Asian Journal of Conservation Biology, July 2014. Vol. 3 No. 1, pp. 90–93 AJCB: SC0015
ISSN 2278-7666 ©*TCRP* 2014

Nest and colony characters of *Trigona (Lepidotrigona) ventralis* var. *arcifera* Cockerell from North East India

K.Vijayakumar*

Department of Zoology, Kongu Nadu Arts and Science College, Coimbatore, Tamil Nadu, India

(Accepted 06 June, 2014)

The feral nests of *Lepidotrigona arcifera* was dissected and documented. Adult worker bees from these feral nests were collected and various key morphological characters were analyzed and identified based on previous literature. Within the subgenus *Lepidotrigona* the "*ventralis*" species group is varied based on the smaller body size from other species in the subgenus. All structural characters of *T.arcifera* is closely related to the *ventralis* group and is varied only the semicircular dark brown band bordering the basal concavity of the first segment instead of dark spots. The present study explained the nest architecture and diagnostic key characters for *T.arcifera* from North East India.

Stingless bees are a monophyletic group principally found in tropical and subtropical areas of America, Africa, Australia, and parts of Asia (Roubik, 1989). The stingless bee species are taxonomically organized into two major genera *viz., Trigona,* the largest group and *Melipona*, a genera consisting exclusively of the genus *Melipona*. All Asian and African stingless bee species belong to the genus *Trigona*. Only the two genus *Trigona* Jurine and *Lisotrigona* Moure have long been found in Indian subcontinent (Michener, 2007). The total number of species is estimated to be about 500 described species worldwide (Michener, 2013).

The genus *Trigona* encompasses worldwide about 120 species, placed in 10 subgenera, of which *Homotrigona*, *Lepidotrigona* and *Heterotrigona* are endemic subgenera for tropical and subtropical Asia (Michener, 1990, 2000). The subgenus *Lepidotrigona*, like the New World subgenus *Paratrigona* and short, thick, rather scale like or tomentose pale to yellowish hairs bordering the mesonotum. This species is found in northeast India, Burma, Thailand, Sumatra, Java, Borneo, and rather isolated in Taiwan.

According to the classification system by Schwarz (1939), *Trigona* (*Lepidotrigona*) *ventralis* is divided into four subspecies: *T. v. ventralis*, *T. v. flavibasis*, *T. v. doipaensis*, and *T. v. hoozana*. In addition, Schwarz assumed *T. arcifera* Cockerell from Testa Bridge, Himalayas, as synonymous with *T. ventralis* var. *fiavibasis,* but according to Moure (1961) the type specimen of *T. arcifera* runs to *T. hoosana.* In addition *T.hoozana* Strand, is endemic to Taiwan, together with *T.ventralis* of N. E. India, are the northernmost representatives of stingless bees in the Eastern Hemisphere (Strand, 1913; Schwarz, 1939; Sakagami, 1978). In addition, the nests of *T.ventralis hoozana* recorded from the mountain areas with altitude is about 1500- 2800m. In addition, native people living this mountain region are rear this species and collected the propolis from nests. The propolis is used as a binding agent or for caulking of ship planks. Generally, *T.v.hoozana* is more cool adapted than other species and this species was found on coolest zone in Taiwan. This species also sensitive to drop of temperature. (Sakagami and Yamane, 1984).

The hind tibia in the "*ventralis*" group is not as apically expanded as it is in some of the other species of the genus (Rasmussen, 2013). The *ventralis* species group includes *L. ventralis, L. arcifera, L. doipaensis, L.flavibasis* and *L. hoozana,* distinguished primarily by colouration and patterning of abdominal tergites, colour and placement of hairs on the vertex, colour of hairs fringing hind tibiae. *T.ventralis* and *T.flavibasis* were found on nearest and could be expected in the South East Asian region. The first report on *Lepidotrigona arcifera* from Testa Bridge of Himalayas in India (Cockerel,1929). Which is closely related to *T.flavibasis,* instead of spots a semicircular dark brown band bordering the basal concavity of the first segment (Cockrell, 1929). *L. ventralis* is recognized based on the dark spots on metasomal tergum 1, whereas *T.flavibasis* have semi-circle of black integument, partly enclosing the basal depression on the pale tergum 1, as in *L. arcifera*; *L. flavibasis* can be recognized by the apical metasomal terga brownish to blackish (yellowish on *L. arcifera)* and the fore and middle tibiae with blackish hairs on the external surface (Schwarz, 1939).

