RESEARCH GAP ON STINGLESSBEE CONSERVATION

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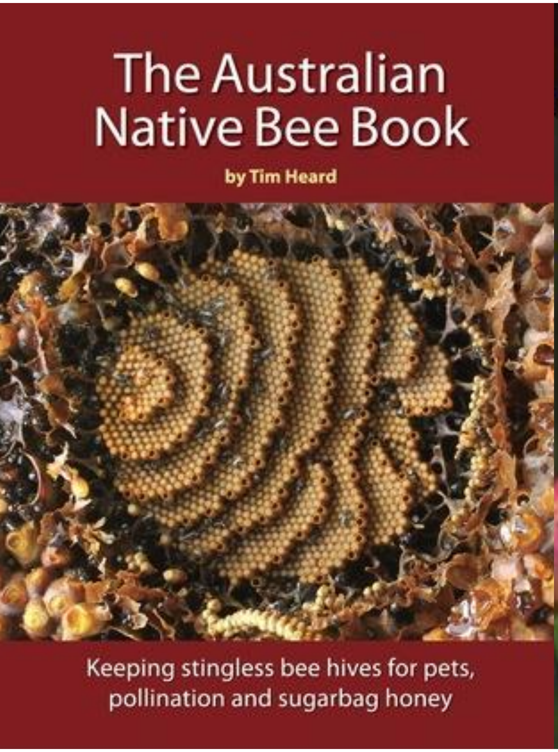
ศูนย์วิจัยผึ้งพื้นเมืองและแมลงผสมเกสร

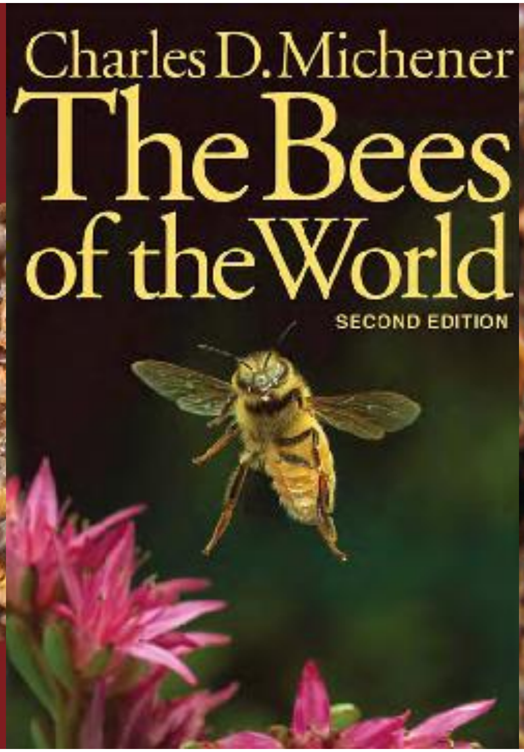
Native Honeybee and Pollinator Research Center

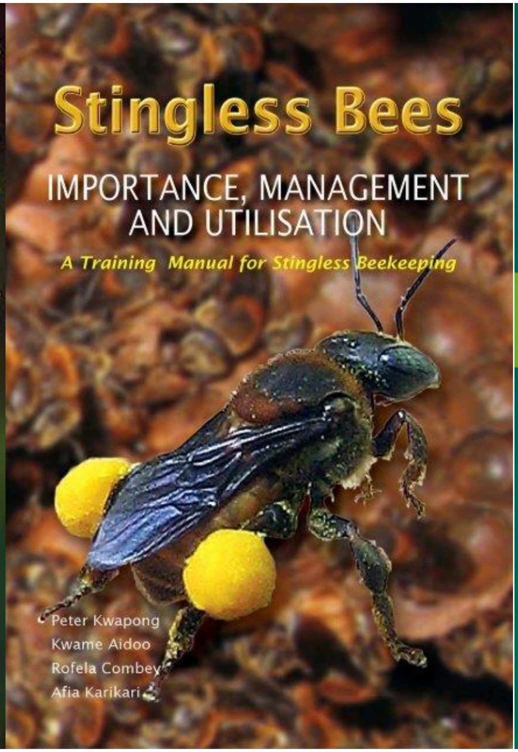
มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี (มจธ.)

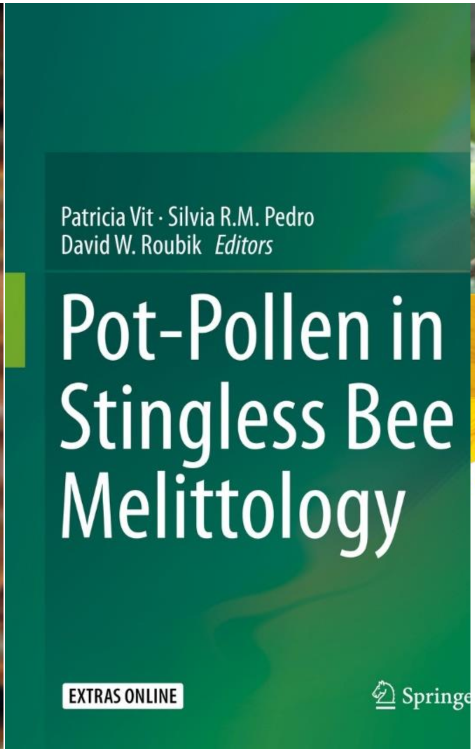
NHBEE

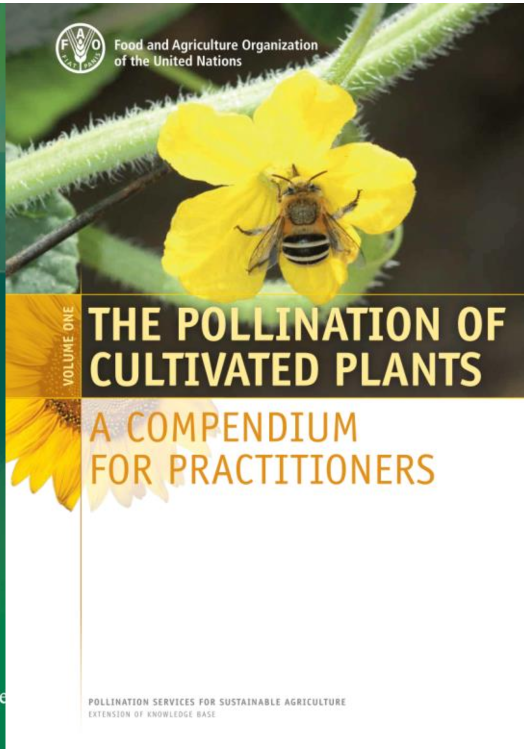
Native Honeybee Research Laboratory


The Australian
Native Bee Book
by Tim Heard
Keeping stingless bee hives for pets,
pollination and sugarbag honey

