# Asian honey bees in Australia

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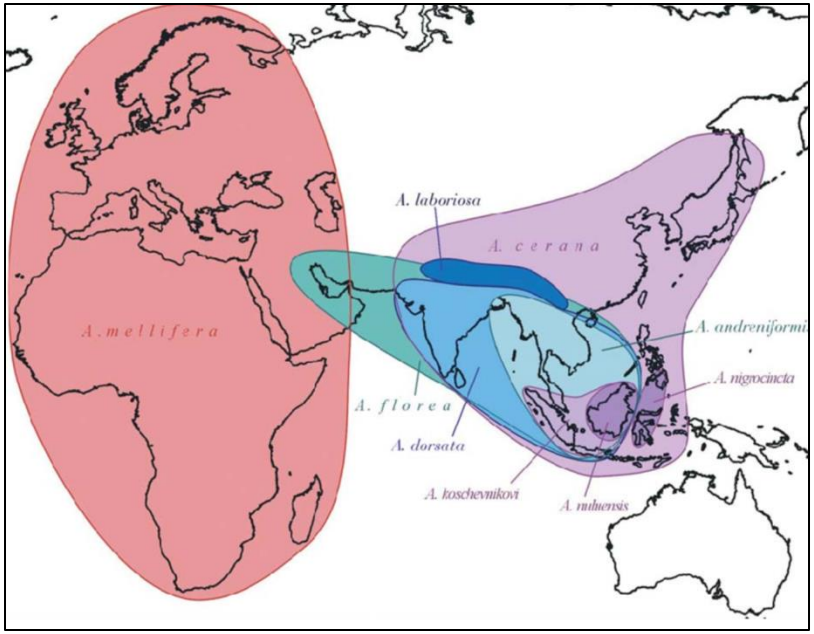
# This talk

- Who are the Asian honey bees?
- Risks posed by *Apis cerana* (AHB) incursions
- Australia's resident *Apis cerana*
  - What we know about them
  - Biosecurity lessons