Two species (*ventralis* and *flavibasis*) of the *Lepidotrigona* species group that occur the nearest to India and *L. ventralis* can be recognized by the two lateral and separate dark spots on the metasomal tergum 1 (forms a complete band in *L. arcifera*) while the *L. flavibasis* can be recognized by the semi-circle of black integument, partly enclosing the basal depression on the otherwise pale tergum 1. *L. flavibasis* can be recognized by the apical metasomal terga brownish to blackish and the fore and middle tibiae with blackish hairs on the external surface (Schwarz, 1939).

Most of the researcher in India concentrates only on stingless bee biology, morphometry, natural enemies and its pollination biology (Muthuraman and Saravanan, 2004, Danareddi and Viraktamath, 2009, and Vijayakumar *et al*., 2013). The North-eastern region of India, covering a diverse natural habitat with varied topography, climate and forest forms part of the Indo-Burma biodiversity hotspots. Nagaland is one of the hill states of north-eastern India. The studies on stingless bee species diversity in this region are highly essential.

*Corresponding Author's E-mail: knvijgs@gmail.com

However, the present study reports on the nest architecture and morphological key characters of *Lepidotrigona arcifera* in India.

MATERIALS AND METHODS

Sample collection

The survey of stingless bee colonies in Tuensang village in Nagaland was carried out during April 2011 to October 2011, helped by local beekeepers and hunters. The adult workers were from collected from five feral nests of *T. arcifera* at Tuensang village (26°.15' N/ 94°.49' E) of Nagaland in India (Figure 1). Specimens were preserved in 90% ethyl alcohol. Observations were carried out on five feral nests of *Trigona (Lepidotrigona) ventralis arcifera* and these feral nests of *T.arcifera* were excavated and dissected to observed the internal structures of the nests. Taxonomic identification of collected stingless bees was examined based on the nest architecture and morphology according to Schwarz (1939). Species identity was confirmed by Dr. Deborah Smith, Department of Ecology and Evolutionary, Biology/Entomology, the University of Kansas, USA. All the taxonomic characters of the worker stingless bees were photographed by using Leica M 165C stereo microscope with image analyzer.

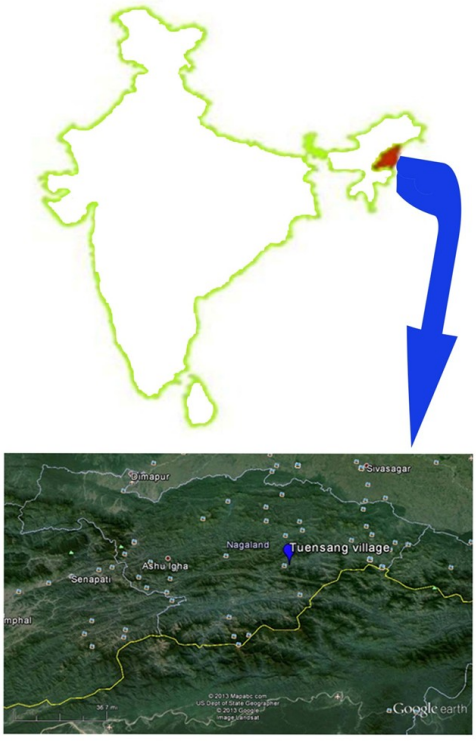

Figure 1. Sampling location of *Lepidotrigona arcifera*

RESULTS

Nest architecture

Nest entrance architecture: Entrance tubes were found at a level of 1-6 m above the ground, and were slightly slanting downward. The nests were found in tree cavities. The colour of the entrance tube varied from dull white to yellowish brown. Similarly the length of the tube also varied depending upon the age of the colony. However, in all colonies the apex of the entrance was wide more or less round and resembled a trumpet (Plate 1a). The average length of the tubes was 5.8 ± 2.0 cm (n = 10). The tube aperture was funnel-shaped, soft, thin-walled with a smooth surface.