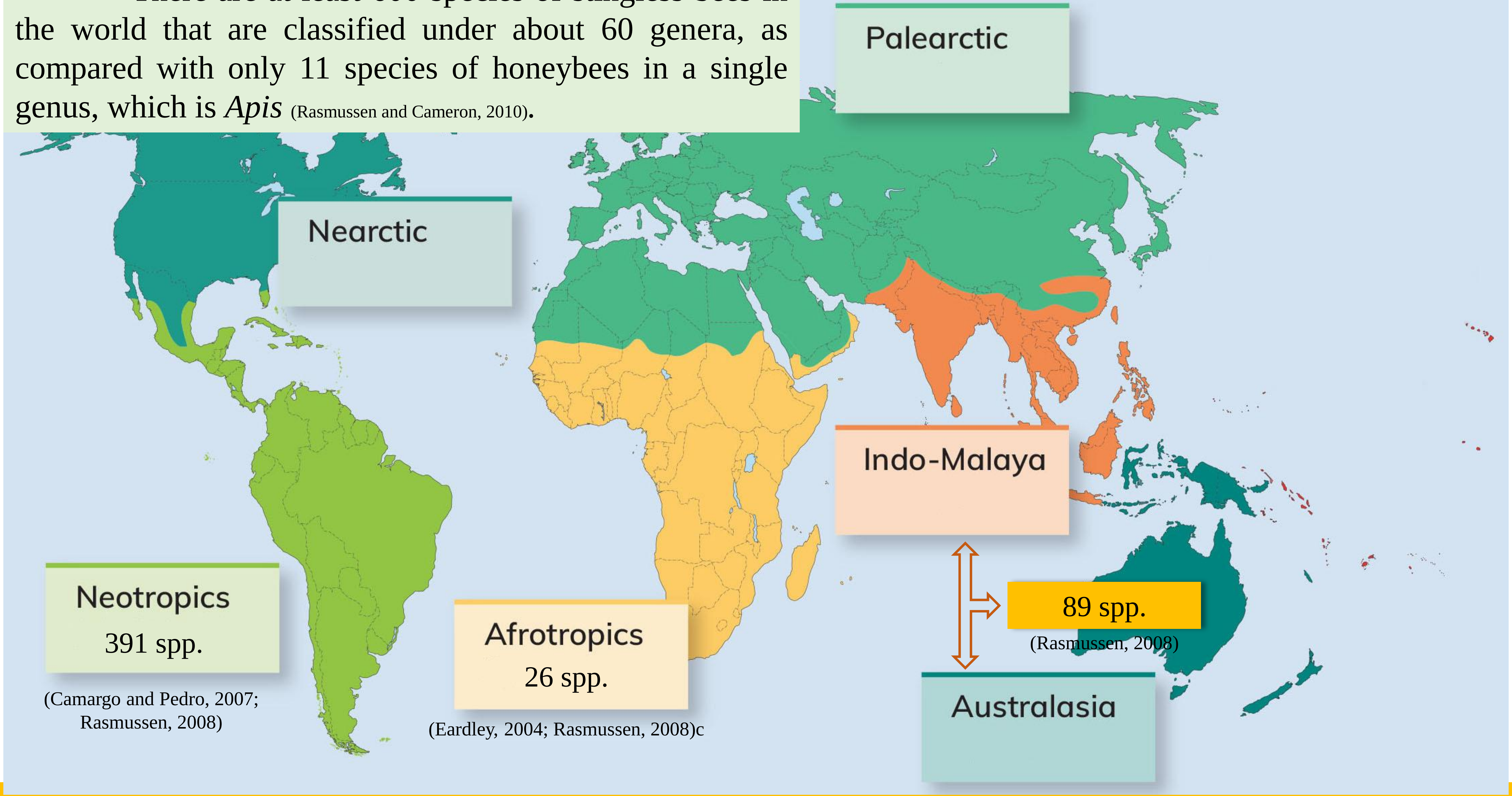

Charles D. Michener
The Bees
of the World
SECOND EDITION


Stingless Bees
IMPORTANCE, MANAGEMENT
AND UTILISATION
A Training Manual for Stingless Beekeeping
Peter Kwapong
Kwame Aidoo
Rofela Combey
Afia Karikari


Patricia Vit · Silvia R.M. Pedro
David W. Roubik Editors
Pot-Pollen in
Stingless Bee
Melittology
EXTRAS ONLINE
Springe


Food and Agriculture Organization
of the United Nations
VOLUME ONE
THE POLLINATION OF
CULTIVATED PLANTS
A COMPENDIUM
FOR PRACTITIONERS
POLLINATION SERVICES FOR SUSTAINABLE AGRICULTURE
EXTENSION OF KNOWLEDGE BASE

There are at least 600 species of stingless bees in the world that are classified under about 60 genera, as compared with only 11 species of honeybees in a single genus, which is *Apis* (Rasmussen and Cameron, 2010).



Taxonomic As a tool for conservation

Indoaustralian or Australasian Meliponini (Vit et al., 2003)-89 species

Austroplebeia Moure 1961 (9)

Heterotrigona Schwarz 1939

- *Geniotrigona* Moure 1961 (3)
- *Heterotrigona* Schwarz 1939 s.str. (3)
- *Sundatrigona* Inoue and Sakagami 1995 (… agami and Moure 1975) (2)

Homotrigona Moure 1961 (4)

Lepidotrigona Schwarz 1939 (12)

Lisotrigona Moure 1961 (4)

Lophotrigona Moure 1961 (1)

Odontotrigona Moure 1961

- *Odontotrigona* Moure 1961 s.str.(1)
- *Tetrigona* Moure 1961 (5)

Papuatrigona Michener and Sakagami 1990 (1)

Pariotrigona Moure 1961 (1)

Platytrigona Moure 1961 (6)

Tetragonula Moure 1961

- *Tetragonilla* Moure 1961 (4)
- *Tetragonula* Moure 1961 s.str.(32)

Entrance types of Sulawesi stingless bees:

(A1–A4) short funnel entrance of *T. sapiens* with irregular ridges,

(B1–B3) extended funnel entrance of *T. sapiens*,

(C1–C2) extended flare funnel entrance *of T. sapiens*,

(D) short funnel entrance of *T. sapiens* with droplets of propolis around the funnel,

(E1–E2) cylindrical tube entrance of *T. sapiens,*

(F) short funnel entrance of *T. sapiens* in the trunk of a coconut tree,

(G) unornamented funnel entrance of *T. sapiens,*

(H) triangle entrance opening of T. sapiens, (I1–I4) entrance variation of *T. clypearis,*

(J1–J2) short funnel entrance of T. fuscobalteata,

(K1 – K2) longitudinal narrow slit entrance of *W. incisa* with propolis mound enlargement, and

(L) cylindrical tube entrance of *L. terminata* with droplets of propolis. Bar ¼ 1 cm.

Sayusti et al, 2020

Figure 4.2 (L-S) Group of stingless bee with round-shaped nest entrance.

(L) *Heterotrigona erythrogastra*,

(M) *Tetrigona peninsularis*,

(N) *Tetragonula fuscobalteata*,

(O) *Heterotrigona itama*,

(P) *Lepidotrigona* sp.

(Q) *Lepidotrigona terminata*

(R) *Lepidotrigona doipaensis*

(S) *Tetragonilla collina*.

R.H. Izfa1 & M.K.M. Imran

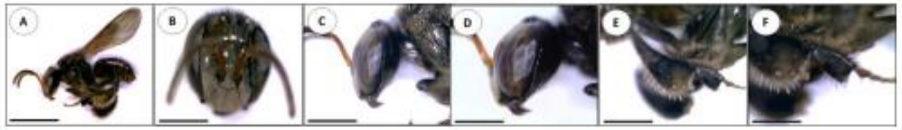


Figure 4. *Tetragonula drescheri*; A. Body length; B. Width of the second flagellomere; C. Width of the gena; D. Width of the eye and malar space; E. Width of the hind tibia; and F. Width of the hind basitarsus. Black bar = 1 mm

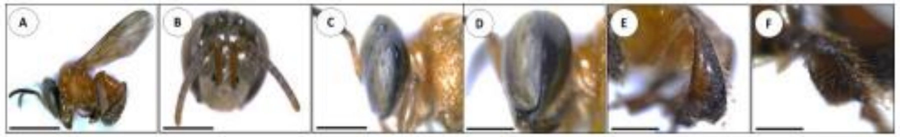


Figure 5. *Tetragonula melanocephala*; A. Body length; B. Width of the second flagellomere; C. Width of the gena; D. Width of the eye and malar space; E. Width of the hind tibia; and F. Width of the hind basitarsus. Black bar = 1 mm

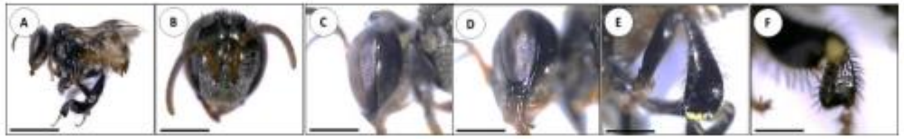


Figure 6. *Tetragonula biroi*; A. Body length; B. Width of the second flagellomere; C. Width of the gena; D. Width of the eye and malar space; E. Width of the hind tibia; and F. Width of the hind basitarsus. Black bar = 1 mm

Figure 7. *Homotrigona apicalis*; A. Body length; B. Width of the second flagellomere; C. Width of the gena; D. Width of the eye and malar space; E. Width of the hind tibia; and F. Width of the hind basitarsus. Black bar = 1 mm

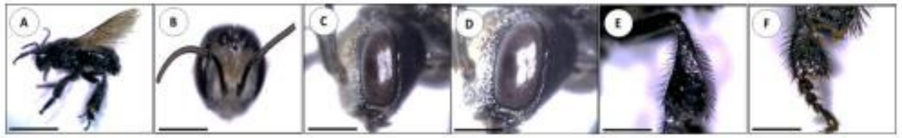


Figure 8. *Homotrigona canifrons*; A. Body length; B. Width of the second flagellomere; C. Width of the gena; D. Width of the eye and malar space; E. Width of the hind tibia; and F. Width of the hind basitarsus. Black bar = 1 mm

Figure 9. *Heterotrigona itama*; A. Body length; B. Width of the second flagellomere; C. Width of the gena; D. Width of the eye and malar space; E. Width of the hind tibia; and F. Width of the hind basitarsus. Black bar = 1 mm

PURWANTO et al. 2022

Ebaiotrigona (1 sp.)

