Stingless bees
for research, education, pets and nature ambassadors

Plenary
9B: Breaking the sting barrier: conservation and sustainable use of stingless bees

Tim Heard,
Sugarbag Bees, Brisbane,
and University of Sydney,

Overview

- Introduction to Stingless bees
- Journey from obscurity to insect ambassadors
- Conservation and sustainable use of stingless bees
- Research to support their sustainable use

Introduction to Stingless bees

Photo: Tobias Smith

- Apidae: Meliponini
- The "other" group of highly eusocial bees
- C. 500 species globally, 11 in Australia
- Pan-tropical distribution
- Nest typically in hollow trees
- Meliponiculture: stingless bee keeping

Stingless bee nest

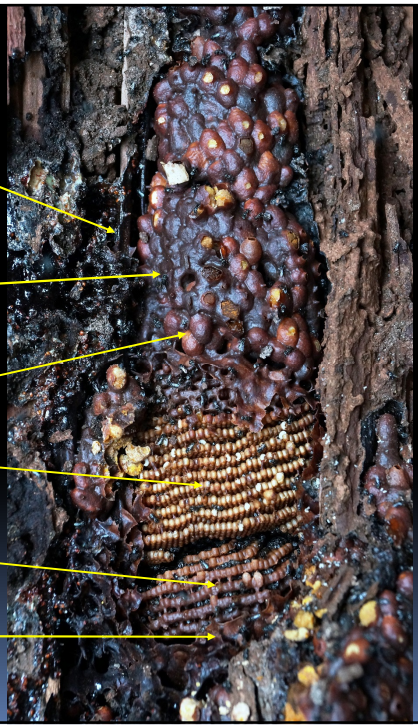
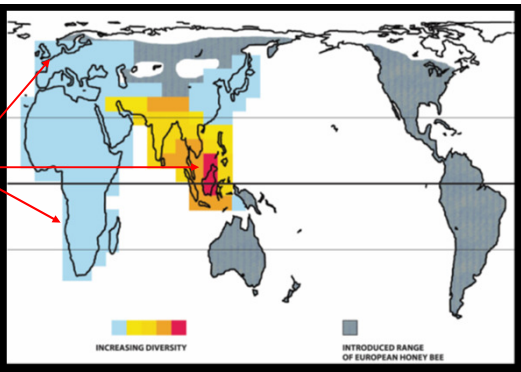


Photo: Dan Coughlan

Honey bees

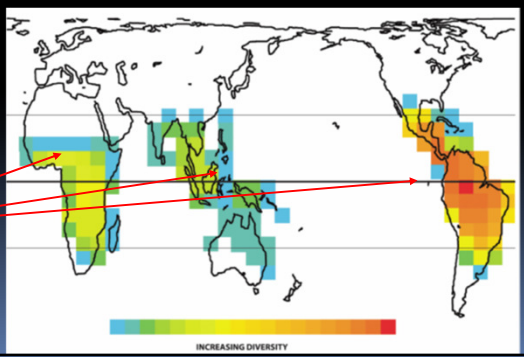
- Old world distribution
- Approx 10 species

Natural distribution
Introduced distribution



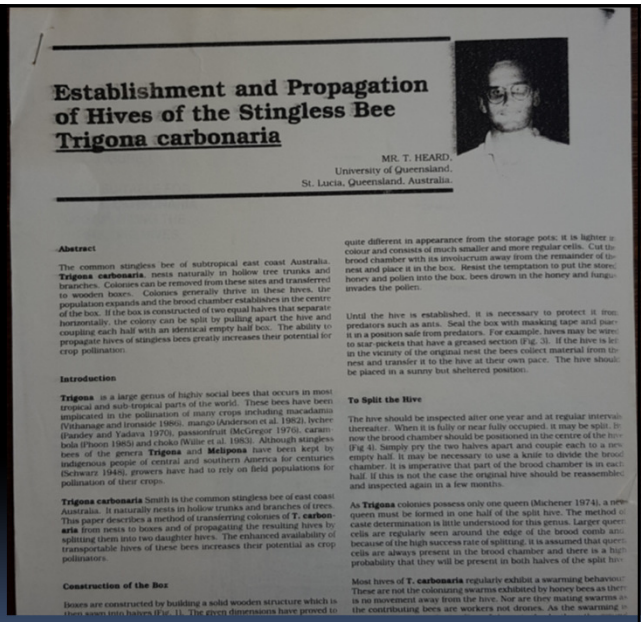
Stingless bees

- Pan tropical distribution
- Approx 500 species



Journey from obscurity to insect ambassadors. Then to now.

- Few beekeepers,
- No hive propagation,
- No resources,
- Honeybee manuals,
- Scientific literature



Establishment and Propagation of Hives of the Stingless Bee Trigona carbonaria

MR. T. HEARD,
University of Queensland,
St. Lucia, Queensland, Australia.

