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Stingless bees in Nagaland: Report on a reconnaissance survey

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Abstract
Stingless bee is the smallest honey producing bee which is not commonly used commercially and its cultivation and maintenance is called "meliponiculture". The honey produced by stingless bee has high medicinal value. The Naga tribes use to keep this bee in their houses as a habit. Both terrestrial (*Tetragonula irridipenis*) and underground (*Lophotrigona canifrons*) bees are found to keep in their houses. But due to lack of knowledge, meliponiculture has not been picked up by villagers of Nagaland as a component of rural livelihood. They use traditional methods for maintaining of these bees. Hence awareness activity and training programme to the farmers to adopt scientific method is urgently required for upliftment of this as a part of rural livelihood.

Keywords: Nagaland, stingless bee, meliponiculture, *Tetragonula irridipenis*, *Lophotrigona canifrons*

Introduction
Stingless bees are the smallest honey producing bees belonging to the family Apidae and subfamily Meliponinae. In India these are widely known as dammar bees [13]. The sting of the dammer bee is vestigial. As a mode of defence action, they bite their enemies or intruders and is different from the four species of genus *Apis* in appearance and habits [9]. Like honeybees they are highly social insects, living in colonies. The colonies of stingless bees are perennial in nature and usually consist of hundreds or thousands of workers [18]. They make their nests in dark places like empty logs, cavities in tree trunks, cracks and crevices in old walls etc., where the nest entrance mostly projects as an external tube. They prefer closed structure for nesting rather than open space. Unlike the honeybees of the genus *Apis*, stingless bees use to keep their honey and pollen in spherical pots separately, prepared by using a mixture of wax, resin/propolis and mud called as "cerumen". The larval feeding process of stingless bees also differs from that of the honeybees of genus *Apis*. Mass provisioning is practised to feed the developing larva in stingless bee, whereas the same are fed progressively with royal jelly and bee bread in case of *Apis* spp. [5]. These bees are important pollinators of various food crops and can be domesticated in hives [8]. Beekeeping with stingless bees is called "meliponiculture", which has been practiced for many centuries in various parts of Latin America especially by the Maya people, where these bees are considered as very valuable domestic species [2, 3, 17]. The speciality of the stingless bees is the ability to pollinate small-sized flowers due to their diminutive figure which cannot be achieved by the relatively big honey bees and other wild bees. As well as, stingless bees are true generalists, collecting nectar and pollen from a vast array of plants [1, 6, 7, 11, 14]. On the contrary they lack functional sting, which makes them suitable especially for pollination of crops that are cultivated in inhabited areas and in enclosures such as cages and greenhouses.
The traditional communities of Nagaland do practice the stingless bee keeping with utilising their local and traditional knowledge. The use of stingless bees as pollinators has opened a new economic possibility for meliponiculture. Thus keeping in mind the importance of pollination benefits as well as honey quality which is mainly used in medicinal purpose, the present survey was carried out to explore the status of stingless bee keeping in Nagaland.

Materials and Methods
The present study was carried out during March, 2018 in the villages of Dimapur ($25^0$4'N latitude and $93^0$47'E longitude) and Peren ($25^0$31'N latitude and $93^0$44'E longitude) districts of Nagaland. The elevations above the mean sea level of Dimapur and Peren districts are in the range of 260 m and 1445 m respectively. The study area comprises of two villages of Dimapur

district namely, Medziphema and Ruzaphema and five villages of Peren district namely, Punglwa, Gaili and Ngwalwa.

Beekeepers were selected randomly and the selection was used in order to identify Naga tribal members who were rearing stingless bees since long or from his forefather's time. The data was collected based on questionnaires prepared regarding species diversity, colony captured and establishment, types of hives, colony management, honey harvesting method etc and the obtained results are discussed in below.

Results and Discussion

The findings of this study are grouped under following subheads.

1. Colony establishment: The beekeepers collect the stingless bee colony from forests to establish the initial colony in their homes and further from this initial colony they divide and increase the number of colonies. They use to find the bee colony in traditional way, after locating any colony in the tree trunk, they simply cut the tree trunk and bring the colony along with cut tree trunk to establish the colony (Fig. 1). Generally, they go out for colony searching after completing the cultivation period (after harvesting the kharif crops during the period of November - February) when the forest area is less dense. Sometimes they locate the bee colony by searching the nearby river bank. The best time to bring the colony inside home is late evening. Earlier Singh AK [15] reported that in Nagaland the terrestrial stingless bees (*T. iridipennis* and *T. laviceps*) prefer their nesting in the hollow tree trunks in forest and the nested tree trunks were cut by saw to avoid disturbing of colony by jerk and in the end, the obtained portable log hives containing colonies were shifted in the evening time.

