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NOTES AND COMMENTS

First report of drinking tear and sweat by *Lisotrigona* bees (Apidae: Meliponini) from India

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We report tear and sweat drinking *Lisotrigona* bees from Thenzawl (Mizoram), Bhanupratppur, and Barnawapara (Chhattisgarh) for the first time from India. Their feeding was observed from 0900 to 1530 hours. Drinking on tear and sweat lasted for 35 to 180 seconds. Further detailed studies on foraging activity, identification of species, nesting behavior, and nest structure of these species are underway.

Keywords: stingless bees; *Lisotrigona*; tear drinking; sweat drinking; India

Stingless bees of the genus *Lisotrigona* are rare and only four species namely, *L. cacciae* (Nurse), *L. mohandasi* Jobiraj and Narendran, *L. revanai* Viraktamath and Sajan Jose and *L. chandrai* Viraktamath and Sajan Jose, are known from India (Rasmussen, 2013; Viraktamath & Rojeet, 2021). During our recent field visits to collect stingless bees, we came across a very interesting behavior of *Lisotrigona* bees drinking sweat and tears for the first time in India in Mizoram and Chhattisgarh. This feeding behavior is described and briefly discussed in this paper.

We observed *Lisotrigona* bees collecting nectar and pollen from rapeseed flowers from December 2019 to February 2020 at Thenzawl (Mizoram) (23.297° N, 92.751° E) (Figure 1a). However, in March when the temperature raised to 25.50°C from 20.20°C prevailing during December-February, these bees interestingly started hovering around the head, ears, eyes, and sweaty hands of the people working in the field. The first author (RT) volunteered himself to allow the bees to feed on his sweat and tears to study their foraging behaviour for seven days. Observations were made on the number of bees feeding on tear from 0900 to 1600 hours at hourly intervals and the data is presented in Figure 2. The hovering began around 0900 hours and lasted till 1530 hours. Their activity was more from 1100 to 1330 hours with seven bees feeding on tear at 1300 h (Figure 2). Initially, one bee hovered around the head, ears, and face region and after a few minutes, four bees joined. They tried to taste the sweat near the forehead and ears (Figure 1b). After hovering for 7-8 minutes, they tried to enter the eyes (Figure 1c-f). After attempting for 2-3 minutes, they alighted on

eyelashes and drank the tears. Each bee drank the tears for about 35-40 seconds and then flew away. After 6 to 7 minutes another group of five bees again began hovering around the head and three bees directly alighted on the eyelids and drank the tears one after the other. Blinking of eyelids did not deter them from drinking tears. When the bees were drinking the tears, it felt like some soft feathers touching the eyes. The bees were very gentle while drinking and did not cause any irritation.

Similar feeding behaviour was observed at two places in Chhattisgarh by the second author (SR). While traveling from Pakhunjur to Raipur on a two-wheeler, SR stopped at Bhanupratappur (20.30° N, 81.07° E) to take a rest. SR took out the helmet as his head and face were covered by sweat. Within 4-5 minutes five bees started hovering around the nose, eyes, forehead, ears, and sweaty hands. After a couple of minutes, two bees alighted on the fingers and one on the nose and started drinking sweat (Figure 1g and h). Two bees alighted near the eye, slowly crawled to the lower eyelid, and drank the tears. The feeding lasted for 120-180 seconds and then the bees flew away.

The second incident occurred at the forest guest house of Barnawapara wildlife sanctuary (20.45° N, 81.97° E) (Chhattisgarh). When SR was participating in an outdoor meeting consisting of 50 people, 2-3 *Lisotrigona* bees started hovering around the face of many people at 0900 hours. SR volunteered himself to allow the bees to feed on his sweat and tears and recorded the number of bees feeding from 0900 to 1500 hours at hourly intervals (Figure 2). Initially, two bees alighted on the nose and drank the sweat while one bee

