

Stingless Bees Can Serve as Efficient Avocado Pollinators

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Abstract

Inadequate pollination was found to be one of the major factors responsible for the poor and erratic avocado yields in Israel. The honey bee serves as the major avocado pollinator in Israel, and honey bee hives are regularly placed in avocado orchards. Unfortunately, the avocado bloom is not attractive enough to the honey bee and the bee tends to abandon the avocado in favor of more attractive blooms. Hence, pollination rates have often been too low during significant part of the avocado flowering season. This problem prompted Israel to fund a comprehensive search for the native avocado pollinators at its region of origin, Mexico. Nine species of native stingless bees were found to be efficient avocado pollinators. At the next stage, it was found that getting permission to introduce foreign pollinators to Israel is a "mission impossible". The Israeli researchers could not get a permit for a trial introduction of even a single stingless bee species. Later, a large Israeli apiary got the permit and brought 14 nests of *Scaptotrigona Mexicana*. The bees were kept in a large screen-house that was built over flowering avocado trees. The bees worked diligently and efficiently on the avocado flowers, but the nests succumbed to a severe hot spell. A request for a permit to introduce a hardier stingless bee species from Australia was denied. The authors argue that pollinators of agricultural crops should be considered as desirable addition to the food producing arsenal. The risks involved in their introduction should be carefully studied and evaluated, but permits for introduction should be denied only for concrete and specific reasons.

Introduction

The honey bee (*Apis mellifera*) currently serves as the predominant avocado (*Persea americana*) pollinator in almost all avocado-producing countries, including Mexico, California in the US, and Israel [1]. Unfortunately, the avocado bloom is not very attractive to the honey bee, apparently because of the very high levels of potassium and phosphorus in its nectar [2]. As a result, honey bees from hives placed in avocado orchards tend to abandon the avocado bloom in favor of more attractive blooms within foraging distance. Indeed, inadequate pollination rate often occurs in Israel and has been found to be one of the main factors responsible for the poor and erratic avocado yields [1, 3].

The search for native avocado pollinators

The avocado originated and evolved in Central America, in the absence of the honey bee. Thus, it is not surprising that the avocado does not have the traits to make it very attractive to this pollinator. With the aim of solving the problem of inadequate avocado pollination, Israel decided to fund a search for the native avocado pollinators in its region of origin. The authorities indicated that they would favorably consider the introduction of efficient bee species.

In the late 1990s, a joint Israeli-Mexican research team conducted a large-scale survey of avocado pollinators in the main avocado-growing states of Mexico [3, 4]. Insects visiting avocado bloom were defined as efficient pollinators if they were observed: visiting avocado flowers at both female and male openings, making contact with anthers and stigmas with the same body parts, and carrying a significant amount of avocado pollen on these "pollinating zones". The honey bee, one wasp species (the social, honey-collecting *Brachygastra mellifica* Say) and nine stingless bee species were found to fit these criteria. Large numbers of stingless bees were observed on blooming avocado trees, mainly in locations that had not been sprayed by potent insecticides. We therefore concluded that the following nine stingless bee species were serving as the major native avocado pollinators in Mexico [3, 4]: *Geotrigona acapulconis* Strand; *Nannotrigona perillampoides* Cresson; *Partamona bilineata* Say; *Plebeja frontalis* Friese; *Scaptotrigona mexicana* Schwarz; *Scaptotrigona pectoralis* Dalla Torre; *Trigona fulviventris* Guerin; *Trigona nigerima* Cresson; *Trigona (Frieseomelitta) nigra* Provancher.



Stingless bee working on avocado flower at its female opening



Honey bee working on avocado flower

In general, the honey bee (mostly "Africanized bees") was the major visitor of avocado bloom in Mexico. However, in several places, we observed the honey bees leaving the avocado bloom for more attractive neighboring blooms, whereas the local stingless bees kept on working on the avocado flowers. This indicated that these stingless bee species are more faithful to the avocado bloom than the honey bee.

Getting permit for the introduction of pollinators

At the conclusion of the research, we applied for permission to introduce one of the above-listed stingless bee species into Israel in order to determine its effectiveness as an avocado pollinator. The Israeli authorities decided that there was no justification for the ecological and agricultural risks involved. As a result, the research project was terminated. A year later, one of the largest apiaries in Israel, which is heavily involved in renting hives for avocado pollination, decided to study the feasibility of using stingless bees instead of the honey bee for this purpose. Despite serious opposition, it got permission for the trial introduction of a domesticated stingless bee species. *Scaptotrigona mexicana* was selected and introduced into Israel. The bees were kept in quarantine until they had been confirmed to be free of pests and diseases and then were placed in a screen-house erected over flowering avocado trees. The released bees exhibited intense activity on the avocado flowers. Unfortunately, a severe hot spell, with temperatures soaring to 43°C, resulted in fatal consequences for the bees. Permission to introduce a hardier stingless bee species (*Trigona carbonaria*) from Australia was not granted and this project was also terminated.



Screen-house enclosing avocado trees and *Scaptotrigona mexicana* hives



Scaptotrigona mexicana hives, inside the screen-house



Two *S. mexicana* bees working on avocado flowers

Recommendation for the avocado industry

In conclusion, several stingless bee species were found to be better adapted than the honey bee to avocado pollination, and to not be diverted away so readily to other blooms [3, 4]. We are convinced that avocado pollination, and consequently its yield, can greatly benefit by the use of such stingless bee species as pollinators. We suggest that wherever stingless bees are present in regions of avocado cultivation, their efficiency for avocado pollination should be determined. If such a species is found to be an efficient avocado pollinator, its use for that purpose should be developed. Moreover, we also would advise avocado-growing countries, which, like Israel, suffer from inadequate pollination rates and have no efficient endemic stingless bees, to consider the introduction of efficient avocado-pollinating stingless bee species.

Introduction of pollinators

Widespread introduction of foreign crops has been carried out extensively throughout the world, and many of these crops are of great economic importance. When needed, pollinators had been routinely introduced to provide for the efficient pollination of the introduced crops. Nowadays, the ability to introduce new pollinators is severely curtailed, if not outright denied. Precautions should be taken of course, but there are no overwhelming reasons to completely stop this beneficial introduction. We should be able to introduce pollinators for agricultural crops that do not pose a specific significant risk to the environment.

References

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