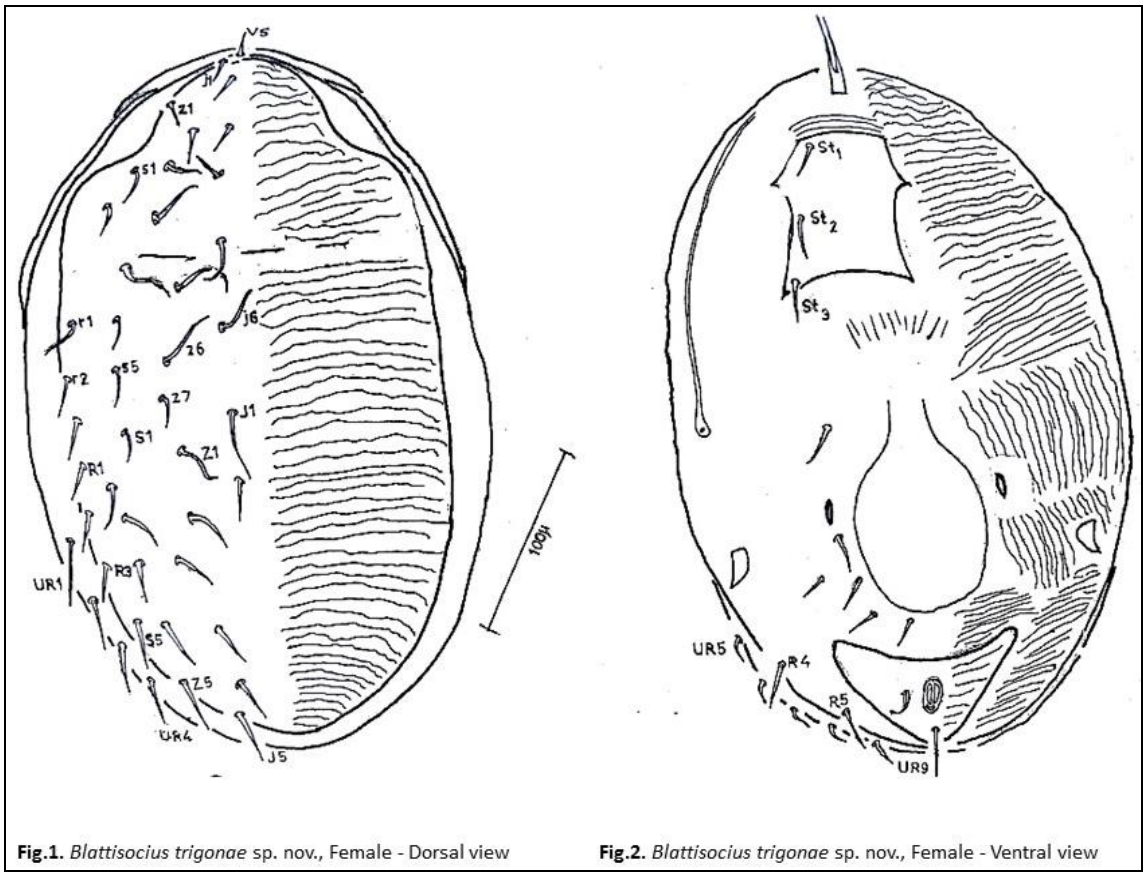

Fig.1. *Blattisocius trigonae* sp. nov., Female - Dorsal view

Fig.2. *Blattisocius trigonae* sp. nov., Female - Ventral view

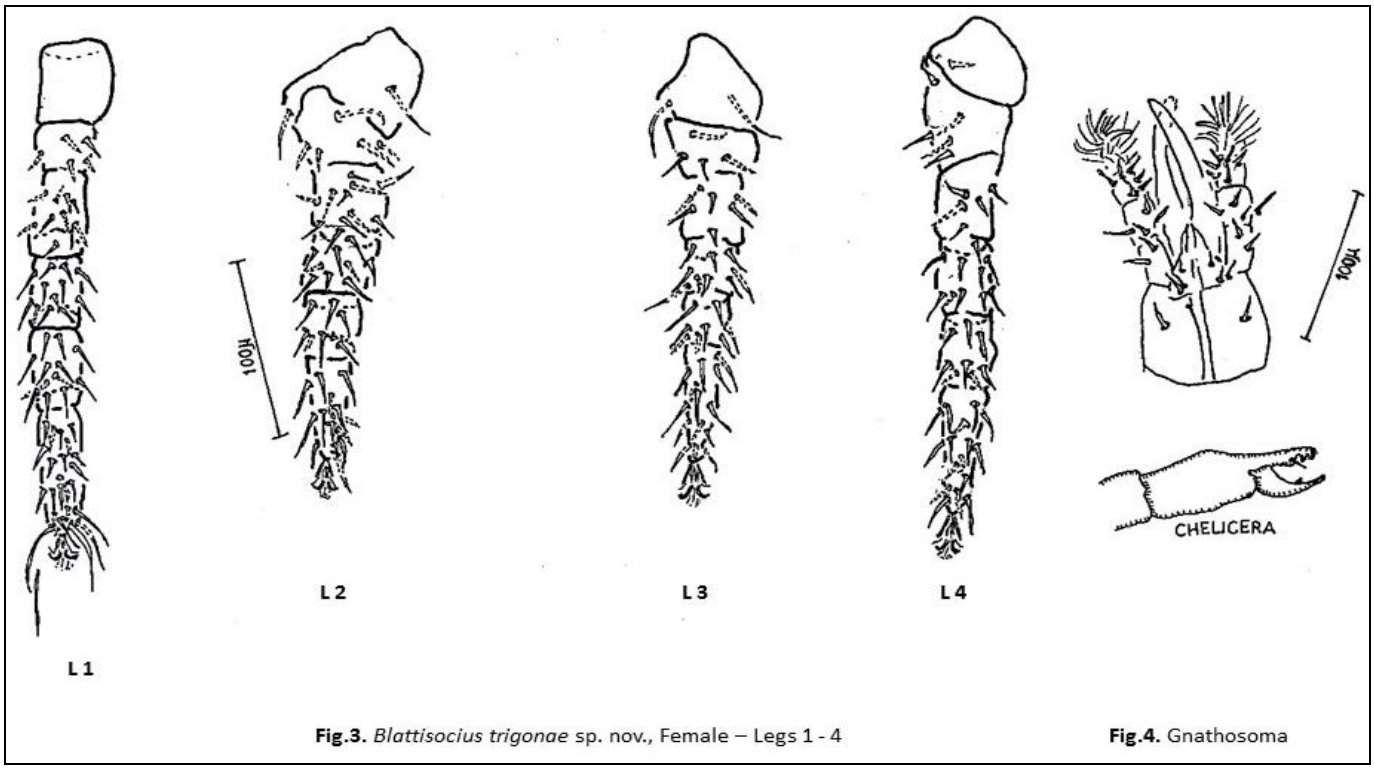

Fig.3. *Blattisocius trigonae* sp. nov., Female – Legs 1 - 4

Fig.4. Gnathosoma

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