Proceedings of the Second Australian and International beekeeping Congress, 1988

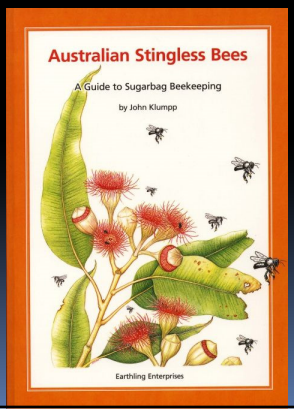
The two stingless bee symposia

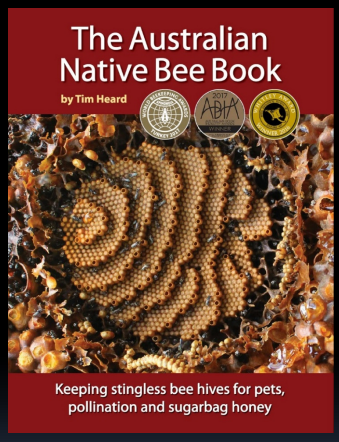
Tomorrow

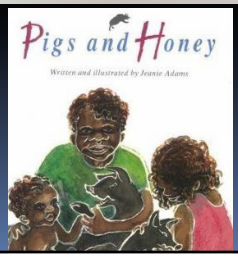
18 of the 32 talks on stingless bees

Nadine Chapman	**Hive movements are changing the genetic structure of the stingless bee (Tetragonula carbonaria)**
Francisco Garcia Bulle Bueno	A new technique for estimating landscape-level density of an Australian stingless bee (Tetragonula carbonaria
Liam Kendall	Stingless bee colony densities within a mass-flowering crop
Abu Hassan Jalil	Meliponiculture and Improper Strategies of Stingless Beekeeping in Malaysia
Bronwen Roy	Lysinibacillus: A disease of stingless bees?
Helen Wallace	Stingless bees, resin ecology and Cadaghi (Corymbia torelliana): friend or foe?
Nick Powell	Hive Design for Australian native bees
Francois Visser	The role of food supplementation in native bee pollination: From a grower / beekeeper's perspective
Glenn Otto	The Bee safe, a secure stand for stingless bee hives
Dean Haley	The use of natural insect repellents to prevent infestation by hive syrphid fly and hive phorid fly
Samantha Redshaw	A new method of marking and tracking stingless bees
Ryan Newis	Bees and plant resin: sources, chemistry and bioactivity
Bryony Willcox	Pollinator distribution and efficiency in mango, avocado and macadamia tree crops across three growing regions in Eastern Australia".
Brian Cutting	Efficiency of Australian native bees for pollination of watermelons
Chris Fuller	Managing stingless bees in the commercial orchard environment
Lisa Evans	Abundance, distribution, and effect on nut set of managed stingless bees in a macadamia orchard
Romina Rader	Stingless bee and honeybee performance in glasshouses, Abstract coming
Mark Hall	Microclimatic conditions in polytunnels used for berry production influence flower visitation by stingless bees (Tetragonula carbonaria)

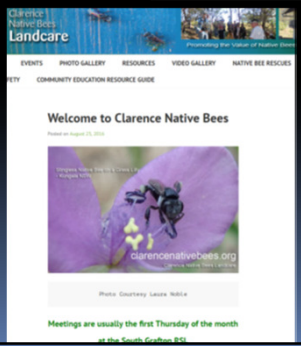
NOW: Books







Clubs



Workshops and seminars

Media

NATIONAL GEOGRAPHIC VIDEO HOME NAT GEO TV NAT GEO WILD KIDS MORE VIDEOS Search Videos

NEWS

See the Unique Spiral Hives of the Australian Stingless Bee

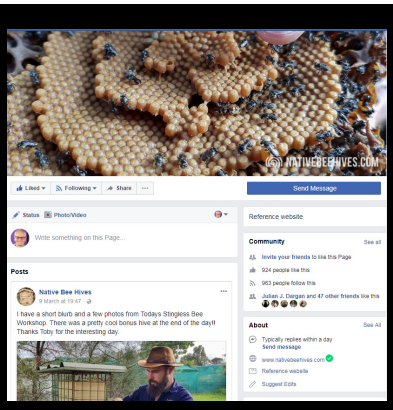
February 2, 2018 - These spiral hives are the work of a type of Australian stingless bees. *Tetragonula carbonaria* is the only species to build... MORE

Schools

Hives now highly visible

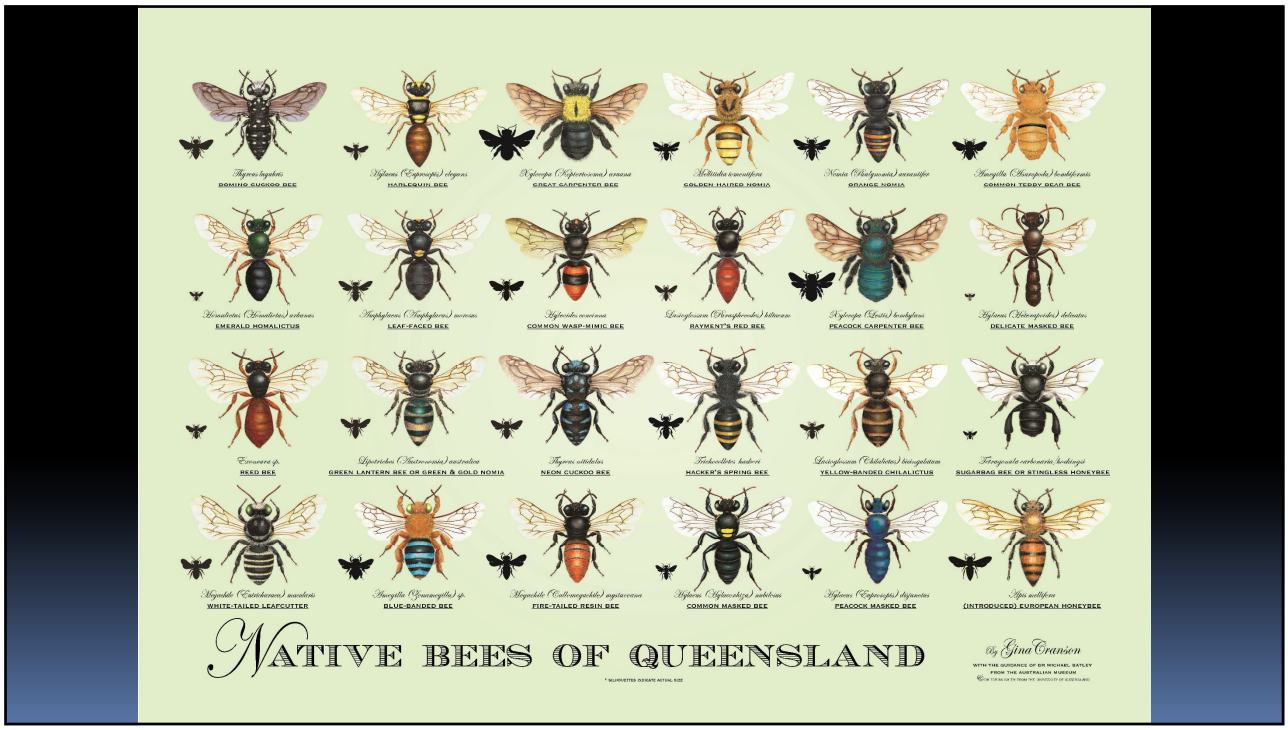
NOW

- Websites, Facebook pages, YouTube videos
- Local council programs
- Men's sheds
- Indigenous groups
- Businesses



Not just stingless bees

Glenbo Craig's image of Chris Fuller's bee hotel



Not just Australia

Proposed for economic development

Why stingless bees?