Internal nest: The interior of the nests was decorated by a lining layer of resin and cerumen. The various nest components were enclosed in brownish, pliable multilayered involucrum (Plate 1b). The internal nest is divided into two major parts: a brood part and an area with storage pots. The brood part was in the middle of the nest and was nearly completely covered with some soft, thin, brownish-dark sheeted involucrum. The involucrum externally connected with the cavity wall by means of short pillars. There was always an internal tunnel directly connecting the external entrance tube to the brood nest chamber.

Brood nest: The brood cells were arranged in regular horizontal combs (Plate 1c).The larval brood was darker and larger and pupal brood was smaller and paler in colour. Brood combs were round in shape. The brownish pillars connected the different brood combs. New cells were brownish, but turned yellow when becoming older. Workers and males were produced in similar cells and both were found in the same combs. Queen cells were elliptical and mostly positioned at the margin of combs.

Food stores: The honey pots and pollen pots are larger in size. The food storage pots are usually found both at the top and bottom of the nest. Storage food pots are spherical or oval; and the walls are soft, thin and dark-brown. Pollen and honey are stored in separate pots of similar shape. The pollen pots are in general found closer to the brood.

Species description

***Trigona (Lepidotrigona) ventralis* variety *arcifera* (Cockerell, 1929)**

This species was tentatively recognized as a valid species within the "*ventralis*" species group (Rasmussen, 2008), although Schwarz (1939) suggested it should be synonymized with *L. flavibasis* (Cockerell, 1929) and Moure (1961) suggested synonymization with *L. hoozana* (Strand, 1913). Within *Lepidotrigona*, the "*ventralis*" species group is characterized by smaller body size.

Diagnostic characters of worker (Plate 2 a-e)

Metric values: Total body length ranging from 4.2 to 4.5mm, head width ranging from 1.65 to 1.82mm, forewing length including tegula ranging from 4.3 to 4.7mm, WL2 ranging from 1.05 to 1.28mm. Hind tibial length ranging from 1.36 to 1.41mm

The head and thorax roughened with an exceedingly dense tessellation that is virtually devoid of shiny interspaces. The hind tibiae one-third as wide toward the apex as they are long.

The scales that border the mesonotum not extended to the scutellum, which has only rather long erect hairs. The posterior margin of hind tibiae fringed with dark brown hairs.

