B09 - Do the oil palm & rubber ecosystems support the bee diversity and stingless bee foraging behaviour?

Rika Raffiudin[1], A.Traya Soegiarso[1], Tri Atmowidi[1], Sih Kahono[2], Ryzka A. Baher[1], Rosi F. Ramadani[1], Siria Biagioni[3], Nunik S. Ariyani[1], Hermann Behling[3], Damayanti Buchori[1], Teja Tscharntke[3]

[1]Bogor Agricultural University, [2]Indonesian Institute of Sciences (LIPI), [3]University of Göttingen

Contact: rika.raffiudin@ipb.ac.id, rraffiudin@gmail.com

Aims: We study the bee diversity and the foraging behaviour of the bees in several agroforestry ecosystems

Question (research in 2012): Which ecosystem has the highest number of the hymenopteran bee species?

Methods: We explored the diversity of hymenopteran bees in oil palm plantation (HO1-HO4), rubber plantation (HR1-HR4), jungle rubber (HJ1-HJ4) and villages at Harapan Rain Forest, Jambi, using sweep net to collect the bees from 7-11 am within 5 days in each 50x50 m^2 plots.

Results: A total of 28 species from six families of hymenopteran bees, i.e. Apidae (16 sp.), Halictidae (4 sp.), Megachilidae (1 sp.), Pompilidae (1 sp.), Sphecidae (1 sp.) and Vespidae (5 sp.). The stingless bee *Trigona* (Apidae) is the genus that has the highest number species and we found *T. minangkabau* which is the endemic species. **The oil palm ecosystem has the highest number of species of Hymenoptera bees (16 species).**

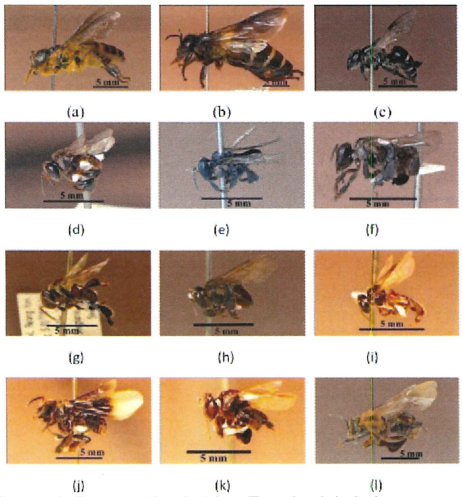


Figure 1. Bees in the Apidae Family: (a) *Apis cerana*, (b) *A. dorsata*, (c) *A. andreniformis*, (d) *Trigona laeviceps*, (e) *T. reepeni*, (f) *T. itama*, (g) *T. terminata*, (h) *T. ventralis*, (i) *T. minangkabau*, (j) *T. nitidiventris*, (k) *T. geissleri*, (l) *T. thoracica*, (m) *T. fuscobalteata* (Apidae: Apinae)

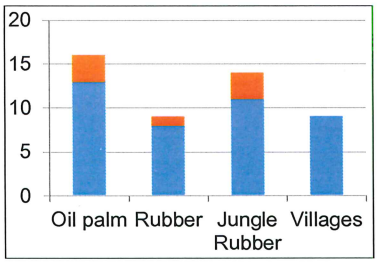
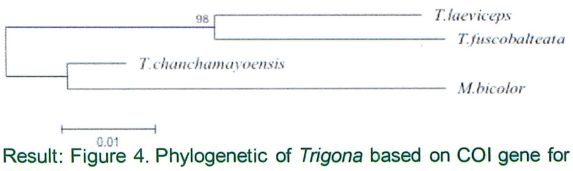


Figure 2. Number of species of **Apidae** and **non-Apidae bee** in oil palm, rubber, jungle rubber plantations and villages at Harapan Rain Forest, Jambi

We also want to know the relationship among the stingless bees.
Method: Amplification of COI gene of *Trigona* as DNA Barcode



Result: Figure 4. Phylogenetic of *Trigona* based on COI gene for DNA Barcode

Figure 5. *Trigona* observations nest in oil palm plantation (HO1)

Questions (research in year 2014): Are the bees able to adapt if the whole nest & colony from secondary forest transferred to a new land use habitat? What type of pollen do the bees collect in the new habitat?