- Stingless
- Pets
- Social insect
- Domestication, propagation
- *Tetragonula carbonaria*
- Honey production
- Pollination
- *Tetragonula carbonaria*
- Conservation

Pets

'Biophilia'
Humans need a relationship with nature to thrive

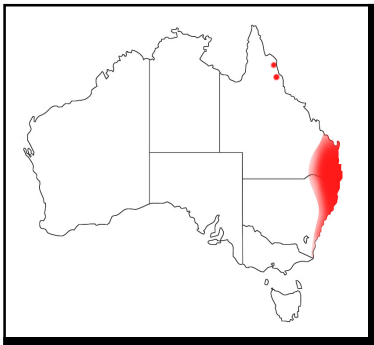
Stingless beekeeping surveys

	1998	2010	2018
No of beekeepers (n)	257	637	?
No of nests (n)	1425	4935	?
Most popular species	*T. carbonaria* (69%) *T. hockingsi* (20%)	*T. carbonaria* (62%) *A. australis* (23%)	?
Reasons for keeping bees	**(%)**	**(%)**	?
Enjoyment	**81**	**78**	**?**
Conservation	68	67	
Pollinate bushland	27	29	
Pollinate crops	24	24	
Crops pollination	--	1	
Honey production	8	11	
Hives sales	5	4	
Education	2	12	
Research	2	4	

Stingless beekeeping surveys
http://www.beesbusiness.com.au/survey.html

Domestication, propagation

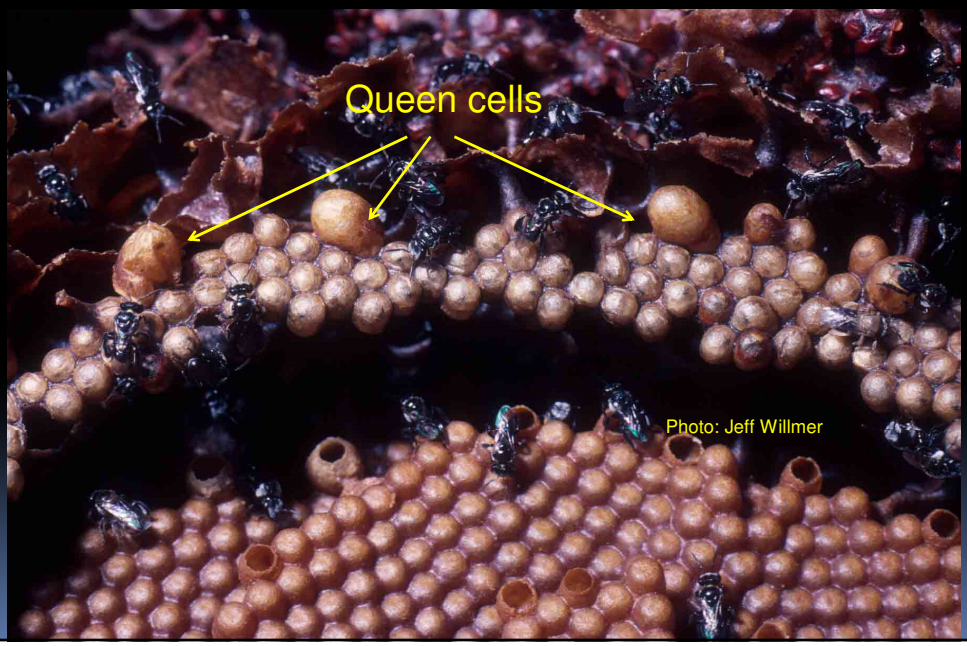
Domestication, propagation



Tetragonula carbonaria

- Subtropical distribution
- Excellent species for keeping
- Model study organism

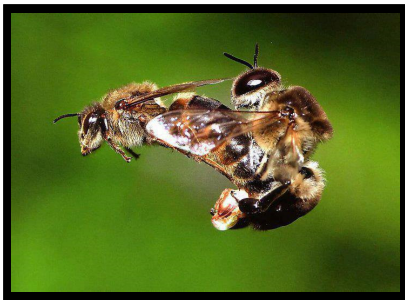
Queen production



Queens *Tetragonula carbonaria*

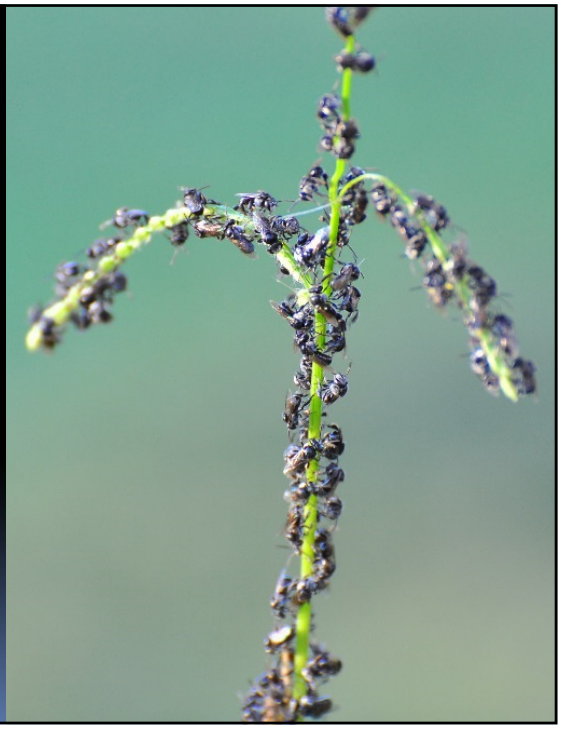
Virgin Queen

Mated Queen



Mating

- Takes place outside nest, on the wing
- Queen only ever does one mating flight
- Males form a congregation in anticipation
- Queen flies through the male congregation
- She mates with one male
- Return to nest and use the stored sperm for rest of her life



Mated queen

Photo: James Dorey

Image: James Dorey

Queen replacement: Emergency queen cells

Austral Entomology (2014) **, **–**

Emergency queens in *Tetragonula carbonaria* (Smith, 1854) (Hymenoptera: Apidae: Meliponini)

Túlio M Nunes,[1]* Tim A Heard,[2] Giorgio C Venturieri[2,3] and Benjamin P Oldroyd[1]

Fig. 3. (a) Brood comb of *Tetragonula carbonaria* in a queenright colony. Note the spiral shape of the brood comb. (b) Brood comb of *T. carbonaria* 1 week after queen removal showing royal-sized cells ('a') constructed by workers, provisioned with food and capped without egg laying.