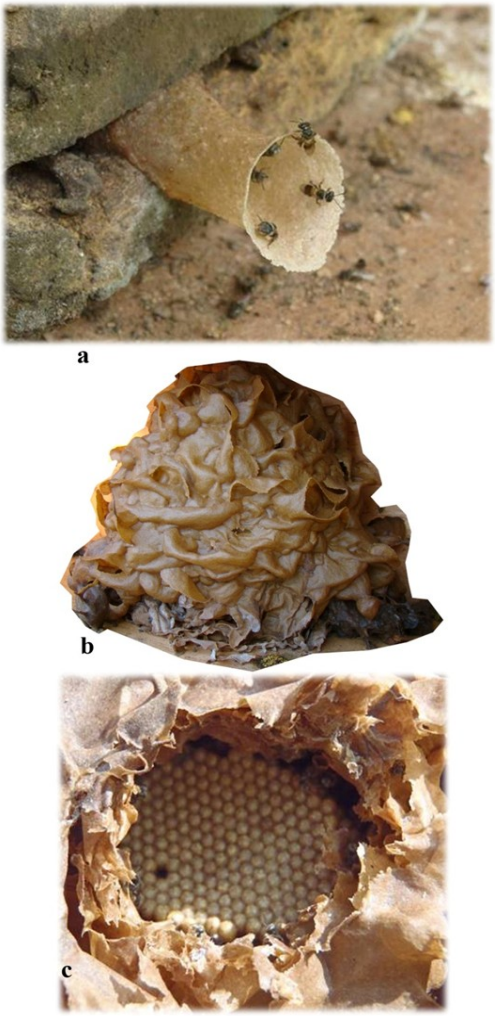

Plate 1. *Lepidotrigona arcifera* nest architecture

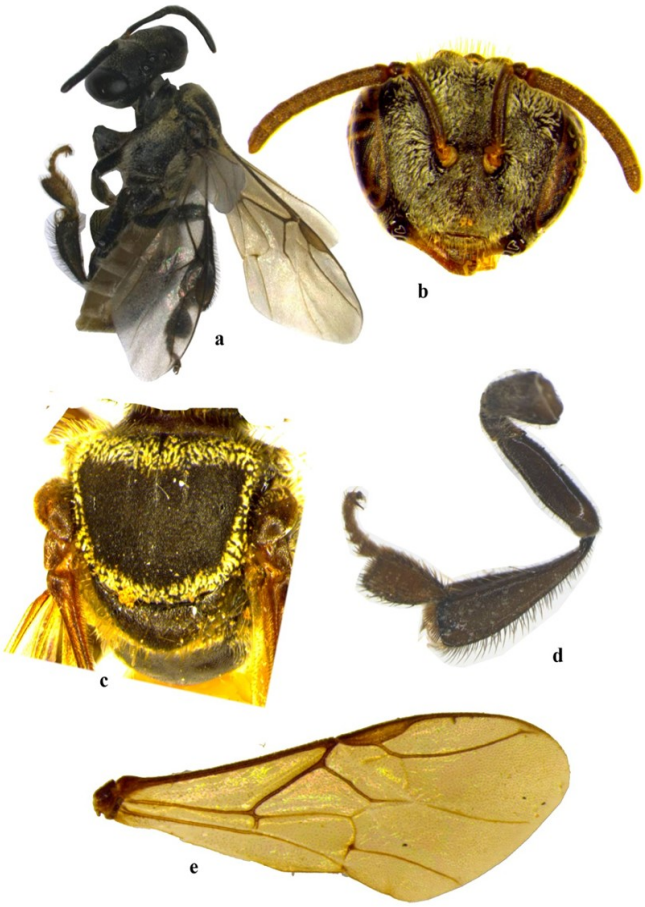

Plate 2. Morphological key characters of *T. arcifera*

Colour: Usually a black spot on each side of the otherwise pale tergite 1 of abdomen. Tergum I
cream coloured,the apical half of tergum V and the whole VI brownish to nearly blackish (Plate 2a). Metasomal terga V apically and VI were pale brown to pale yellow brown. Whereas brown to nearly blackish in continental specimens, sometimes only VI apically pale orange brown.
Metasomal tergum I exhibits the palest pattern. Particularly mesosomal tomenta are very pale.

Pilosity: The mesonotum usually enclosed by a border of short thick scale like or tomentose
yellowish to whitish hairs (Plate 2c). Hair fringes of hind tibia as well as hairs on mid and hind tibiae and basitarsi brown to blackish hairs on posterior margin very thick and short, simple (Plate 2.d).

According to the previous literature, the number of recorded stingless bee species known from India is seven (Rathore *et al*., 2013). Rasmussen (2013) summarized eight species of stingless bees from the Indian subcontinent. The subgenus *lepidotrigona* is found in northeast India, Burma, Thailand, Sumatra, Java, Borneo, and rather isolated in Taiwan. The subspecies in "*ventralis*" species group are comparatively smaller (forewing length Less than 5 mm) than other species in *Lepidotrigona* (Rasmussen, 2013).

ACKNOWLEDGEMENTS

We are grateful to Dr.Deborah Smith (University of Kansas, USA) for identifying stingless bee species and providing some of the valuable literature. I extend my sincere thank to Also I express my sincere thanks to Dr. M. Muthuraman, for his encouragement and motivation to pursue the research work. I would also like to thank to beekeeper Mr.Tavelhu from Tuensang village for sample collection and documentation.

REFERENCES

Biesmeijer, K, 1993, Stingless bees: Discussion and paper at the International symposium on pollination tropics. Pegone 1: 6-8.

Cockerell, T.D.A. 1929. Descriptions and records of bees. —CXX. Annals and Magazine of Natural History, [10]4:584–594.

Danaraddi, C.S., Viraktamath, S. 2009. Morphometrical studies on the stingless bee, *Trigona iridipennis* Smith. Karnataka Journal of Agricultural Sciences, 22:796–797.

Jobiraj, T., Narendran, T.C. 2004. A revised key to the world species of *Lisotrigona* Moure Hymenoptera: Apoidea: Apidae) with description of a new species from India. Entomon, 29: 39–43.