Geniotrigona (1 sp.)

Heterotrigona (2 spp.)

Homotrigona (2 spp.)

Lepidotrigona (5 spp.)

Lisotrigona (2 spp.)

Lophotrigona (1 sp.)

Pariotrigona (2 spp.)

Tetragonilla (4 spp.)

Tetragonula (15 spp.)

In Thailand, 35 species 10 genera of the tribe Meliponini were found.

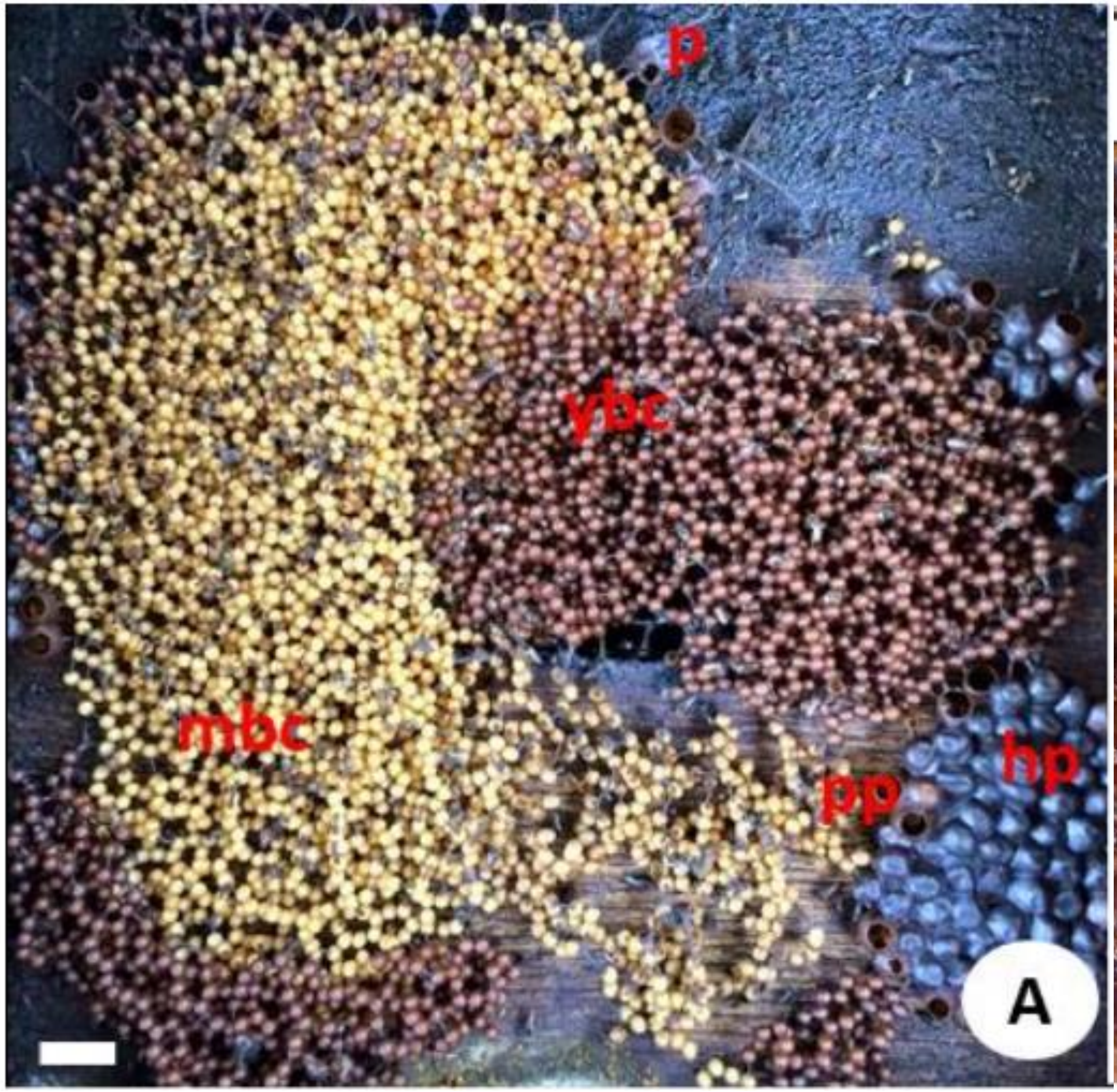
(Schwarz, 1939; Sakagami et al., 1985; Rajitparinya et al., 2000; Michener and Boongird, 2004; Klakasikorn et al., 2005; Engel et al., 2017; Resmussen et al., 2017; Chelong and L, 2020; Engel et al., 2022)

In Thailand, 35 species 10 genera of the tribe Meliponini were found.