Fig. 4. (a) Mature brood comb of *Tetragonula carbonaria* from a queenless colony showing an emergency queen cell attached to an empty auxiliary cell on the top. (b) Queen larva of *T. carbonaria* adjacent to an empty brood cell.

Indigenous beekeeping in Central America

Totanacas keep small *Scaptotrigona mexicana* in clay pots

Domestication, propagation

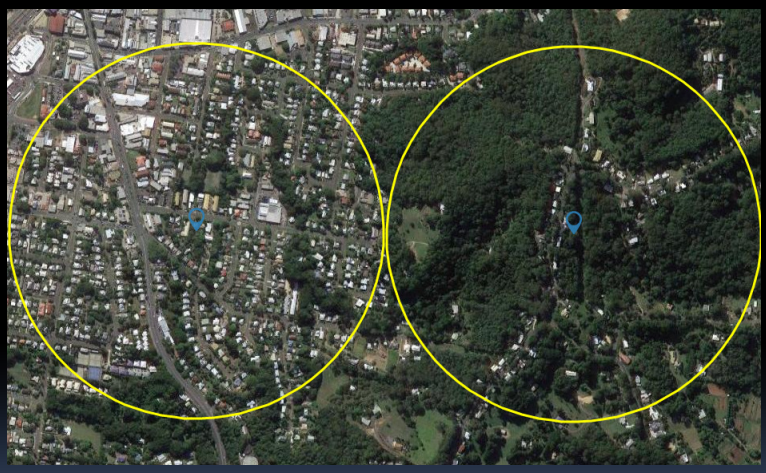
9B Propagation techniques including queen transfers and brood grafts
Dean Haley, Facilities Supervisor, Luina Bio Pty Ltd, Darra, QLD

Natural enemies and defence mechanisms



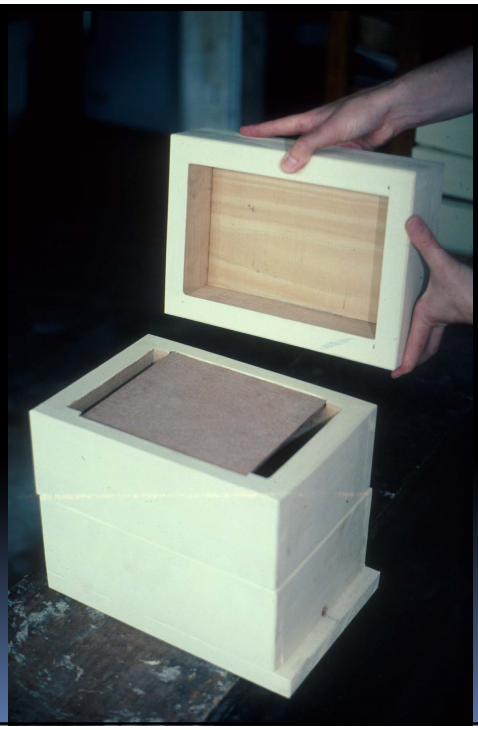

9B Stingless bee pests and diseases
Assoc Prof Robert Spooner Hart

Habitat, type, diversity and bee health



9B Resource diversity and bee health

Dr Sara Leonhardt, Research Group



Honey production

Stingless bees for pollination

Crops

Gardens

Conservation and sustainable use of stingless bees

- Conservation Threats
  - Harvesting of wild populations
  - Destruction of colonies by land clearing
  - Anthropogenic movements cause adverse genetic consequences for wild populations
  - Spread of disease
  - Competitive impacts on other species
  - Loss of cryptic species

Conservation Threats

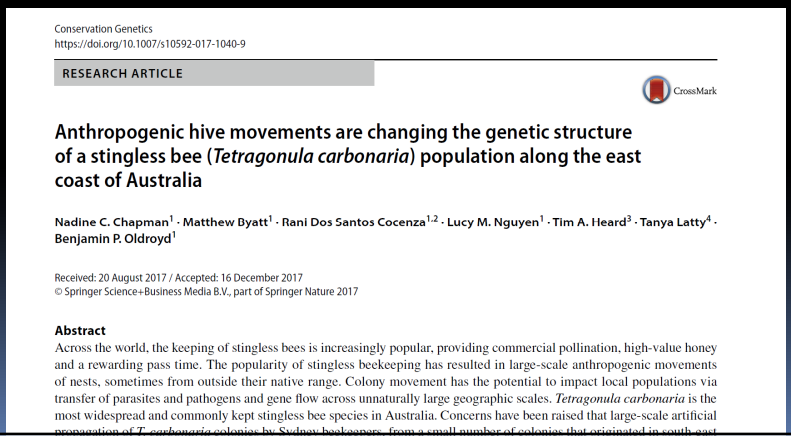
1. Harvesting of wild populations
   - Does commercialisation and trade motivate harvesting of wild populations?
   - Easy propagation of colonies takes pressure off wild populations

Conservation Threats

2. Destruction of colonies by land clearing
   - Commercialisation of stingless bees gives them a dollar value and motivates the rescue of colonies under threat.
   - Appreciation of the value of bees as crop pollinators may motivate the preservation of remnant native vegetation.