Methods: Each *Trigona terminata* colony collected from the secondary forest was placed in an experimental box at oil palm (HO1) and rubber plantation (HR1) (Figure 5) and observed the foraging behavior from 6 am – 6 pm (10 days). Pollen were collected from the pollen basket of a single bee. Nest development were recorded at day-1 & day-30.

Results: In oil palm plantation, high number of stingless bees foraged and returned back to the nest with pollen and resin from the morning until afternoon (Figure 6a). In rubber plantation (HR1), the bees mostly collect pollen during the afternoon (Figure 6b)

- Ten types of pollen collected by the bees (Figure 7).
- The nest of *T. terminata* was developed from day 1 to day 30; the brood cells that was exposed were covered with layered of honey pots (Figure 8).

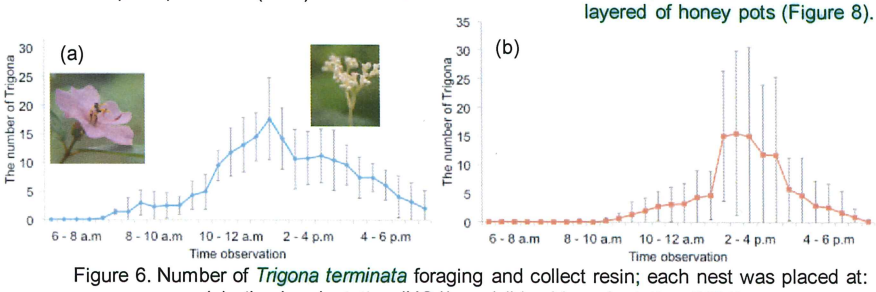


Figure 6. Number of *Trigona terminata* foraging and collect resin; each nest was placed at: (a) oil palm plantation (HO1), and (b) rubber plantation (HR1)

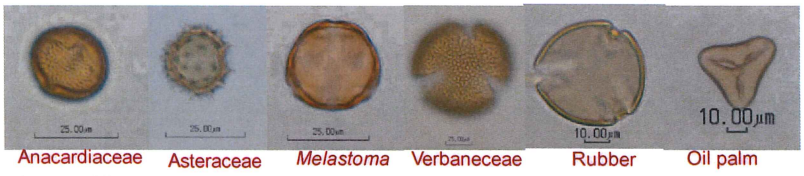


Figure 7. The main types of pollen collected by the stingless bees

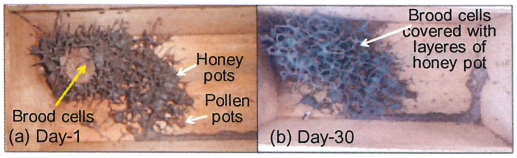
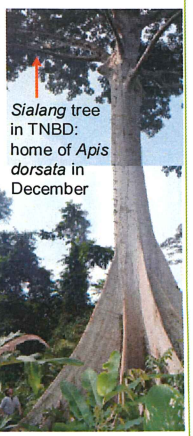


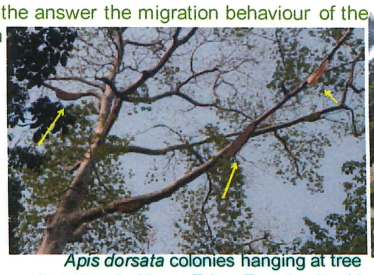
Figure 8. *Trigona terminata* nest development in rubber (HR1) plot: (a) day-1 & (b) day-30; the brood cells were covered with layers honey pots in day-30

Questions for our future works…

1. Are the pattern of stingless bee behaviour in above studies similar with other colonies in oil palm and rubber plots and also in natural forest ?
2. What type of pollen do the bees bring to their natural nest in the forest?
3. How far and in what directions do the bees forage? Lesson learn using bee tracking microchips
4. Is DNA microsatellite able to the answer the migration behaviour of the *Apis dorsata* from colonies in Temple, Jambi?



Apis dorsata forage to *Mimosa* flower



Apis dorsata colonies hanging at tree branches in Muara Takus Temple, Jambi

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