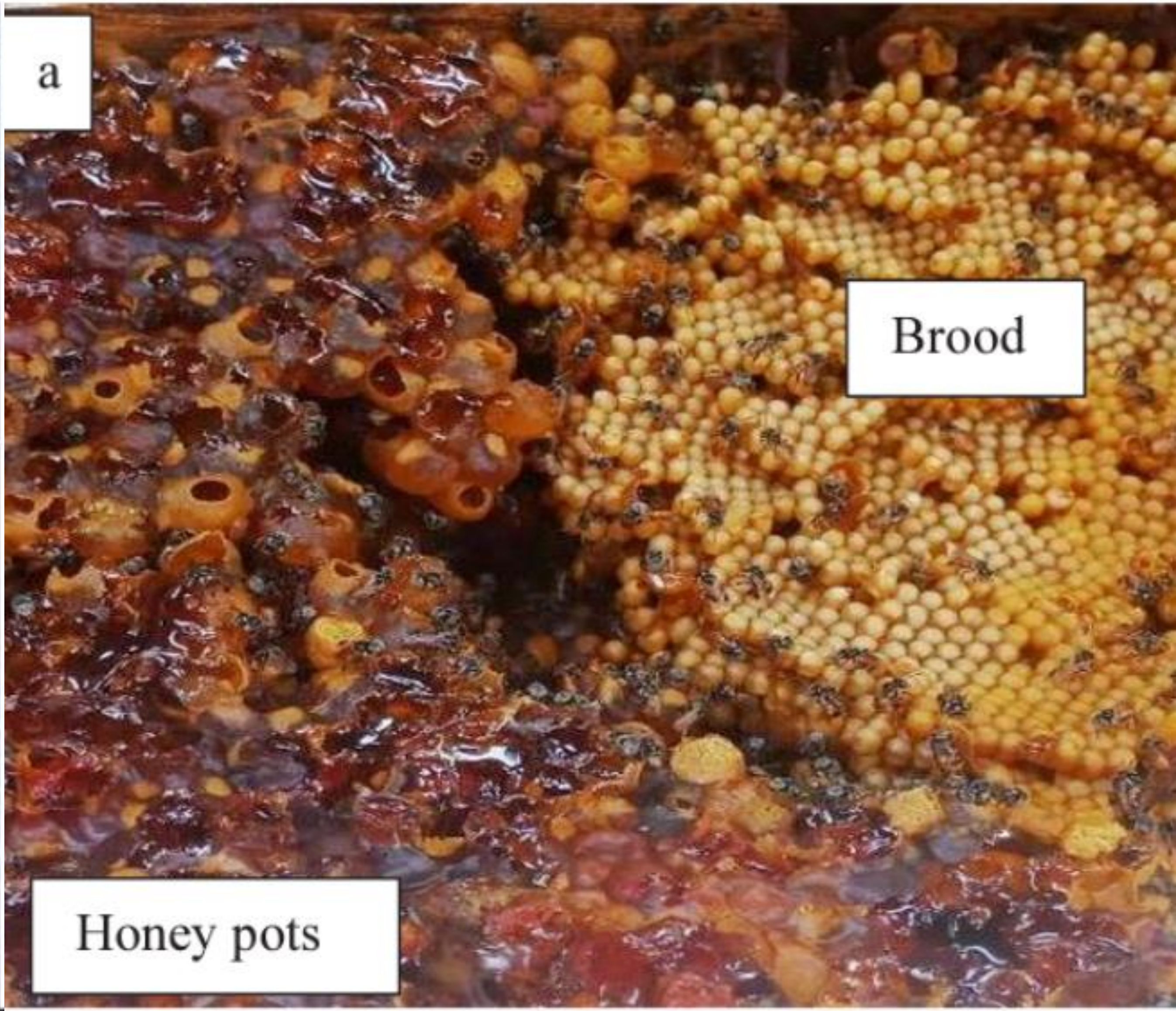
1. *Ebaiotrigona carpenteri* (Engel, 2000)
2. *Geniotrigona thoracica* (Smith, 1857)
3. *Heterotrigona itama* (Cockerell,1918)
4. *Heterotrigona aliceae* (Cockerell, 1929)
5. *Homotrigona fimbriata* (Smith, 1857)
6. *Homotrigona lutea* (Bingham, 1897)
7. *Lepidotrigona doipaensis* (Schwarz, 1939)
8. *Lepidotrigona flavibasis* (Cockerell, 1929)
9. *Lepidotrigona nitidiventris* (Smith, 1857)
10. *Lepidotrigona terminata* (Smith, 1857)
11. *Lepidotrigona satun* Attasopa and Bänziger, 2018
12. *Lisotrigona cacciae* (Nurse, 1907)
13. *Lisotrigona furva* Engel, 2000
14. *Lophotrigona canifrons* (Smith, 1857)
15. *Pariotrigona klossi* (Schwarz, 1939)
16. *Pariotrigona pendleburyi* (Schwarz, 1939)
17. *Tetragonilla atripes* (Smith, 1857)
18. *Tetragonilla collina* (Smith, 1857)
19. *Tetragonilla fuscibasis* (Cockerell, 1920)
20. *Tetragonilla hirashimai* (Schwarz, 1939)
21. *Tetragonula fuscobalteata* (Cameron, 1908)
22. *Tetragonula geissleri* (Cockerell, 1918)
23. *Tetragonula laeviceps* (Smith, 1857)
24. *Tetragonula malaipanae* Engel, Michener and Boontop, 2017
25. *Tetragonula melina* (Gribodo, 1893)
26. *Tetragonula minor* (Sakagami, 1978)
27. *Tetragonula pagdeni* (Schwarz, 1939)
28. *Tetragonula pagdeniformis* (Schwarz, 1939)
29. *Tetragonula reepeni* (Friese, 1918)
30. *Tetragonula sirindhornae* (Michener and Boongird, 2004)
31. *Tetragonula testaceitarsis* (Cameron, 1901)
32. *Tetrigona apicalis* (Smith, 1857)
33. *Tetrigona binghami* (Schwarz, 1937)
34. *Tetrigona melanoleuca* (Cockerell, 1929)
35. *Tetrigona peninsularis* (Cockerell, 1927)

(Schwarz, 1939; Sakagami et al., 1985; Rajitparinya et al., 2000; Michener and Boongird, 2004; Klakasikorn et al., 2005; Engel et al., 2017; Resmussen et al., 2017; Chelong and L, 2020; Engel et al., 2022)

Tetragonula laeviceps



PURWANTO et al. 2022



Khongkwanmueang et al, 2020

Taxonomic As a Tool for Conservation

Species name

Species description

Morphometric characters

DNA barcoding

Facilitate the recognition of those morphological characters that are useful in separating species

Indoaustralian or Australasian Meliponini (Vit et al., 2003)-88 species

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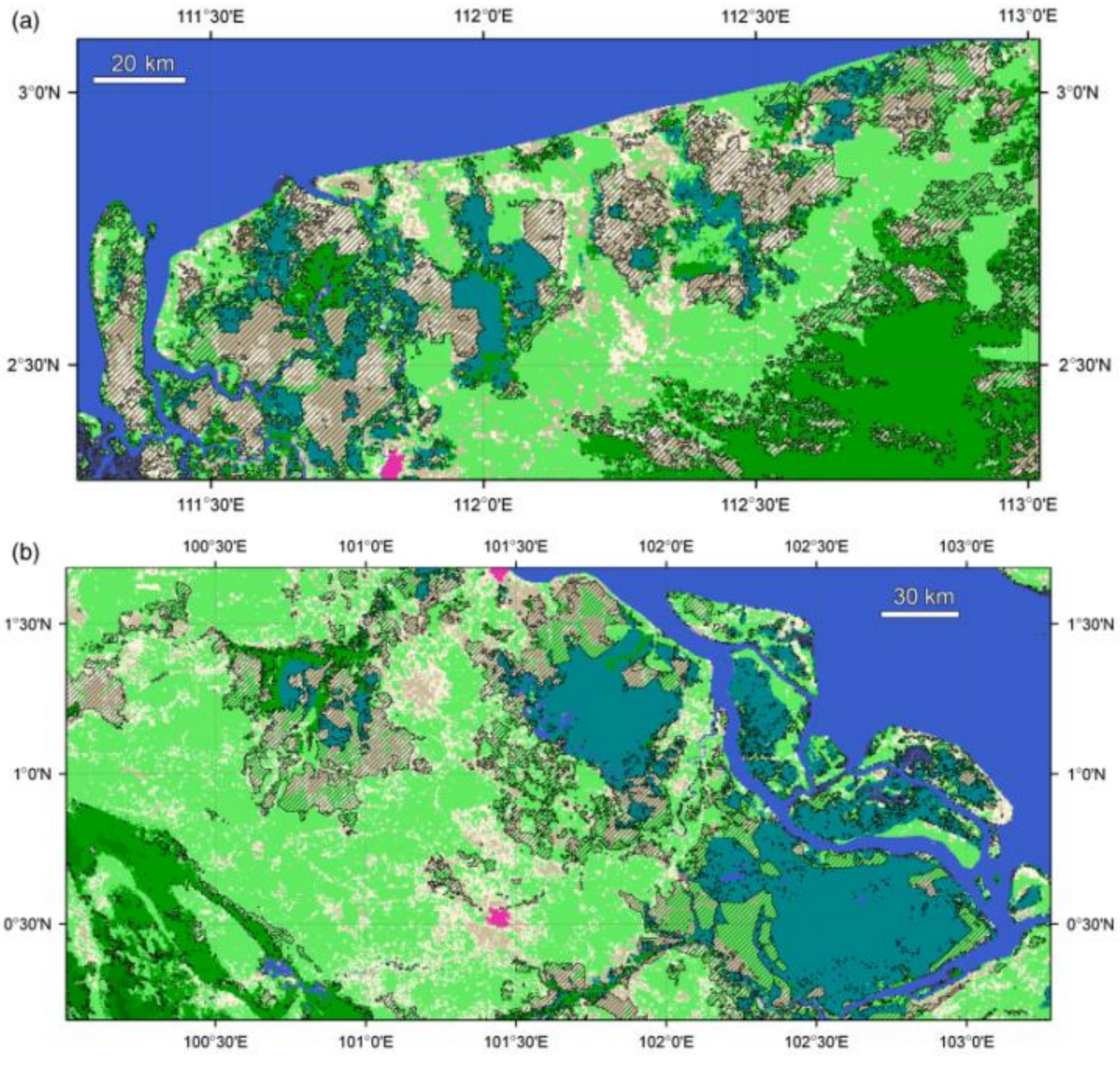
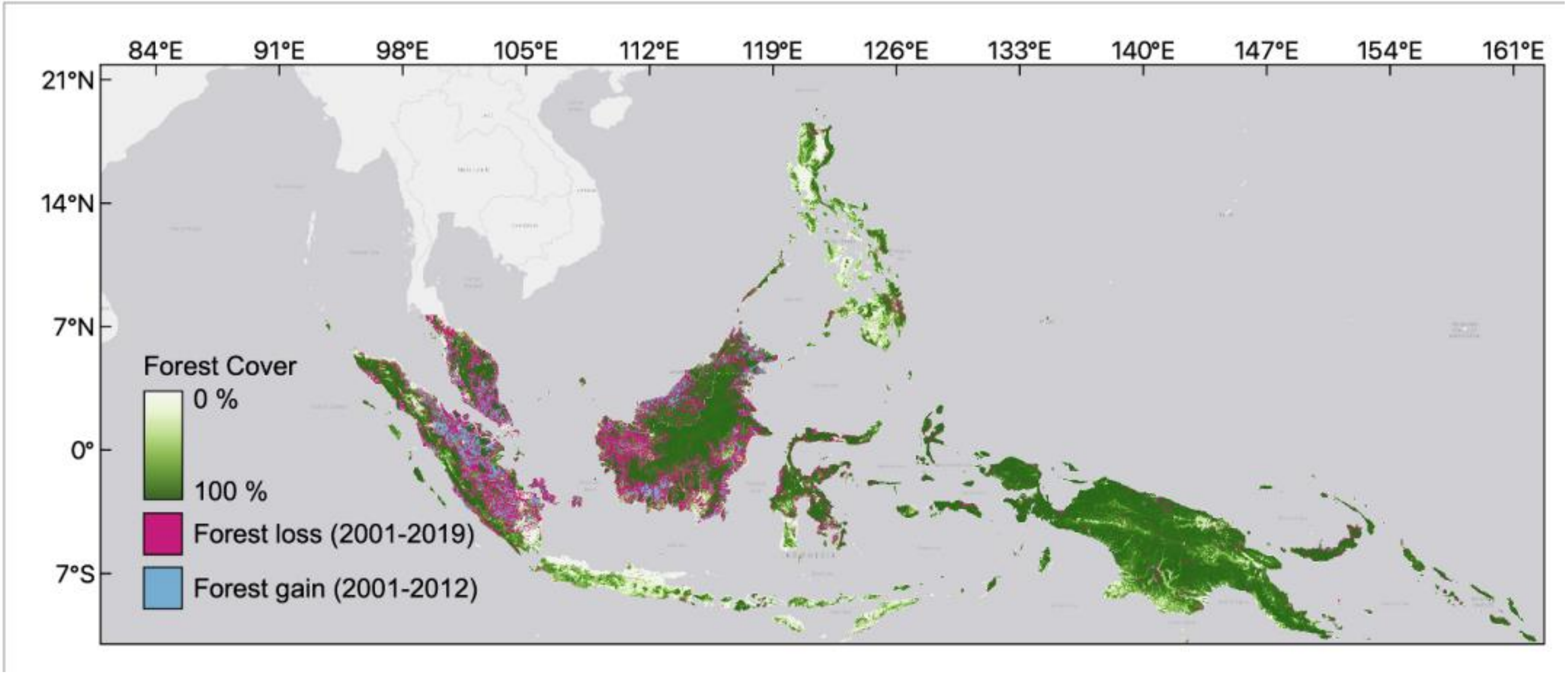
Disturbance, Habitat Fragmentation, and Bee Communities & Challenges to Stingless Bee Survival