Michener, C.D. 1990. Classification of the Apidae (Hymenoptera). Appendix: *Trigona genalis* Friese, a hitherto unplaced New Guinea species. University of Kansas Science Bulletin, 54: 75–163

Michener, C.D. 2000. The bees of the world. Johns Hopkins University Press, Baltimore, xiv+[1]+913.

Michener, C.D. 2007. The bees of the world, second edition. Johns Hopkins University Press, Baltimore, xvi+953.

Michener, C.D. 2013. The Meliponini. *In*: Vit, P., Pedro, S.R.M. & Roubik, D.W. (Eds.), Pot-Honey: A legacy of stingless bees. Springer, New York, pp. 3–17.

Moure, J.S. 1961. A preliminary supra-specific classification of the old world meliponine bees (Hymenoptera, Apoidea). Studia Entomologica, 4: 181–242.

Muthuraman, M. and Saravanan, P.A. 2004. Utilization of stingless bees for crop pollination. Indian Bee Journal, 66: 58–64.

Rakhee Mohan. and Devanesan, S. 1999. Dammer bees, *Trigona iridipennis* Smith. (Apidae: Meliponinae) in Kerala. Insect Environ., 5 (2): 79.

Rasmussen.C.A. 2013. Stingless bees (Hymenoptera:Apidae:Meliponini) of the Indian subcontinent: Diversity, taxonomy and current status of knowledge. Zootaxa 3647(3): 401-428.

Rasmussen C. and Cameron S.A. 2010. Global stingless bee phylogeny supports ancient divergence, vicariance, and long distance dispersal. Biological Journal of the Linnean Society, 99, 206 –232.

Rasmussen, C. 2008. Molecular phylogeny of stingless bees: Insights into divergence times, biogeography, and nest architecture evolution (Hymenoptera: Apidae: Meliponini). Ph.D. Dissertation, University of Illinois at Urbana-Champaign, USA, iii + 301 pp.

Rathor, V.S., Rasmussen, C. and Saini, M.S. 2013. New record of the stingless bee *Tetragonula gressitti* from India (Hymenoptera: Apidae: Meliponini). Journal of Melittology, 7: 1–5.

Roubik, D.W. (1989) Ecology and natural history of tropical bees. Cambridge University Press, New York, 514.

Sakagami, S.F. and Inoue, T. 1985. Taxonomic notes on three bicolorous *Tetragonula* stingless bees in Southeast Asia. Kontyû, 53, 174–189.

Sakagami, S.F. 1978. *Tetragonula* stingless bees of the continental Asia and Sri Lanka (Hymenoptera, Apidae). Journal of the Faculty of Science, Hokkaido University, Series VI, Zoology, 21: 165–247.

Sakagami, S.F. and Inoue, T., Salmah, S. 1990. Stingless bees of central Sumatra. *In:* S.F. Sakagami, R. Oshgushi and D.W. Roubik (Eds.), Natural History of social wasps and bees in equatorial Sumatra, Hokkaido University Press, Sapporo, pp. 125–137.

Sakagami S.F., Inoue T. 1987. Stinglee bees of the genus *Trigona* (subgenus *Trigonella*) with notes on the reduction of spatha in male genitalia of the subgenus *Tetragonula* (Hymenoptera, Apidae). Kontyû, 55:610–627.

Sakagami, S.F. and Yamane, S. 1984. Notes on the taxonomy and nest architecture of the Taiwanese stingless bee *Trigona (Lepidotrigona) ventralis hoozana*. Bulletin of the Faculty of Education, Ibaraki University (Natural Sciences), 33: 37–48.

Schwarz H.F. 1939. The Indo-Malayan species of *Trigona*. Bulletin of the American Museum of Natural History. 76:83–141.

Strand, E. 1913. Apidae con Ceylon, gesammelt 1899 von Herrn Dr. W. Horn. Archiv für Naturgeschichte. Abteilung A, 79: 135–150.

Vijayakumar.K. Muthuraman.M. and Jayaraj.R. 2013. Infestation of *Carpoglyphus lactis* (Linnaeus) (Acari:Carpoglyphidae) on *Trigona iridipennis* (Apidae:Meliponinae) from India. Scholarly Journal of Agricultural Science. 3(1):25-28.