Conservation Threats

3. Anthropogenic movements cause adverse genetic consequences for wild populations



Conservation Genetics
https://doi.org/10.1007/s10592-017-1040-9

RESEARCH ARTICLE

Anthropogenic hive movements are changing the genetic structure of a stingless bee (*Tetragonula carbonaria*) population along the east coast of Australia

Nadine C. Chapman[1] · Matthew Byatt[1] · Rani Dos Santos Cocenza[1,2] · Lucy M. Nguyen[1] · Tim A. Heard[3] · Tanya Latty[4] · Benjamin P. Oldroyd[1]

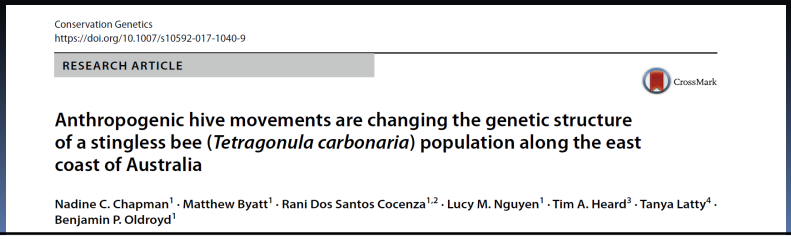
Received: 20 August 2017 / Accepted: 16 December 2017

Abstract
Across the world, the keeping of stingless bees is increasingly popular, providing commercial pollination, high-value honey and a rewarding pass time. The popularity of stingless beekeeping has resulted in large-scale anthropogenic movements of nests, sometimes from outside their native range. Colony movement has the potential to impact local populations via transfer of parasites and pathogens and gene flow across unnaturally large geographic scales. *Tetragonula carbonaria* is the most widespread and commonly kept stingless bee species in Australia. Concerns have been raised that large-scale artificial propagation of *T. carbonaria* colonies by Sydney beekeepers, from a small number of colonies that originated in south-east

Conservation Threats

3. Anthropogenic movements cause adverse genetic consequences for wild populations

"We conclude that the anthropogenic movements of stingless bees along the east coast of Australia is unlikely to have adverse genetic consequences for wild populations."



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Conservation Threats

4. Anthropogenic movements or other beekeeping activities lead to spread of disease or pests
   - Most pests are native and widespread so movement of colonies wont make much difference.

Conservation Threats

5. Competitive impacts on other species
   - Is the keeping of stingless bees at high densities to the detriment of other native species that use floral resources?

Conservation Threats

6. Loss of cryptic species

E.g. *Tetragonula davenporti* is a cryptic species that we think is very restricted in geographic range.

Could beekeeping activities be threatening it?

Could other human activities be leading to its demise?

Stingless bee diversity in Australia

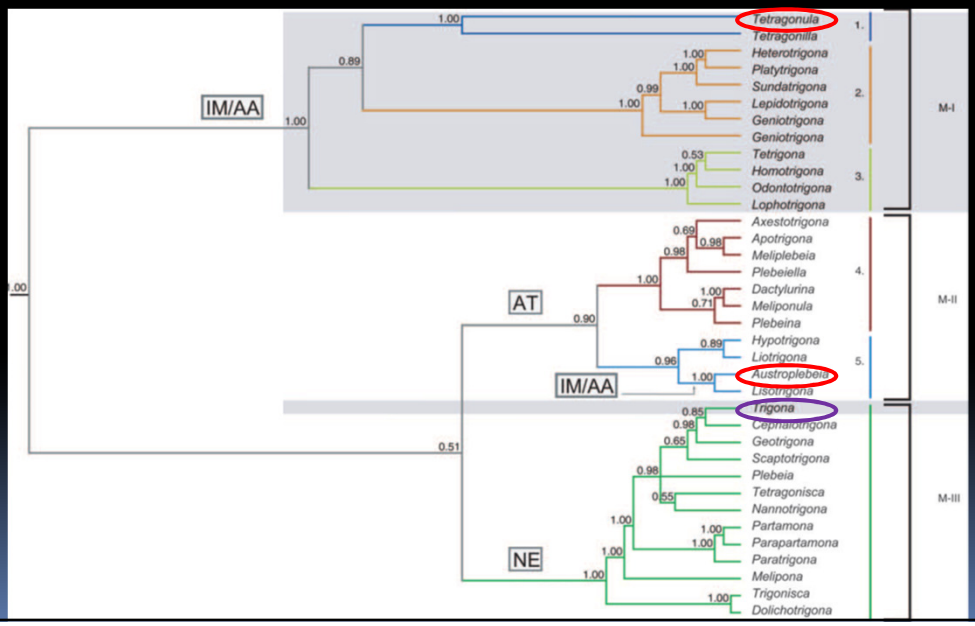
Two genera

–*Tetragonula*

–*Austroplebeia*

Photos: Tobias Smith

What happened to *Trigona* (CSIRO 1991)?



Anne Dollin

-Revision of Tetragonula

Invertebrate Taxonomy, 1997, **11**, 861–896

Australian Stingless Bees of the Genus *Trigona* (Hymenoptera: Apidae)

Anne E. Dollin[A], *Leslie J. Dollin*[A] *and the late Shôichi F. Sakagami*[B]

[A]Australian Native Bee Research Centre, PO Box 74, North Richmond, NSW 2754, Australia.
[B]Formerly of Hokkaido University, Sapporo, Japan.

Abstract

Six Australian stingless bee species in *Trigona* (*Heterotrigona*) are redescribed. Workers, males and queens are described of *T. clypearis* Friese (formerly *T. wybenica* Cockerell), *T. sapiens* Cockerell (formerly *T. laeviceps* Smith), *T. carbonaria* Smith, *T. hockingsi* Cockerell and an enigmatic fifth species from north-western Australia. The name *T. mellipes* Friese is assigned to this latter species on morphometric and geographical grounds, despite differences in described coloration. A key to the species is given. Species distributions and nest descriptions based on 188 nests are provided. Workers of a sixth Australian species, *T.* aff. *fuscobalteata* Cameron, previously unknown in Australia but recently found on Cape York Peninsula, Queensland, are also described.

