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ORIGINAL ARTICLE



Pollination potential of stingless bees in vegetable crops under field and precision horticultural ecosystems

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Stingless bees or Dammer bees taxonomically classified under the tribe Meliponini are one among the largest groups of eusocial bees on earth, with over 500 species documented, which is 50 times more than its rival cousins, the honey bees (*Apis* sp.). They are believed to have inhabited our planet 65 million years ago—longer than *Apis* sp. (Tayeet *al.*, 2019). Stingless bees live in permanent colonies made up of a single queen and workers, who collect pollen and nectar to feed larvae within the colony and likewise store honey in the hive for this purpose. Honey produced by stingless bees is known by various names such as Meliponine honey, pothoney, sugarbag honey (in Australia), and Keluluthoney (in Malaysia). In Kannada stingless bees are known as *Nasarujenu* or *Mujentijenu* or *Ralajenu* or *Sollejenu*. Under these and other names, stingless bee honey has a long history of traditional indigenous use with a wide range of purported therapeutic properties, including antidiabetic and antioxidant properties.

The most prominent stingless bees seen in India are *Trigona* (= *Tetragonula*) *iridipennis* smith. species (Swaminathan, 2000). Earlier it was known as *Meliponairidipennis* smith. However, the species located in India and Sri Lanka has been re-designated under *Trigona* genus and this classification is widely accepted (Michener, 1974; Sakagami, 1978). Once again this bee was named as *Tetragonulairidipennis*. The bee got its name *Trigona* (= *Tetragonula*) *iridipennis* due to its triangular abdomen and iridescent wings. For building nest, they usually collect resins from trees which makes them to be called as Dammer bees. In India although stingless bees have been domesticated long back, not much importance and attention has been given to them

when compared to the large scale beekeeping with *Apis cerana indica* and *Apis mellifera*. Very little scientific studies were conducted on stingless bees though its honey has got immense medicinal properties and utility as a very good plant pollinators when compared to other types of honey bees. Even though the stingless bees produce very less quantity of honey (400-600 ml per colony per year), due to its high medicinal property of honey, smooth taste and fragrance make it honey qualitatively superior compared to other types of honey. The importance of stingless bee pollination is much higher than stingless bee culture (Meliponiculture) especially in Kerala and also greater than the value of their honey that is produced. There are lot of smaller plant species that exclusively depend upon stingless bees for fulfilling their pollination needs.

Features of stingless bees

- 1) They do not desert or abscond their hive very easily or frequently unlike *Apis cerana*
- 2) They do not sting, so they could be handled very easily without fear or panic
- 3) They are highly capable of collecting honey and pollen from the smallest of the small flowers which facilitate such plant species and sustain their bio-diversity
- 4) They are the most efficient pollinators of ornamental plants and vegetables
- 5) High availability of resins for making the stingless bee hive from various tree species, especially, mango, jack etc.
- 6) Effective control of natural enemies can be achieved because these bees seal their entire hive, except the portion of entrance tube, which will be heavily guarded by guard bees
- 7) Melliponiculture is low cost and easily available materials can be used for hive fabrication and maintaining stingless bees viz., bamboo poles, wooden logs, wooden boxes, coconut shells and mud pots
- 8) Stingless bee hives can be placed hanging on the sunshades of houses, porticos, open porches, or in farms by using bee hive stands.
- 9) These hives can be placed very close to each other and they require very limited space
- 10) Shifting and transporting these hives is very easy and less cumbersome

Impact of stingless bee pollination on crop yield parameters findings at UAS, Bangalore, Karnataka