2. Places for colony keeping: There are no such fixed places for their colony establishment. Generally, most of the farmers keep the newly collected bee colonies below the roof of their houses by hanging the hives (Fig. 2). Sometimes, they also keep the hives under some kind of shade like livestock shed, tree shade etc. (Fig. 3 & 4). Some fix the hives in orchards or near farm land area for pollination of their crops. Unlike honeybee hives, they do not always maintain a specific distance between adjacent stingless bee hives, the arrangement is more natural and religious. Similarly Singh AK (15) observed that usually the log hives were hung by ropes and wires from the roof or pole or wall in shaded places.

3. Type of hives: Though there are scientific bee hives/boxes for stingless bee keeping (Fig. 5), but they do not always use these boxes. They mostly keep the bees in traditional hives like hollow tree logs, handmade wooden rectangular boxes etc. (Fig. 6a and 6b). The initial colony is contained inside the incised tree trunk which is collected from forest. This newly collected colony acts as the starter colony. After that they use traditional handmade wooden frames or tree logs to multiply into new and larger colonies. Some farmers also use Newton bee boxes for storing bee colonies, by modifying it in their own way (Fig. 7). Previously in his study, Singh AK [15] also reported that Naga tribes' have been rearing stingless bees in traditional beehive since their forefathers' time. They kept terrestrial stingless bee colonies in log hives, rectangular wooden boxes etc. and its size and shape were varied since they made as per their convenience.

4. Management of bee colonies: The locals do not follow a stringent set of rules to manage the colonies. The colonies are allowed to thrive themselves and expected to collect the required quantity of nectar and pollen from the surrounding floral diversity for their proliferation. For the same reasons, artificial feeding in form of sugar syrup or pollen supplement is not provided during lean seasons. The most befitting reason is probably because there is not such report of colony absconding due to unavailability of food source. The hives are not inspected periodically for the prevalence of diseases and pests. They open the hives only once in a year during the time of honey harvesting and colony separation in the month of November to January.

5. Honey harvesting and colony separation: Honey harvesting is done only once in a year when the hives are opened. But after establishment of the initial colony, the first harvesting is done after 2-3 years. Then subsequent harvestings are done once every year. In stingless bee colony honey is stored in spherical pots made by "cerumen" which are distributed surrounding the brood combs. Generally in this colony the comb orientation is such that the pollen pots are placed near the entrance, followed by brood chamber and honey pots at the end. They simply open the box and collect the honey pots by hands without damaging the broods, but a little portion is left as the food for bees. In earlier study Singh AK [15] stated that during honey harvesting Naga beekeepers first close the entrance gate with cloth and open the box by removing wooden plank on the upper side with the help of chisel and hammer, thereafter most of the beekeepers used bare hand or sharp wooden strip to pluck and pull out the honey pots.

Colony division is followed by honey harvesting at the time of hive opening. However, colony division totally depends upon the strength of the colony. Before colony division the bee keepers prepare new traditional hives with wooden frames compressed with cow dung and mud. They separate the brood pots and almost half of the portion of brood pots along with the queen cell is kept in the new box. Then they keep the new box in the place of old box and the old one is kept a bit away from its original place. However, if the colony is not so strong, division is not done. Then the colony is kept as usual after collecting the honey. Both honey harvesting and colony division is done in between the months of November and January. When the colony is not divided during the appropriate period (November - January), in spite of having a standard population, a heavy population is seen wandering around the box/hive during the months of April- May, which according to the bee keepers, makes it very difficult for them to re-establish into a new colony.

6. Pest and diseases infestation: Honeybees like all other creatures suffer from many diseases and are attacked by various parasites, pests, predators and enemies. However, there is no report of major pest and disease infestation in stingless bee colony. As the beekeepers only keep the native bees like stingless bee and Indian honey bee, there is no report of fatal bee diseases introduced by European bees. Ants and wasps problems are seen in very few cases when the boxes are kept unnoticed for a pretty long period.

Generally water pans are kept at the base of hive stands to avoid ants attack especially when those are kept near farm land (Fig. 8).

7. Honey and hive products: Honey is the main product of stingless bee colonies and it has high medicinal value. The average yield in these areas is about 200-250 ml per colony per year and it may vary on the size of bee colony/ or population. Due to its high medicinal value, sometimes there is high demand and in such cases, pre-harvest booking of honey is done. They get an average price of about Rs1500-2000 per bottle (200-250 ml) of honey.

The other important hive products are pollen, cerumen etc. but these are sometimes extracted by the farmers.

Ramanujam *et al*. [12] recorded that honey, pollen and cerumen are the three stored products of stingless bees, and out of these, honey is the most important product in the hives, produce limited quantity up to 100 ml/ colony. Similarly Singh AK [15] reported that stingless bees are poor honey gatherer; they store only limited quantity of honey (about 500gm/ hive/ year).