Australian and New Guinean Stingless Bees of the Genus *Austroplebeia* Moure (Hymenoptera: Apidae)—a revision

ANNE E. DOLLIN[1,3], LESLIE J. DOLLIN[1] & CLAUS RASMUSSEN[2]
[1]*Australian Native Bee Research Centre, PO Box 74, North Richmond NSW 2754, Australia. E-mail: annedollin@aussiebee.com.au*
[2]*Department of Bioscience, Aarhus University, Ny Munkegade 114, Bldg. 1540, DK-8000 Aarhus C, Denmark. E-mail: alrunen@yahoo.com*
[3]*Corresponding author. E-mail: annedollin@aussiebee.com.au*

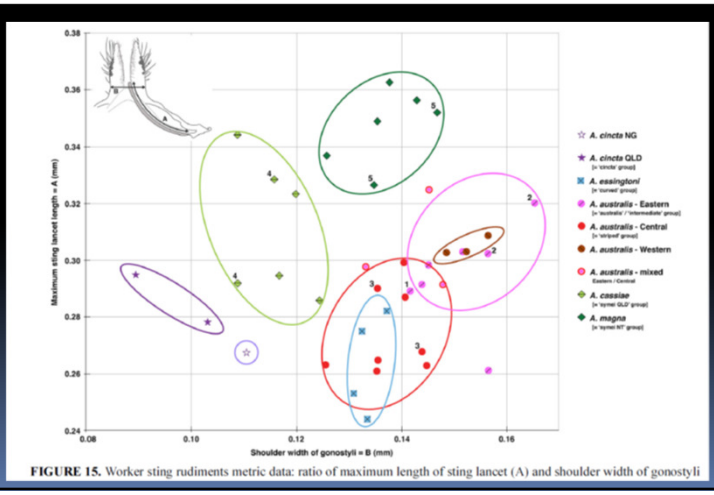
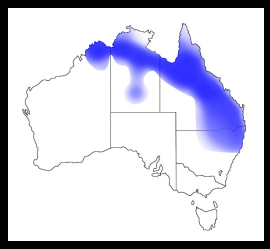


FIGURE 15. Worker sting rudiments metric data: ratio of maximum length of sting lancet (A) and shoulder width of gonostyli

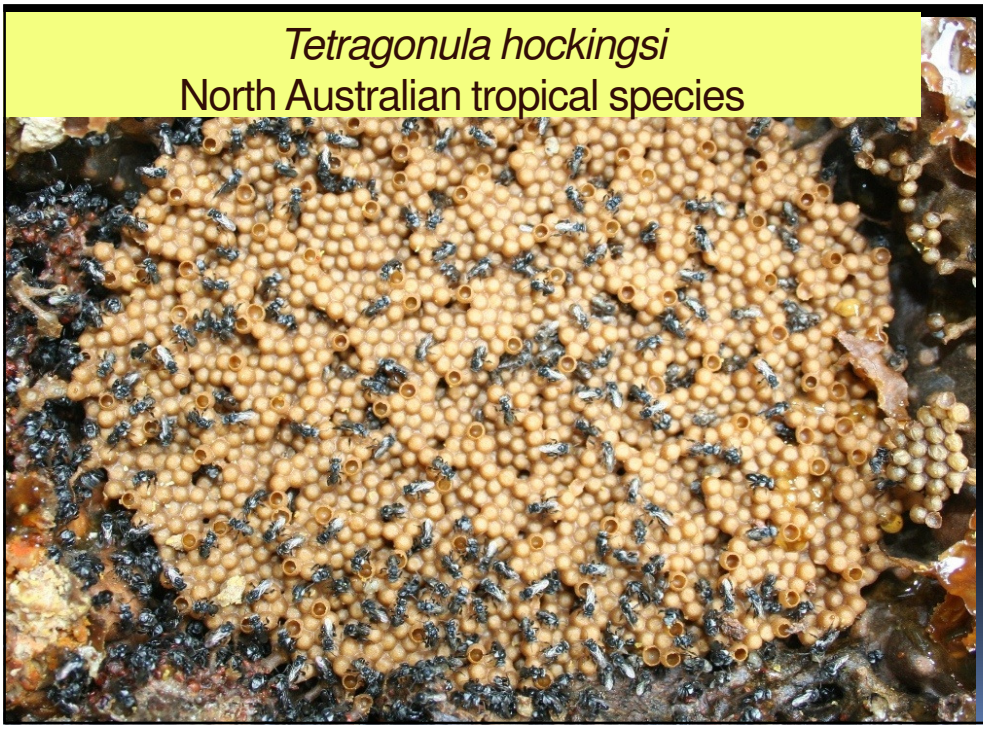
Austroplebeia australis

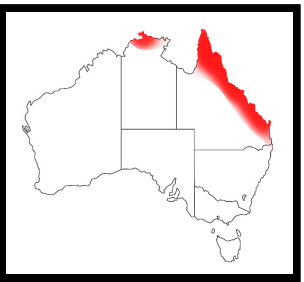
Wide distribution, particularly common in drier areas from Hunter Valley to the Kimberley



Photos: Jeff Willmer

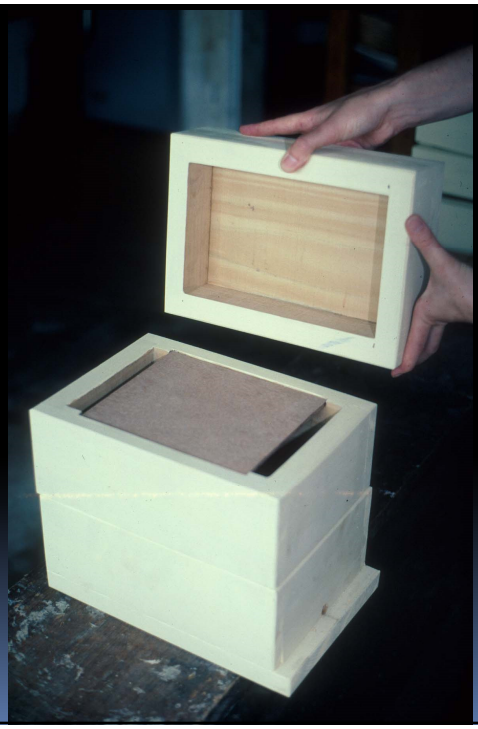
Tetragonula hockingsi
North Australian tropical species





Conservation and sustainable use of stingless bees

- Utilisation
  - Honey production
  - Pollination



Honey production

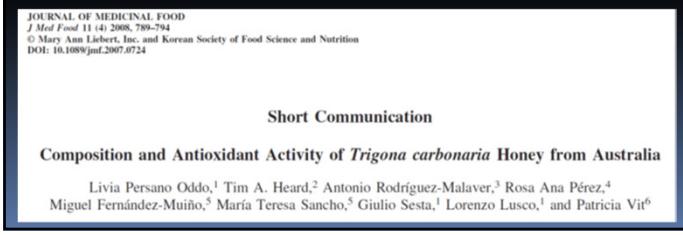
Indigenous Australians

Hunters of stingless bee nests

Photo: Alan Yen

Honey

- Production
  - 1 kg /hive/year
- Composition
  - High water content
  - High acidity
  - Unusual sugars