- **Radish (*Raphanussativus*):** In seed production plots, stingless bee, *Tetragonulairidipennis* constituted 2.78% of all honeybee pollinators contributing to significantly higher number of siliquae per plant, seeds per plant, per cent filled seeds, test weight, and yield in open and bee pollinated plots (ShivanandHaveri,2004).
- **Summer Squash (*Cucurbita pepo*):** Under field conditions, *T. irridipennis* was one of the major species among 20% of non-*Apis* pollinators contributing significantly higher fruit set, fruit weight, fruit volume, good seeds per fruit and 100 seed weight when number of bee visits were maximum (8 bee visits/flower)(Manjula,2007).
- **Ridge gourd (*Luffa acutangula*):** Under field conditions, *T. iridipennis* was one of

the major species among 21.10 % of non-*Apis* pollinators contributing to significantly higher fruit set, fruit weight, fruit volume, good seeds per fruit and 100 seed weight, when number of bee visits were maximum (8 bee visits/flower)(Ramesh,2007)

- **Cucumber (*Cucumis sativus*):** Under field conditions, *T. iridipennis* constituted 3.24 % of all honeybee pollinators, contributing to significantly higher fruit set, fruit weight, fruit volume, good seeds per flower and test weight, when number of bee visits were maximum (10 bee visits per flower) for *A. cerana*, *A. florea* and *T. iridipennis* (KhajaRubina, 2010).
- **Coriander(*Coriandrum sativum*):***T. iridipennis* constituted 5.25 % of all honeybee pollinators under field conditions contributing to significantly enhanced number of seeds/ umbel, seed weight/umbel and seed size when 8 - 10 bees visited the umbel, irrespective of the bee species (Roopashree,2011).

A. Findings in other countries

- **Eggplant (*Solanum melongena*):**Under greenhouse conditions, at Brazil, stingless bee, *Melipona fasciculata* pollination increased the fruit set by 29.20% as compared to control, (Patricia Nunes - Silva *et al.*,2013)
- **Capsicum (*Capsicum annuum*):**Under greenhouse conditions at Richmond, Australia, pollination by stingless bees, *Austroplebia australis* and *Trigonacarbonaria* showed good potential to increase fruit yield and quality, (Mark Greco *et al.*2011)
- **Sweet pepper (*Capsicum annum*):**Under greenhouse conditions at North – eastern Brazil, stingless bee, *Melipona subnitida* pollination contributed to enhanced fruit weight and seeds per fruit, while fruit malformation was reduced as compared to traditional system of greenhouse cultivation without bees, (Darci de Oliveira Cruz *et al.*,2005)
- **Mini Watermelon (*Citrullus lanatus*):**Under greenhouse, stingless bees, *Melipona subnitida* and *Scaptotrigona* sp. were evaluated for pollination of mini watermelon at Brazil. *Scaptotrigona* sp. was well adapted for green house and can be used successfully, but not *M. subnitida*(Iga Bomfim, *et al.*, 2014)
- **Chilli, *Capsicum annuum*:** At Malaysia, under greenhouse conditions, pollination from stingless bee, *Heterotrigona itama* and hand cross pollination produced significantly heavier, longer fruits and contained greater number of seeds per fruit as compared to chilli crop which was self-pollinated, proving *H.itama* as an effective pollinator of chillies in green houses(Wahizatul Afzan Agmi, *et al.*, 2016)
- **Hot pepper, *Capsicum annuum*:**Under open field situation, *Apis cerana* and stingless bee, *Trigona laeviceps* could be used for improving fruit set, fruit production per plant, fruit weight and fruit size at North Bandung, Indonesia (Ramadhani Eks Putra *et al.*,2014)

Conclusion

Contribution of stingless bees in pollination of vegetable crops is significant and it has the capacity to pollinate the small flowers for which the other bees cannot access

and pollinate. Besides stingless bees honey has got immense medicinal properties and it commands premium value in the market, it has high potential in improving the productivity and yield of the crops. Further, because of its non-sting nature these can be handled by any age groups and reared in the backyards of their households without any fear of bee sting. These species of honey bees not only suit to the rural households but also to the urban situations as well, besides they help mankind in the conservation of plant biodiversity.

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