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Meliponiculture towards Enhancing Crop Pollination in Protected Cultivation of Cucumber

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Protective covers *viz.,* glasshouses, netting enclosures, and polytunnels are increasingly used for commercial crop production to enhance crop quality, yield, and productivity. Nevertheless, many of the crops cultivated in protected environment require external agents for pollination *i.e.,* insects to attain ideal pollination and there is no consensus about how best to manage pollinators and crop pollination in these environments. Insects are the most important agents that play a vital role in breeding of plants. Insects are known to contribute about 85 per cent of all modes of pollination, and of this 75-80 per cent are attributable to honeybees.

In India there are highly diverse species spectrum of honey bees, among which the important honey yielding ones include; Indian bee (*Apisceranaindica),* Rock bee (*Apisdorsata),* Little bee *(Apisflorea)*, the introduced species like, Italian bee (*Apismellifera), and* Stingless bee/Dammer bee *(Tetragonulairidipennis)*. Among, these species, stingless bees are potential pollinators in enhancing the yield of various crop species especially in tropical conditions. Further, these stingless bees can be domesticated (Kishan*et al.,*2017b).

Stingless bees are also called as Dammer bees belong to Apidae family, meliponini tribe and are classified under order hymenoptera. It is one of the largest groups of eusocial bees on earth. It is supposed that, stingless bees inhabited on the planet earth much earlier than *Apis sp.* i.e., over65million years ago. The stingless bees are characterized by the construction of permanent colonies made up of a single queen and workers, who collect pollen and nectar to feed larvae within the colony and also store honey for this purpose.

Stingless bees are eusocial insects that are widely distributed across subtropical and tropical regions (Quezada-Euán, 2018; Rattanawannee & Duangphakdee, 2019).

Stingless bee, *H. itama* plays an important role in pollen transfer of melon. The anthesis of both flowers occurred in the early morning (06.00 a.m.) and staminate flowers

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opened an hour earlier to hermaprodhite flowers. The stigma receptivity duration was between 08.00 a.m. to 06.00 p.m. and the peak receptivity occurred around 06.00 pm. Tostimuli melon fruit formation, at least 500 viable pollens are needed on stigma (Mussen& Thorp 1997). It's reported to set fruits, muskmelon required 15 to 20 bee visit/flower and there was no fruit set with 0, 1 and 2 visits/flower/day. Our visual observation also showed that foraging time of the bees coincides with the stigma receptiveness (Atmowidi*et. al.,*2022).

The advantages of stingless bees as pollinators are floral constancy, populous and consistent perennial colonies, non-functional sting, ease of handling, and marked worker recruitment behaviour (Bartelli *et al*., 2014; da Silva *et. al.,* 2017).

Adding honey bee hives can increase the number of floral visitors, and thus could increase pollination.

Pollination in Cucumber

Cucumbers (*Cucumis sativus*) are annual vines that flower throughout the summer. Most cucumber varieties are monoecious with unisexual flowers-have separate male and female flowers within the same plant and thus require aid of an agent in pollination for fertilization. However, some varieties are mostly or totally gynoecious (produce only female flowers) and can produce fruit through parthenocarpy and these are grown under protected structures. Additionally require pollinationfor maintenance of such lines.

Pollination of cucumber plants impact on the yield, size, and weight of fruit in monoecious varieties. Records of floral visitors in the native geographic range of cucumbers include the Asian honey bee (*Apiscerana*), the Western honey bee (*Apismellifera*), several bumble bees (e.g., Bombushaemorrhoidalis), ants (*Formica spp.*), sweat bees (Halictus spp.), and flies, among other insects (Thakur & Rana, 2008).

A female flower of Cucumber needs about 8 to 12 pollinator visits in a single day in order to set a fruit. As the individual cucumber flowers are open only for a single day, and the best time for pollination is in morning time between 7 to 9 AM, the more bees you have in the field in the morning, greater will be the chance of successful pollination.

Kishan *et al.* (2017a) concluded that, stingless bees in greenhouse cucumber can improve its pollination and thereby the fruit weight and yield. However, supplementary research studies with respect to the suitable microclimate inside greenhouses for stingless bees under tropical conditions are essential to make use of the bees for pollination.

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Conclusion

We can infer that, in comparison to pollination without stingless bees, stingless bees contribute to higher fruit quality and quantity. Thus, it is conceivable that stingless bees could be used in greenhouses to pollinate cucumbers.

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