JOURNAL OF MEDICINAL FOOD
J Med Food 11 (4) 2008, 789–794
© Mary Ann Liebert, Inc. and Korean Society of Food Science and Nutrition
DOI: 10.1089/jmf.2007.0724

Short Communication

Composition and Antioxidant Activity of *Trigona carbonaria* Honey from Australia

Livia Persano Oddo,[1] Tim A. Heard,[2] Antonio Rodríguez-Malaver,[3] Rosa Ana Pérez,[4] Miguel Fernández-Muiño,[5] María Teresa Sancho,[5] Giulio Sesta,[1] Lorenzo Lusco,[1] and Patricia Vit[6]

	Average± SD
Moisture (g/100 g honey)	26.5 ± 0.8
Electrical conductivity (mS/cm)	1.64 ± 0.12
Ash (g/100 g honey)	0.48 ± 0.06
HMF (mg/kg honey)	1.2 ± 0.6
pH	4.0 ± 0.1
Acidity (milliequivalents/kg honey)	128.9 ± 23.3
Nitrogen (mg/100 g honey)	202.3 ± 191.2
Diastase (DN)	0.4 ± 0.5
Invertase (IN)	5.7 ± 1.5
Fructose	24.5 ± 1.9
Glucose	17.5 ± 2.8
Maltose	20.3 ± 2.9
Sucrose	1.8 ± 0.4
Fructose + glucose	42.0 ± 4.5
Total sugars	64.6 ± 1.9

Antimicrobial activity of honey

ELSEVIER

International Journal of Antimicrobial Agents 32 (2008) 89–98

Antimicrobial Agents

www.ischemo.org

Letters to the Editor

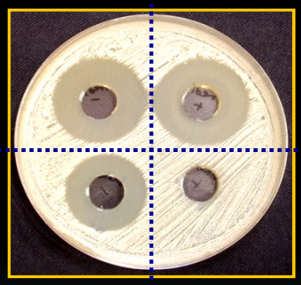
Antibacterial activity of honey from the Australian stingless bee *Trigona carbonaria*

The antibacterial activities of the 22 samples of *Trigona* honey are shown in Table 1. The initial total antibacte-

Peroxide vs Non-peroxide activity

Leptospermum honey

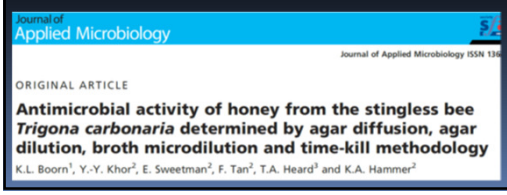
Brush box honey



Leptospermum honey + catalase

Brush box honey + catalase

Staphylococcus aureus



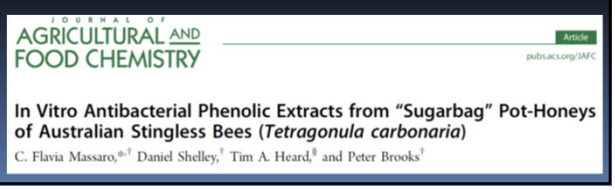
Journal of Applied Microbiology

Journal of Applied Microbiology ISSN 136

ORIGINAL ARTICLE

Antimicrobial activity of honey from the stingless bee *Trigona carbonaria* determined by agar diffusion, agar dilution, broth microdilution and time-kill methodology

K.L. Boorn[1], Y.-Y. Khor[2], E. Sweetman[2], F. Tan[2], T.A. Heard[3] and K.A. Hammer[2]



JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY

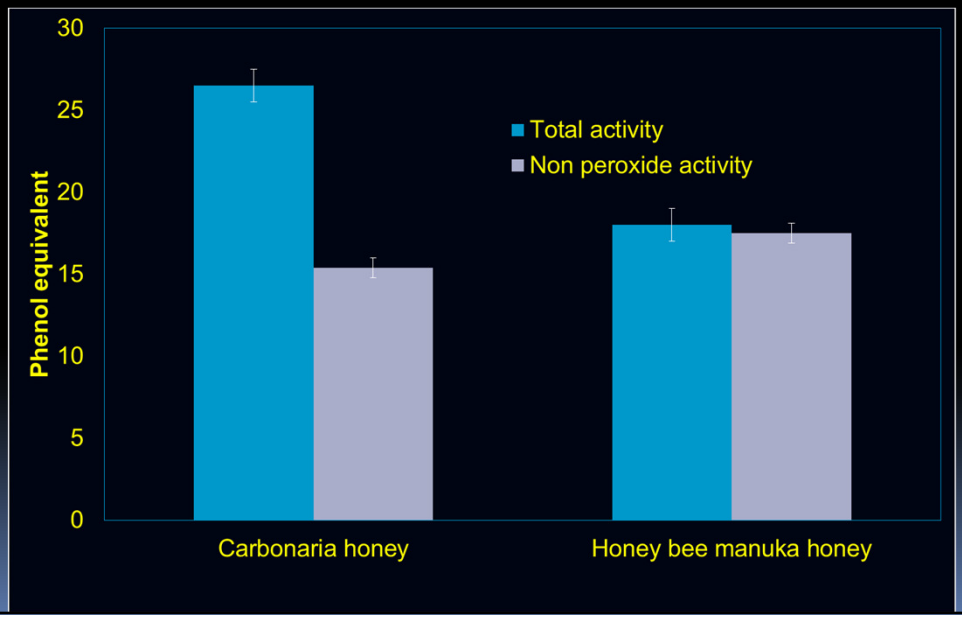
Article

pubs.acs.org/JAFC

In Vitro Antibacterial Phenolic Extracts from "Sugarbag" Pot-Honeys of Australian Stingless Bees (*Tetragonula carbonaria*)