8. Prevalent bee species: Mainly two stingless bee species were reported from the studied areas. The first one is *Tetragonula irridipenis* which is more common in Nagaland (Fig. 9). The abdomen of which is reddish-brown in colour, whereas the head and thorax is blackish (Fig. 10). This one is kept in boxes for rearing. Stingless bee species which are commonly seen in India are *Trigona* (*Tetragonula*) *iridipennis* [4, 10, 16]. Apart from *T. iridipennis*, seven other stingless bee species were also reported from India.

The second one is *Lophotrigona canifrons*, an underground stingless bee reported from the studied areas. It is blackish in colour and very shy in nature (Fig. 11). It can't be reared in boxes and their hives can be identified by the presence of a very small entrance tube on ground surface (Fig. 12).

In earlier study Singh AK [15] reported three species of stingless bees namely, *Tetragonula irridipenis*, *Tetragonula laviceps* and *Lophotrigona canifrons* from across the six selected districts, viz. Dimapur, Peren, Kohim, Mokokchung, Zunheboto and Wokha. Further in his study he also observed two types of nesting habitats; terrestrial and subterranean. The *Tetragonula irridipenis* and *Tetragonula laviceps* constructed their nests terrestrially, whereas the nesting behaviour of underground stingless bee (*Lophotrigona canifrons*) was subterranean. But in the present study *Tetragonula irridipenis* and *Lophotrigona canifrons* were observed as the study area covered only two districts namely, Dimapur and Peren.

Conclusion and Recommendations

People of these areas keep the stingless bees as a kind of hobby and not for commercial purpose. This survey revealed that 8 out of 10 farmers kept stingless bee hives in their houses. However, the number of hives per farming family was very less. Survey showed that only 2 or 3 farmers out of 8 were having 15 or more bee hives in their houses.

Hence there is a need to increase the usefulness of these native stingless bees among the farmers as efficient pollinators of cultivated crops, as well as for the value of honey and other hive products which would help to improve their economic condition and livelihood. The following strategies are suggested-

- Training be imparted to the farmers to create awareness about stingless bee keeping for commercial purpose.
- Training to adopt scientific method of bee keeping by utilising scientific bee boxes and others.
- Increasing awareness about the role of stingless bee in pollination improvement and thereby production enhancement of cultivated crops, especially in green house condition.
- Government should pay more attention towards formulation of policies related to boosting stingless bee keeping amongst farmers and development & marketing of hive products.

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Fig 1: Establishment of new colony with cut tree trunk

Fig 2: Keeping of bee colonies below the roof of houses by hanging the hives

Fig 3: Keeping of bee hives under livestock shed

Fig 4: Keeping of bee hives under tree shed

Fig 5: Scientific boxes for stingless bee keeping

Fig 6a: Traditional hive **(**handmade wooden rectangular box**)**

Fig 6b: Traditional hive **(**hollow tree log**)**

Fig 7: Modified Newton bee boxes for stingless bee keeping

Fig 8: Use of water pan to avoid ants attack

Fig 9: Colony of *Tetragonula irridipenis*

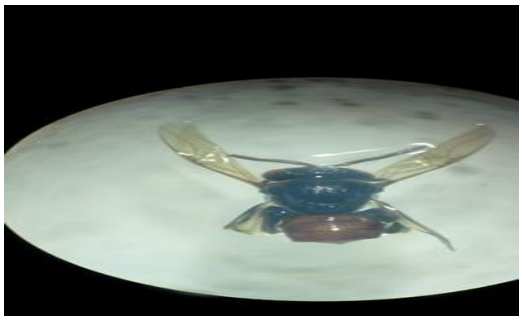

Fig 10: *Tetragonula irridipenis*, terrestrial stingless bee (abdomen is reddish-brown in colour, whereas the head and thorax is blackish)

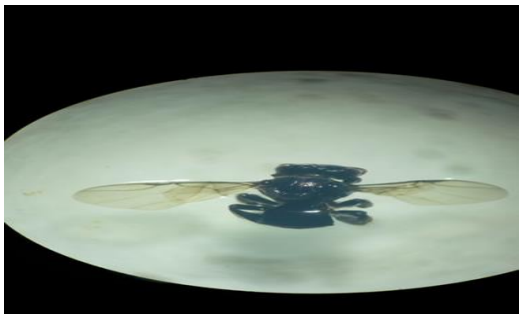

Fig 11: *Lophotrigona canifrons*, an underground stingless bee with entirely blackish in colour

Fig 12: Hive entrance tube of underground stingless bee, *Lophotrigona canifrons* on ground surface

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