

## Scientific note

### A scientific note on the use of stingless bees for commercial pollination in enclosures

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Stingless bees are considered to be very important pollinators in the tropics, and they are known to effectively pollinate at least 9 crops [1]. Nevertheless, they are seldomly used for commercial pollination. To our knowledge, only one study has been published using stingless bees for crop pollination [2]. In that study, *Nannotrigona testaceicornis* was used successfully to pollinate strawberries in a greenhouse in Japan. There are several advantages that might make stingless bees more suitable for the pollination of certain crops than the commonly used honeybee [1, 3]. The fact that they lack a functional sting makes them especially suitable for pollination in enclosures. In our study, we compared the pollinating activity between two species of sting-less bees and honeybees on the ornamental plant *Salvia farinacea* var. *strata* (Lamiaceae) in enclosures. *S. farinacea* is an ornamental herbaceous plant, with small (ca. 1 cm) purple and white flowers. It is commercially grown for seed export, usually in enclosures to ensure the production of pure seeds.

Experiments were carried out at the seed company Flora Feliz, Cartago, Costa Rica (9° 43' 51'' N, 83° 54' 51'' W, altitude 1388 m). Flower visitors of *S. farinacea* were captured in an open-air patch of 40 plants in December 1995. Pollination experiments were conducted in four netted enclosures (6 × 3 × 3 m) in April 1996. Each enclosure contained 60 plants that were pollinated by one of the three bee species during one month, or were left without pollinators (control). The following bee species were used: *Nannotrigona testaceicornis*, *Tetragonisca angustula*, and *Apis mellifera*. *N. testaceicornis* is a small robust bee with a body length of 4.1–4.2 mm. Colonies contain a few thousand individuals and the species is quite common in the Neotropics. *T. angustula* is a small, slender bee with a body length of 4.4–4.7 mm. It is the most abundant stingless bee species in Costa Rica with a colony size up to 5,000 individuals. We used a 5-frame hive of Africanized *A. mellifera* with approximately 10,000 workers.

Bees in the family Apidae were the most common visitors of *S. farinacea* in the open

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**Table I.** Foraging and seed production in 4 enclosures containing *Salvia farinacea* provided or not with different species of bee pollinators (mean  $\pm$  SE). Data in the last column were calculated as (seed yield with pollinators – seed yield control)/(foraging activity).

Bee species	Foraging activity # visits·plant <sup>-1</sup> ·min <sup>-1</sup>	Seed yield g·seed·plant <sup>-1</sup>	Seed yield / foraging activity g·seed / # visits·min <sup>-1</sup>
<i>A. mellifera</i>	4.6 $\pm$ 4.1	1.02 $\pm$ 0.15	0.21
<i>N. testaceicornis</i>	3.3 $\pm$ 3.4	0.77 $\pm$ 0.12	0.22
<i>T. angustula</i>	2.4 $\pm$ 2.8	0.61 $\pm$ 0.08	0.24
Control	0	0.04 $\pm$ 0.02	

(73% of all visitors;  $n = 286$ ). Both *A. mellifera* and *T. angustula*, used in our experiments, visited *S. farinacea* in good numbers (20 and 23% of all bees, respectively). The other bee visitors were 2 other stingless bee species, *Partamona* aff. *cupira* (42%) and *T. fulviventris* (15%).

In the enclosure experiment, bees visited the flowers mostly during the morning. On a daily basis, the plant visitation rate of *A. mellifera* was almost twice as high as that of *T. angustula*. *N. testaceicornis* showed an intermediate foraging activity (Tab. I).

Seed production was very low in the control enclosure without pollinators in comparison with that in the enclosures provided with bees (Tab. I). Comparison of the three bee species showed that pollination was most effective for *A. mellifera*, followed by *N. testaceicornis* and *T. angustula* (Tab. I). Pollination by all tested pollinators resulted in the production of good quality seeds with seed weight (953–1,176 seeds/g) and germination rate (61–71%) similar among the enclosures.

The lower seed production obtained with stingless bees in comparison with honeybees may have been a consequence of their lower foraging activity, which in turn was probably related to their much smaller population of foragers. Seed yield evaluated per unit of foraging activity, was similar for all three species of bees (Tab. I).

This study shows that stingless bees can be effective pollinators in enclosures and

can therefore be a valuable alternative to honeybees for commercial crop pollination.

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## Note scientifique sur l'utilisation d'abeilles sans aiguillon pour la pollinisation commerciale sous abris.

## Eine wissenschaftliche Notiz über die Nutzung von stachellosen Bienen zur kommerziellen Bestäubung in Gewächshäusern.

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