C. Flavia Massaro,*[,†] Daniel Shelley,[†] Tim A. Heard,[§] and Peter Brooks[†]

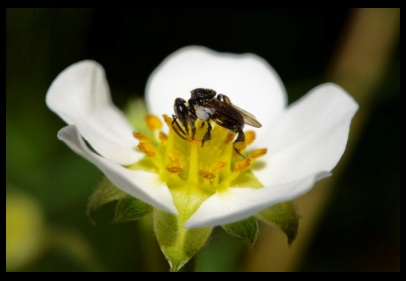
Antimicrobial activity of honey



Sustainable use - pollination

Remnant vegetation provides wild pollinators

Sustainable use - pollination

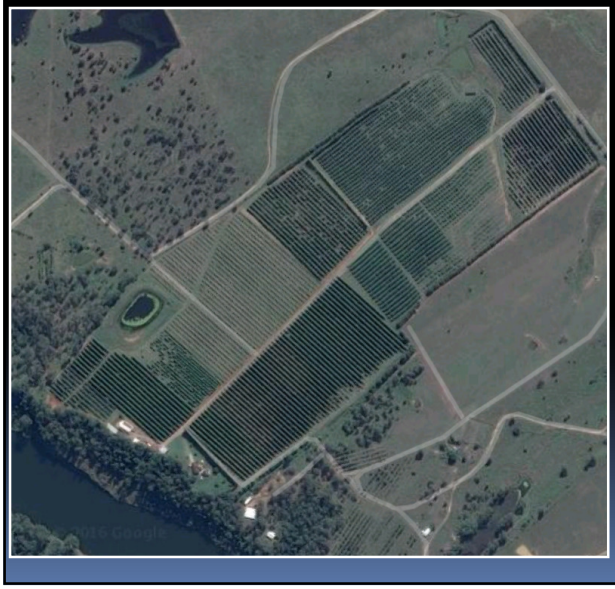


11B The pollination contribution of stingless bees to 5 Australian crops

Dr Romina Rader, University of New England, Armidale, NSW

Sustainable use - pollination

Crop pollination – role of remnant

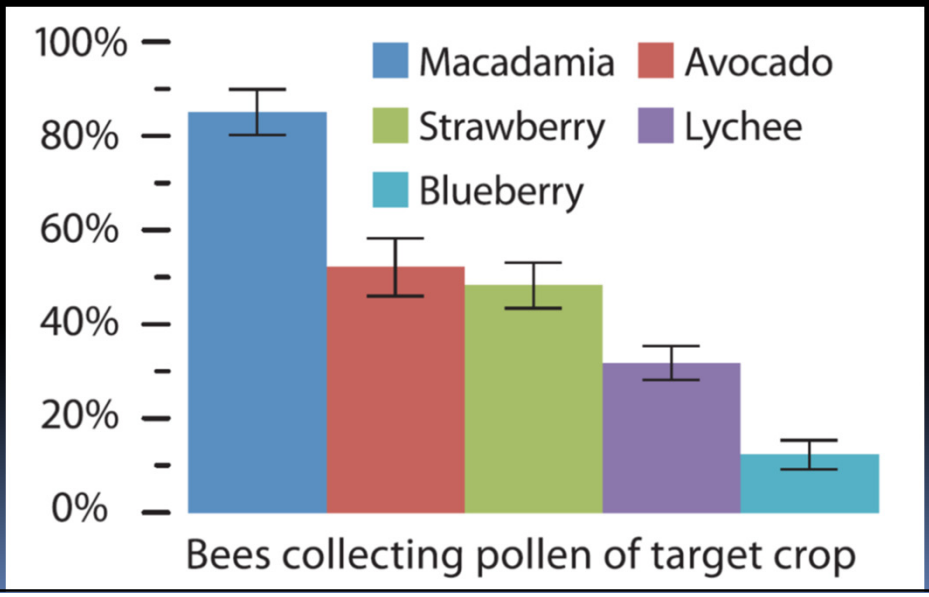


Introducing hives of stingless bees to farms

11B Protecting stingless bees from insecticides on farms

Chris Fuller, Owner and Director, Kin Kin Native Bees, Kin Kin, QLD

The proportion of bees collecting pollen of the target crop for five crop species

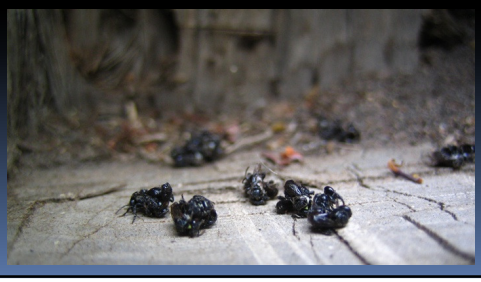


Efficient ways of mounting hives on farms

Fighting swarms are caused by an attacking colony attempting to usurp the nest of the defending colony

11B Fighting swarms and tolerance to crowding in Australian stingless bees

Dr Ros Gloag, School of Life and Environmental Sciences, University of Sydney, Sydney, NSW

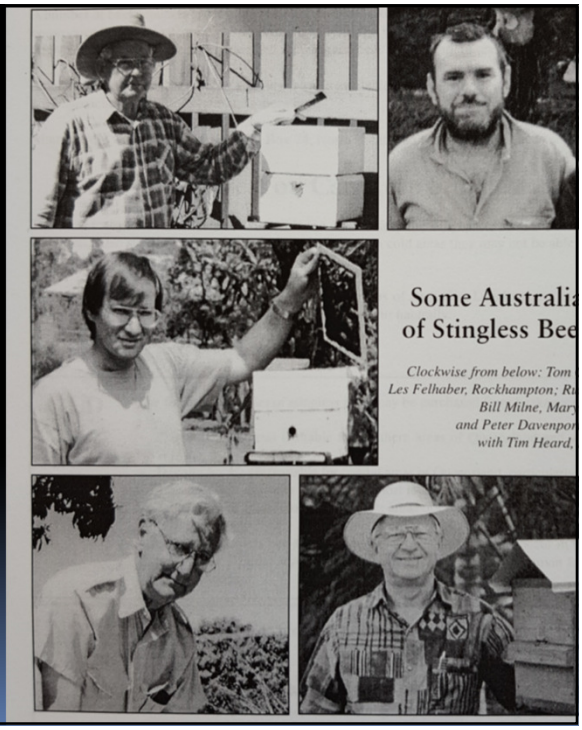


Summary

- Introduction to Stingless bees
- Journey from obscurity to insect ambassadors
- Conservation and sustainable use of stingless bees
- Research to support their sustainable use

Dedication

To Australia's stingless bee keepers



Thank you!

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