Samples of deforestation concentration areas in insular Southeast Asia 2000–2010. Note the large geometrically shaped deforested areas (hatched) in (a) the peatlands of Sarawak and (b) the eastern lowlands of Sumatra overlaid on the 2010 land cover map. Colour legend and location of the subsets within the region are provided in Fig. 1. With the exception of a few patches of former lowland forest located furthest inland, all the deforested areas within the subsets were peat swamp forest in 2000.

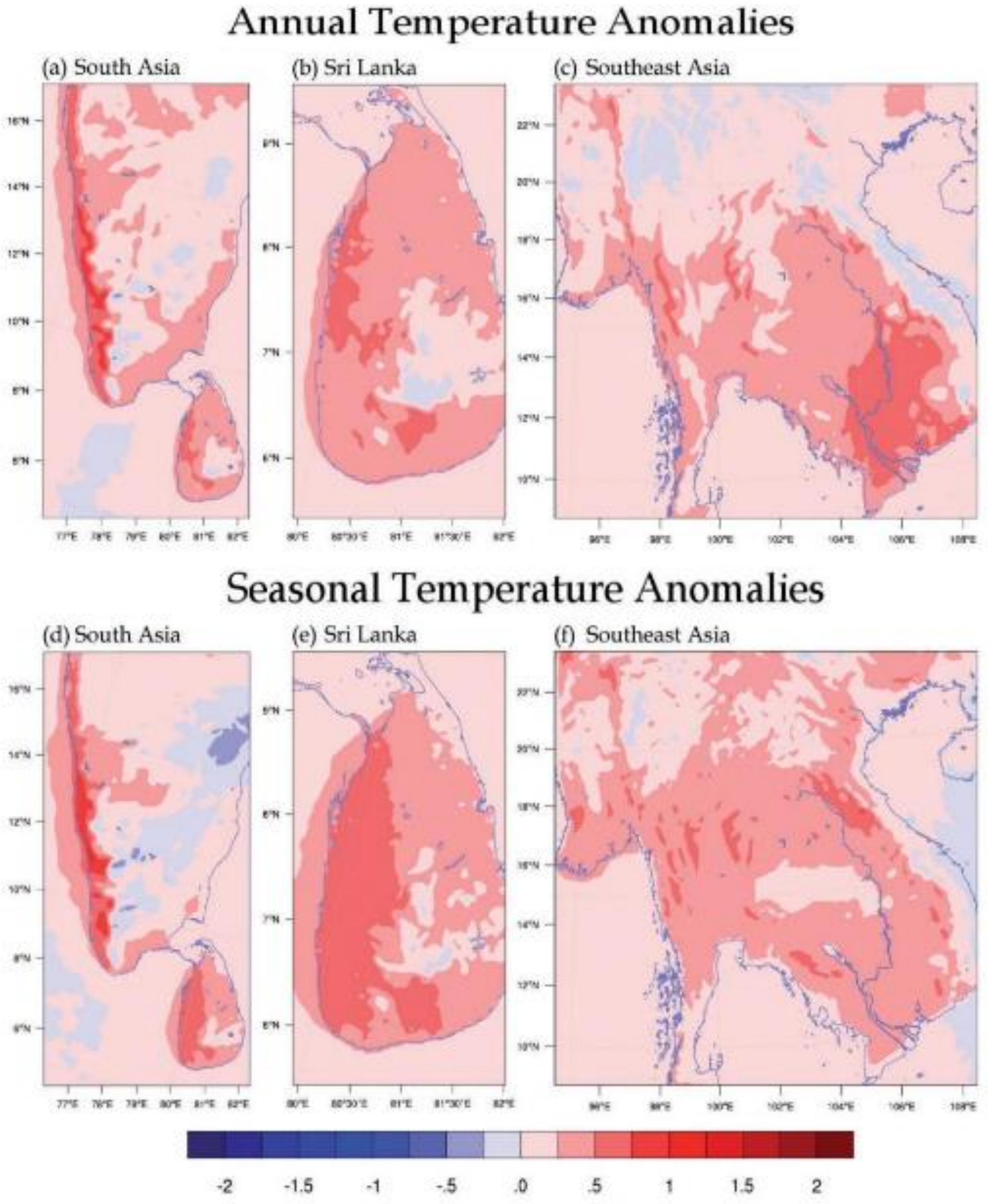
Miettinen-et-al.-2011



- Figure 1. The study region is the Maritime Continent (MC), comprised of Brunei, Indonesia, Malaysia, the Philippines, Singapore, and East Timor. Red coloring shows forest loss over the 2001–2019 period, purple shows forest gain over the 2001–2012 period, and green shows remaining forest cover in 2019. Forest cover data is from the global forest cover dataset (Hansen et al 2013),

Crompton et al 2021

Tree as nesting cavity



The annual and the seasonal (June, July and August) Temperature anomalises (i.e. deforest-forest) for South Asia (a,d), Sri Lanka (be,e) and Southeast Asia (c,f) for 1988 Temperature is the surface air temperature 2m above the surface abd is expressed in Kelvins (K) with a contour interval of 0.25 K. (Mawalagedara and Oglesby, 2012)

The removal of rainforest in several Southeast Asian countries has been extensive, with Indonesia, the Philippines, and Thailand losing 57%, 97% and 95% of their primary rainforest, respectively.
As a result of deforestation, local precipitation in Southeast Asia is significantly reduced for each month of the year. (Werth and Avissar, 2005)