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Figure 1. *Lisotrigona* bees feeding on nectar, sweat and tears. (a) *Lisotrigona* bee on mustard flower at Thenzawl (Mizoram); (b) *Lisotrigona* bee drinking sweat on ear at Thenzawl (Mizoram); (c-f) Various position of *Lisotrigona* bee while feeding on tears at Thenzawl (Mizoram); (g) *Lisotrigona* bee drinking sweat on a finger at Bhanupratappur (Chhattisgarh); (h) *Lisotrigona* bee drinking sweat on nose at Bhanupratappur (Chhattisgarh).

on the eyelash and drank the tears. The feeding lasted for 60-120 seconds. A maximum of five bees drank tear at 1200 and 1300 hours (Figure 2). This feeding continued till 1500 hours with intermittent breaks. A search around the guest house led to the presence of a colony on a sal tree trunk (*Shorea robusta* Roth) (Supplementary Figure S1c)

Samples of the bees were identified as three species of *Lisotrigona* based on the key (Rasmussen, 2013) and then photographed at the Department of Entomology, University of Agricultural Sciences, GKV, Bengaluru (Supplementary Figure S1b, d)

Insects feeding on tears and sweat are called “lachryphagy” and “sudophagy” respectively (Plotkin & Goddard, 2013). The tear drinking behaviour of *Lisotrigona* bees is well documented by Banziger et al. (2009) and Banziger (2018) from Thailand. Karunaratne et al. (2017) reported *L. cacciae* feeding on tears from the central hills of Sri Lanka.

According to Zaspel et al. (2012), tears and sweat are rich sources of sodium which is essential for successful reproduction for these insects. Downes (1973) believes that lachryphagy is derived from puddling

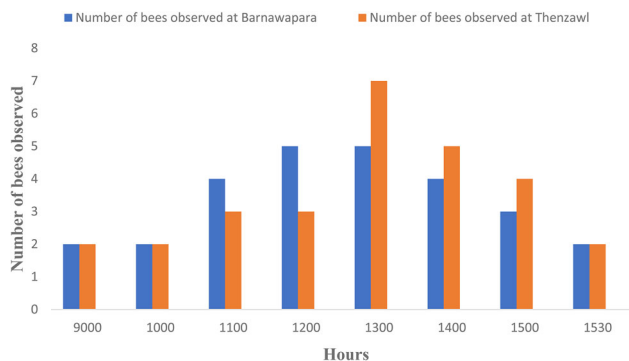


Figure 2. Tear drinking activity by *Lisotrigona* bees at different hours at Barnawapara (Chhattisgarh) and Thenzawl (Mizoram).

behaviour exhibited by several moths, butterflies, and bees. Similarly, sudophagous behaviour is considered as a subset of puddling by Boggs and Dau (2004). Banziger (2018) proposes that lachryphagous behaviour in *Lisotrigona* bees is to obtain proteins rather than salt or water as the tears are 200 times richer in proteins than sweat. As Plotkin and Goddard (2013) opine sudophagous and lachryphagous insects provide fascinating examples of evolutionary adaptation. However, we hypothesize that this behaviour may represent a transition status from carnivory to highly specialized feeding behaviour of nectarivore and palynivore. It will be interesting to study the detailed chemical composition of the tears and sweat and to find out whether any other chemical acts as an attractant to these bees besides meeting the needs of sodium and proteins,

Interestingly all the 28 lachryphagous and sudophagous bees collected from three locations in the present studies are females. Banziger (2018) proposes that *Lisotrigona* colonies have specialised tear collectors besides nectar and pollen foragers. Tears will be stored in the cells like honey and pollen and utilized whenever needed by other bees.

Further studies are being made to collect male bees for identification of the species, to understand their feeding behaviour, foraging activity in different seasons, the chemical composition of sweat and tear, nest structure, and their distribution.

Though lachryphagy behaviour is very common in Thailand, this is the first report of sudophagous and lachryphagous *Lisotrigona* bees from India. This is also the first report of the occurrence of the *Lisotrigona* bees from Mizoram and Chhattisgarh states of India.

Disclosure statement

No potential conflict of interest was reported by the authors.

Supplementary material

Supplementary Figure S1 is available via the 'Supplementary' tab on the article's online page (<http://dx.doi.org/10.1080/00218839.2021.1933369>).

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