Stingless bee keeping: Infant industry

Indoaustralian or Australasian Meliponini (Vit et al., 2003)-88 species

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Tetragonula Moure 1961

- *Tetragonilla* Moure 1961 (4)
- *Tetragonula* Moure 1961 s.str.(32) √

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Geniotrigona thoracica

Heterotrigona itama

pic by Mohd Amri Md Yunus

Homotrigona fimbriata

Homotrigona apicalis

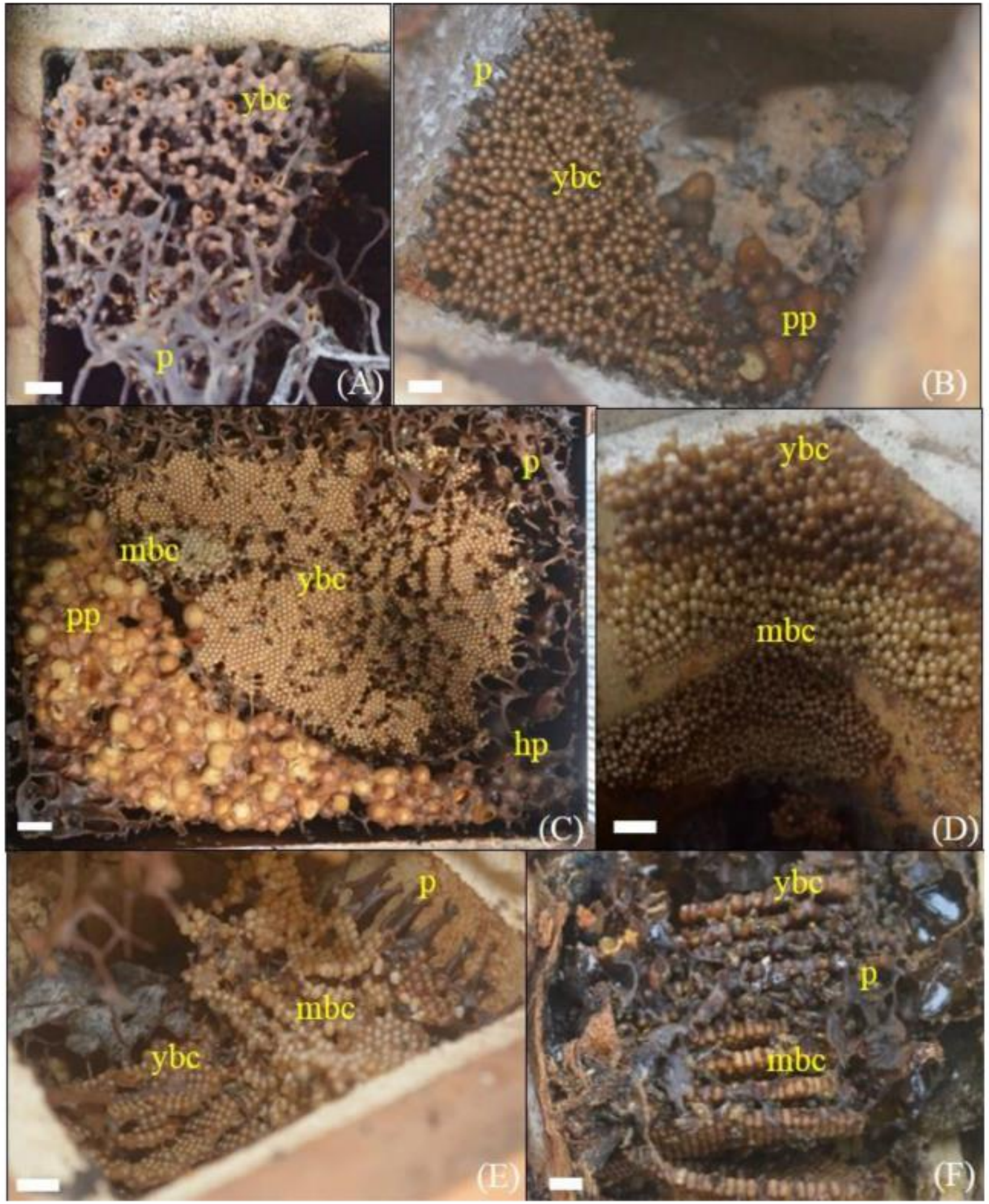
Lepidotriogona terminata

Tetragonilla collina

Kelly et al., 2014

Propagation technique/Queen raring/Microclimate support nest material

Geniotrigona thoracica



Brood cell arrangement of four Sulawesi stingless bees.

(A) Semi-cluster brood cells of *T. sapiens*

(B) Cluster brood cells of *T. sapiens*

(C) Semi-comb brood cells of *T. sapiens*

(D) Cluster brood cells of *T. fuscobalteata*

(E) Semi-comb brood cells of *T. clypearis*

(F) Regular layered comb brood cells of *L. terminata*

R.H. Izfa1 & M.K.M. Imran

Harmful effects of inbreeding/Reproductive interference




https://vulcanpost.com/

phuphafarm88

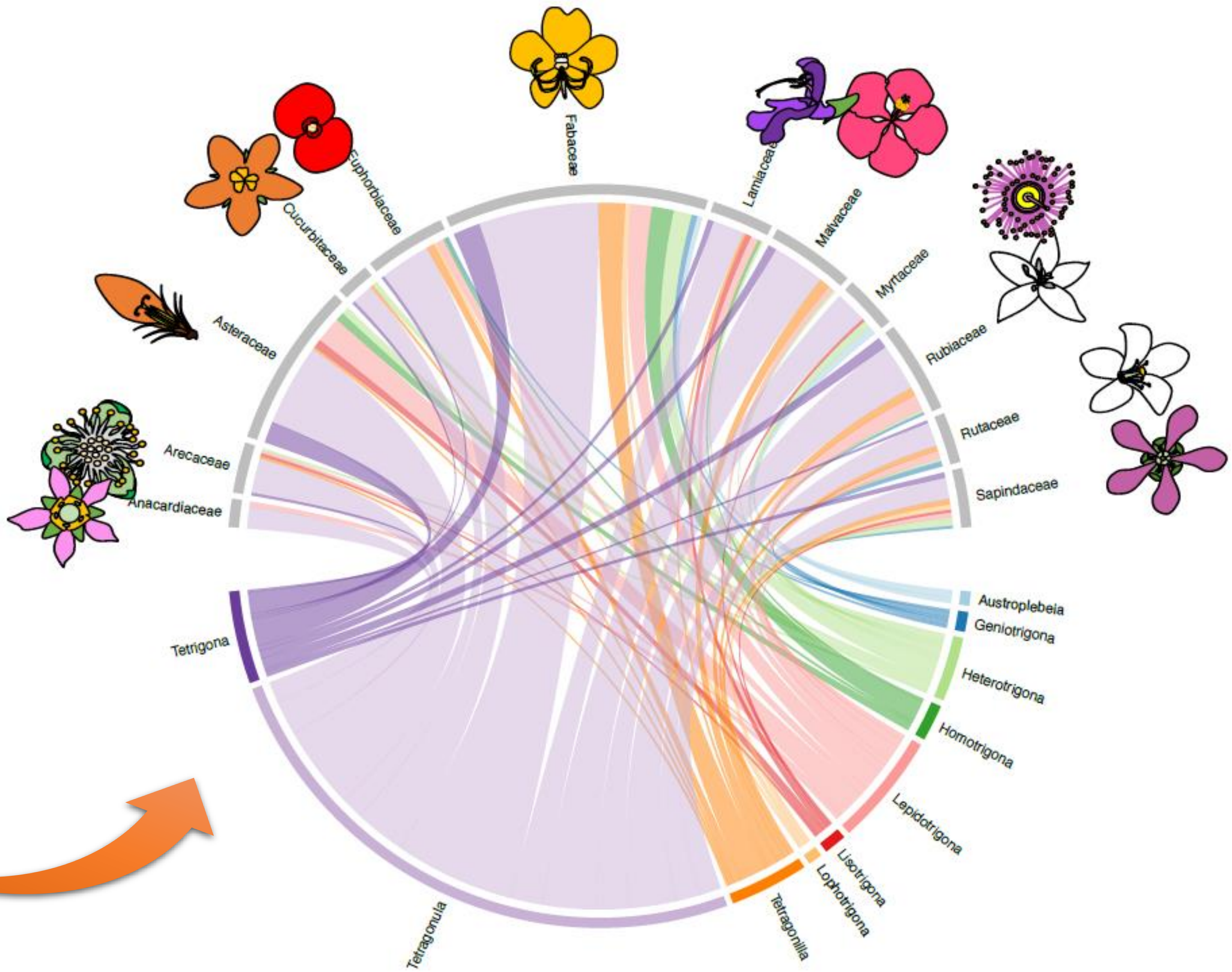
Challenges to Stingless Bee Survival: Flora resources and Nesting sites of Stingless Bees:

Stingless bee floral visitation

Stingless bees have been reported to **visit the flowers of plants from at least 215 different families and 1,434 genera worldwide.**

A visitation network of stingless bees to flowering plants in the Indo-Malayan-Australasian region

(Bueno et al. 2021)



Pollination Biology and Forager Behaviors

Stingless bee crop pollination

Stingless bees have been recorded as **floral visitors in approximately 90 of crop species.** (Heard 1999)

Slaa et al. (2006) reported that **18 crops were effectively pollinated by stingless bees.**

More than 25 stingless bee species are known to **contribute significantly to pollination in 14 economically important crops** belonging to 12 different plant families.

10 crops under enclosed or greenhouse conditions have been pollinated by stingless bees.

(Ramírez et al. 2018)

Studies of stingless bee pollination in 14 field crops (Ramírez et al. 2018)

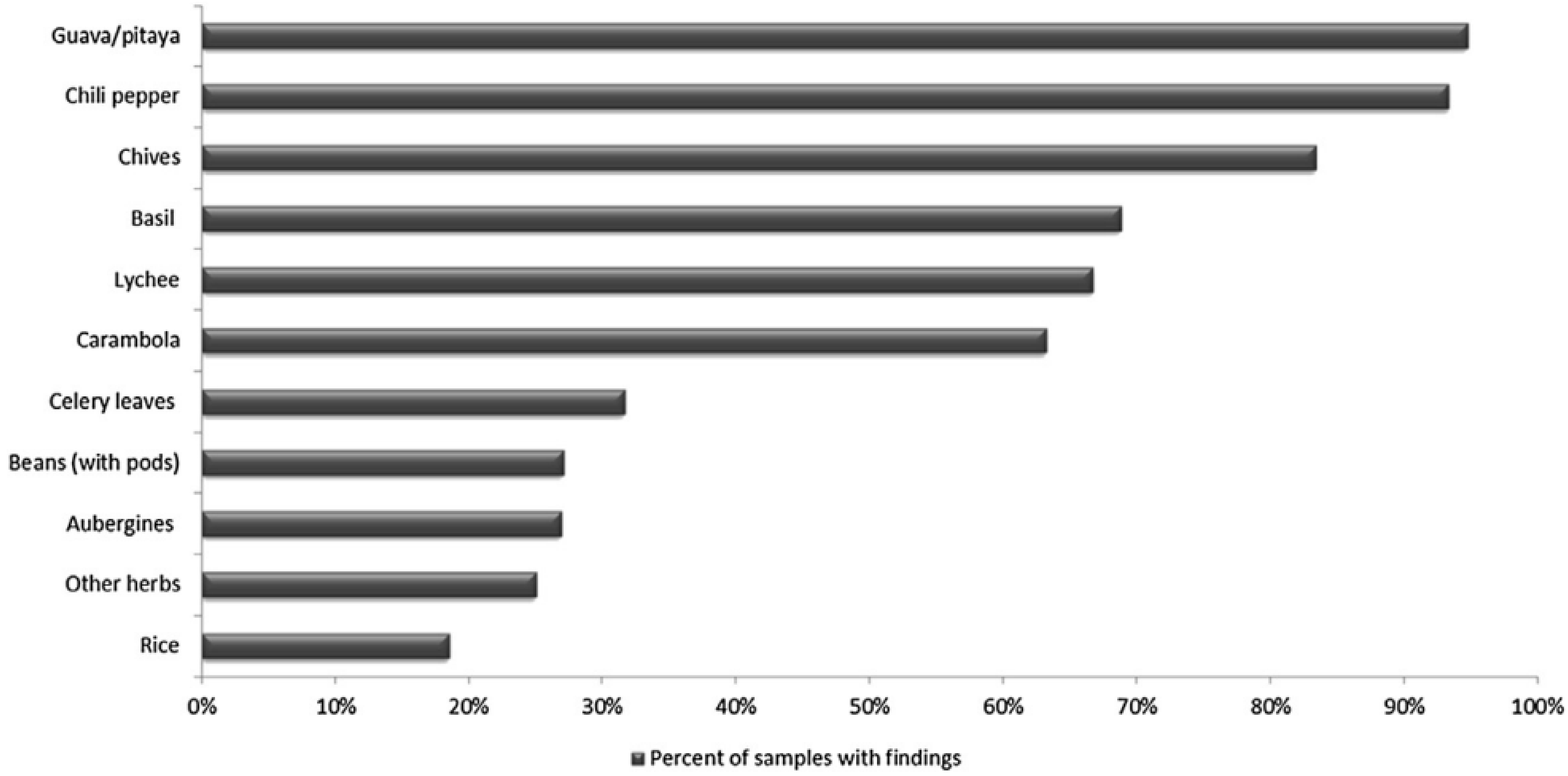
Crops	Locality	References
Annatto, achiote	Amazonas, Many regions, Ivory Coast	Maues and Venturieri (1995); Wille (1976); Lobreau-Callen et al. (1990); Absy and Kerr (1977); Absy et al. (1984)
Apple	Brazil	Viana et al. (2014)
Avocado	Mexico	Ish-Am et al. (1999); Can-Alonso et al. (2005)
Camu camu	Peru Amazonian	Peters and Vasquez (1986)
Carambola, starfruit	Surinam	Engel and Dingemans-Bakels (1980)
Chayote, choko	Costa Rica	Wille et al. (1983)
Chili	Indonesia	Eka et al. (2014)
Coconut	Costa Rica, Surinam, Mexico	Engel and Dingemans-Bakels (1980); Hedstrom (1986); Melendez et al. (2004)
Coffee	Indonesia	Klein et al. (2003a, b)
Cupuassu	Brazil, Belem, Manaus	Venturieri (1994), Heard (1999)
Macadamia	Costa Rica, Australia eastern	Masis and Lezama (1991); Heard and Exley (1994)
Mango	Brazil, India, Mexico, Australia	Cortopassi-Laurino et al. (1991); Iwama and Melhem (1979); Simao and Maranhao (1959); Singh (1989); Anderson et al. (1982);Sosa-Najera et al. (1994)
Mapati, uvilla, Amazon tree grape	Brazil	Falcao and Lleras (1980)
Pumpkin	Mexico	Melendez et al. (2002)

Studies of stingless bee pollination in enclosed or greenhouse conditions (Ramírez et al. 2018)

Crops	Locality	References
Blue salvia	Costa Rica	Slaa et al. (2000a, b)
Cucumber	Brazil	Santos (2004b); Nicodemo et al. (2013)
Eggplant	Brazil	Nunes-Silva et al. (2013)
Green pepper	Kenya, Australia, Mexico	Kiatoko et al. (2014); Occhiuzzi (2000) Greco et al. (2011); Cahuich et al. (2006); Palma et al. (2008b)
Pumpkin	Mexico	Melendez et al. (2000)
Rambutan	Mexico	Rabanales (in Slaa et al. 2006)
Strawberry	Netherlands, Japan, Brazil	Asiko (2004); Lalama (2001); Kakutani et al. (1993); Maeta et al. (1992); Malagodi-Braga and Kleinert (2004)
Sweet pepper	Netherlands, Brazil	Meeuwsen (2000); Cruz et al. (2005)
Tomato	Brazil, Mexico	Santos et al. (2004a, 2005); Cauich et al. (2004); Palma et al. (2008a)
Watermelon	Brazil	Bomfim et al. (2014)

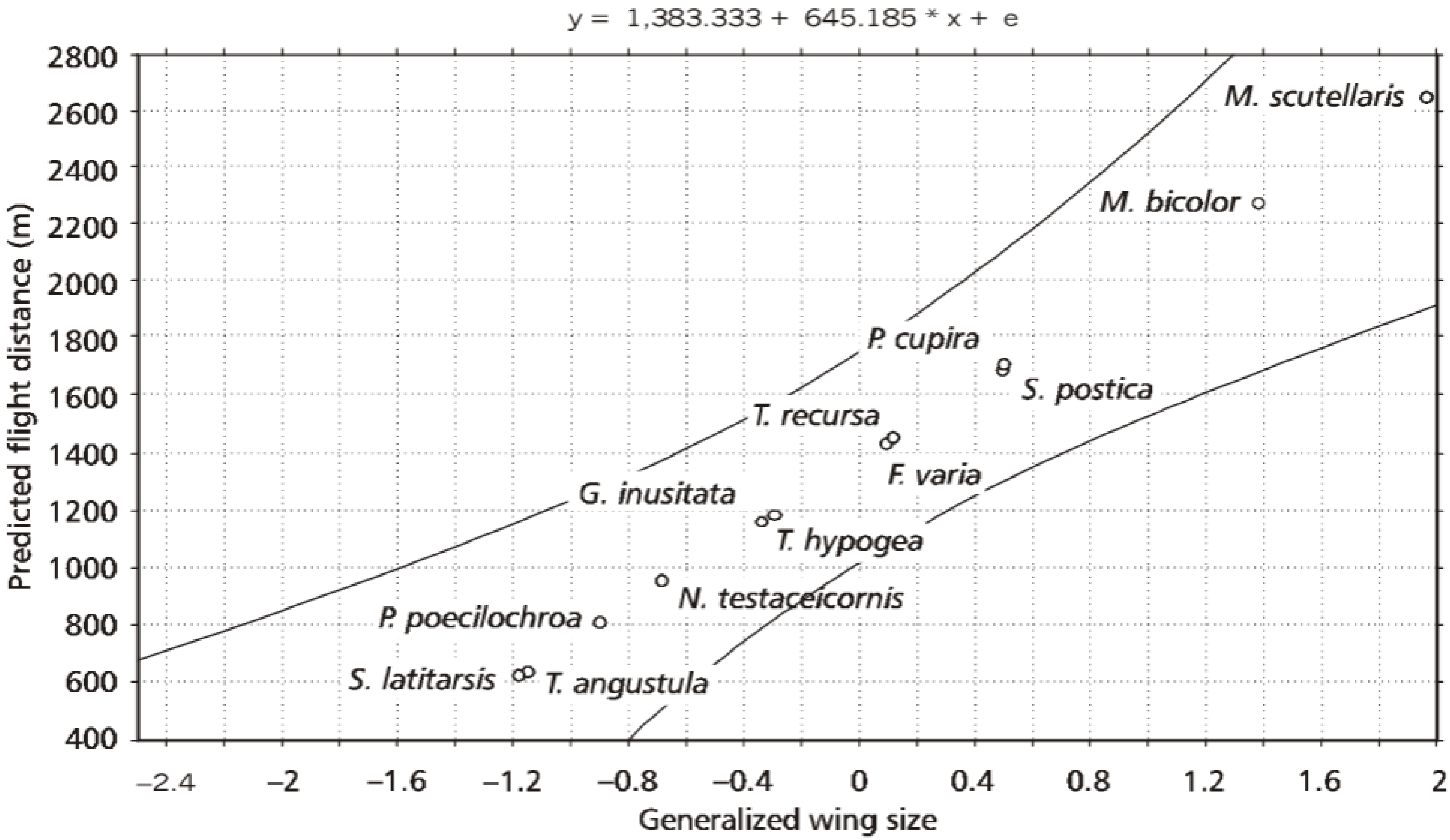
14 stingless bee species have been used most often in these studies, mostly from the genera ***Melipona*, *Nannotrigona*, *Scaptotrigona*, *Tetragonula*, and *Tetrigona*.**

Pesticide Usage



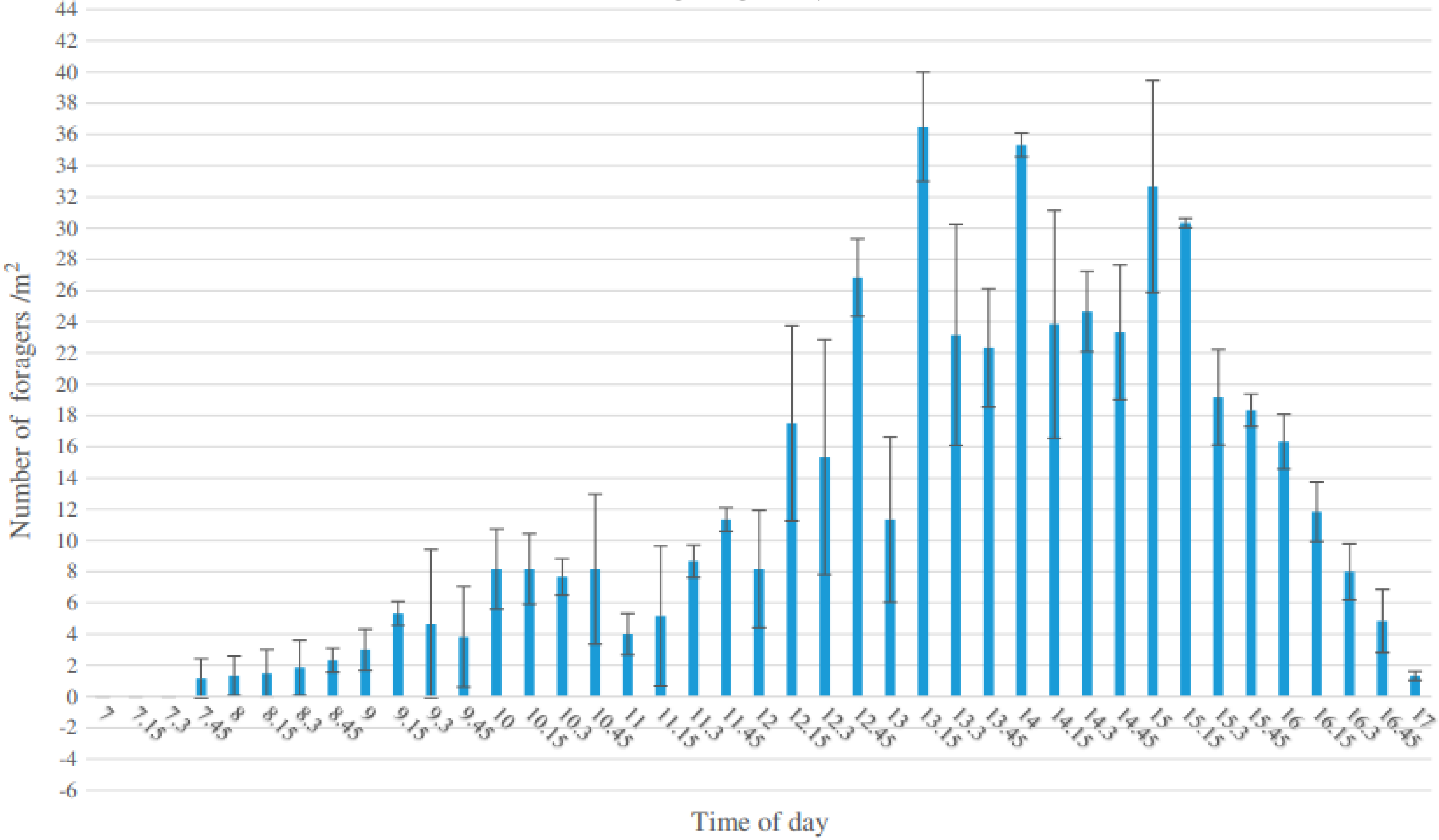
Percent of samples with findings for commodities with more than 10 samples analysed (Skretteberg et al, 2015)

Stingless bees and Potential Flight range/foraging range



Maximum flight distances for 12 species of Meliponini estimated using a linear regression model. Dotted lines show the confidence interval ($\alpha = 0.05$), based upon the linear regression of six documented species. ARAÚJO et al, 2004

Foraging rhythm



The mean frequency distributions of the numbers of *Apis florea* foragers visiting *Antigonon leptopus* flowers

Rod-im et al., 2015

Value creation


Bee Park