# The honey bees (*Apis*)

Western honey bee
*Apis mellifera*

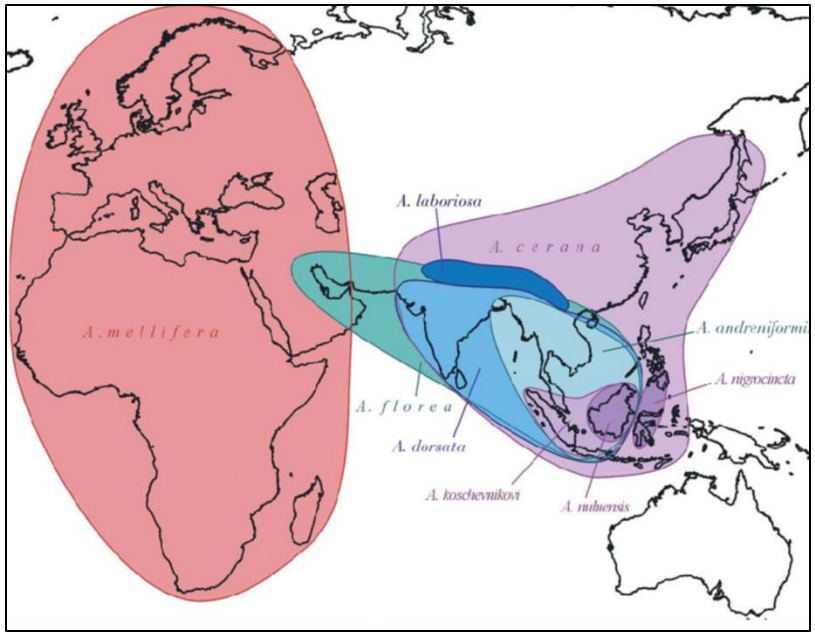



Native distributions of honey bee species

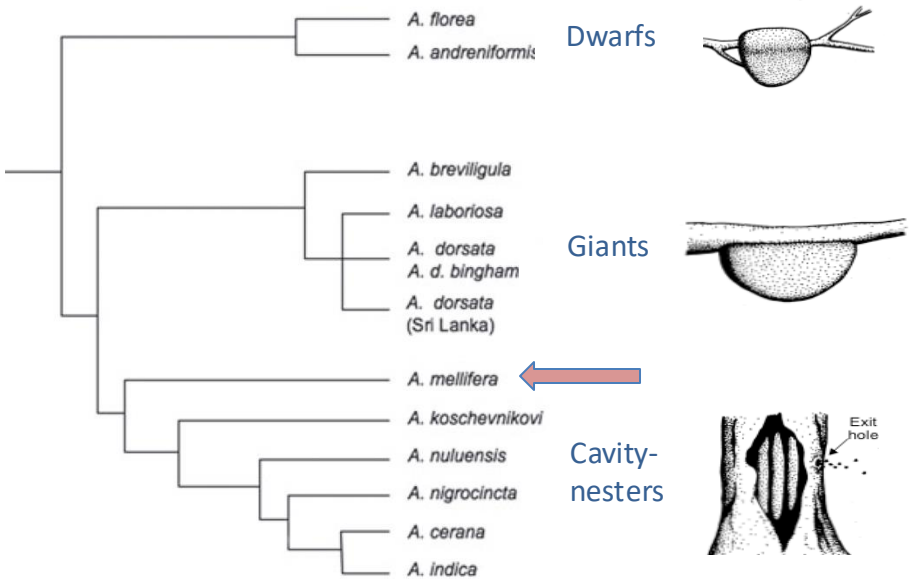
Franck et al 2000

"Asian honey bees"
7 (more?) species

# The honey bees (*Apis*)




Franck et al 2000




Lo et al. 2007

# Giant honey bees

*Apis dorsata*

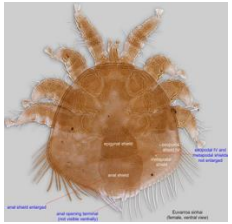

Hosts of
*Tropilaelaps* mites

- Not established in Australia
- Occassionally intercepted at ports

# Dwarf honey bees

- Incursion Karratha WA 2023 - ongoing
- Carried Euvarroa mites and viruses


Red dwarf honey bee (RDHB), *Apis florea*

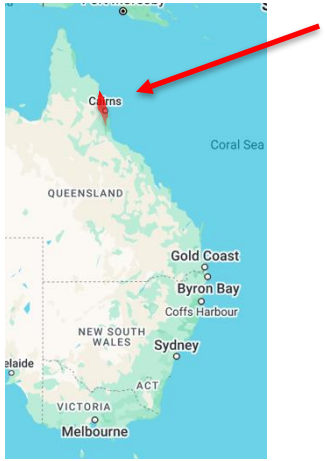



Hosts of *Euvarroa* mites

# Cavity nesting honey bees

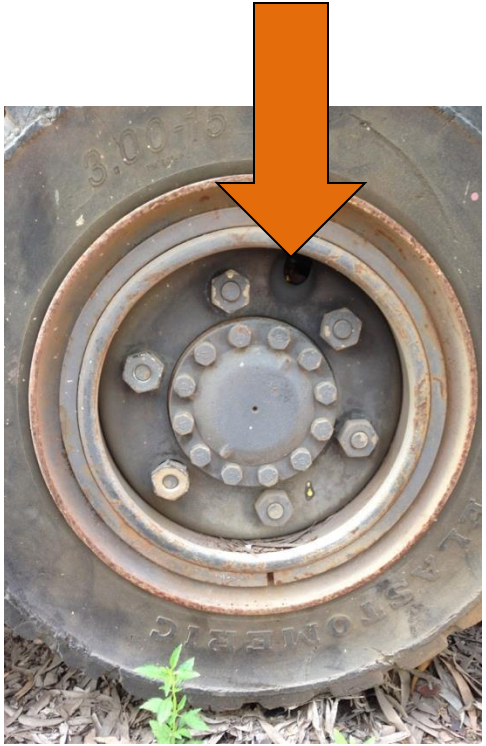
Asian honey bee (AHB), *Apis cerana*

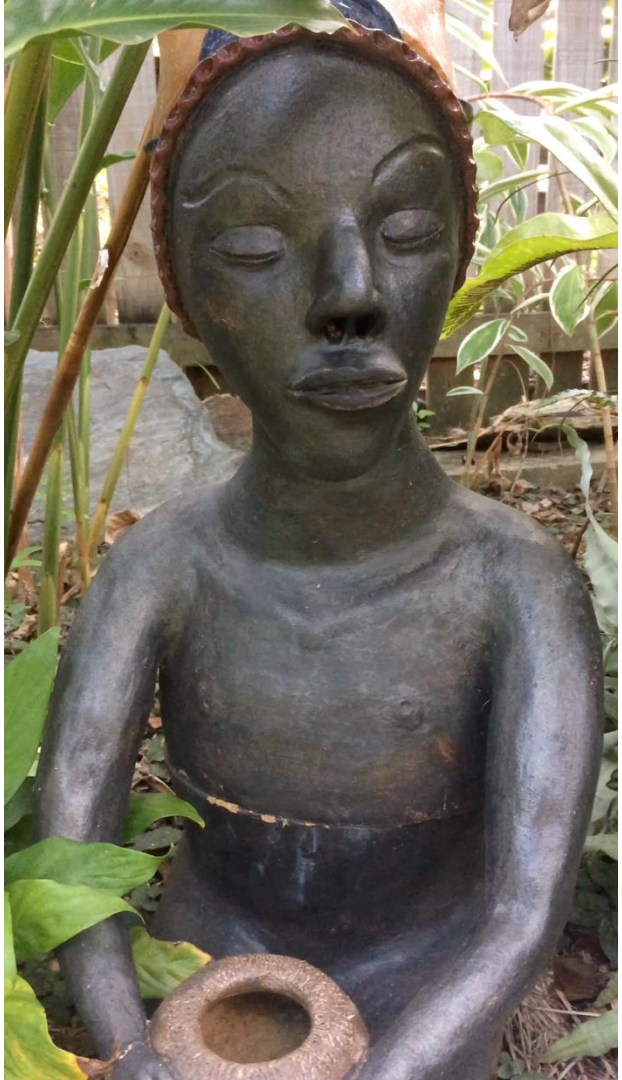

AHB EHB




- Cairns region AHB population established since 2007
  - today: 50, 000 colonies
- Native host of Varroa
  - but Cairns population Varroa-free
- Regularly detected at ports
  - Townsville 2016, 2019/2020, 2022, 2025
  - Brisbane 2024

# *Apis cerana* are good stowaways!



# *Apis cerana* (AHB): how does it differ from EHB?

- Smaller colonies (often ~ 6000 workers)
- Swarms often
- Lower honey stores – no overwintering behaviour in tropical range
- High colony mobility → frequent absconding

# *Apis cerana* beekeeping

Southern China

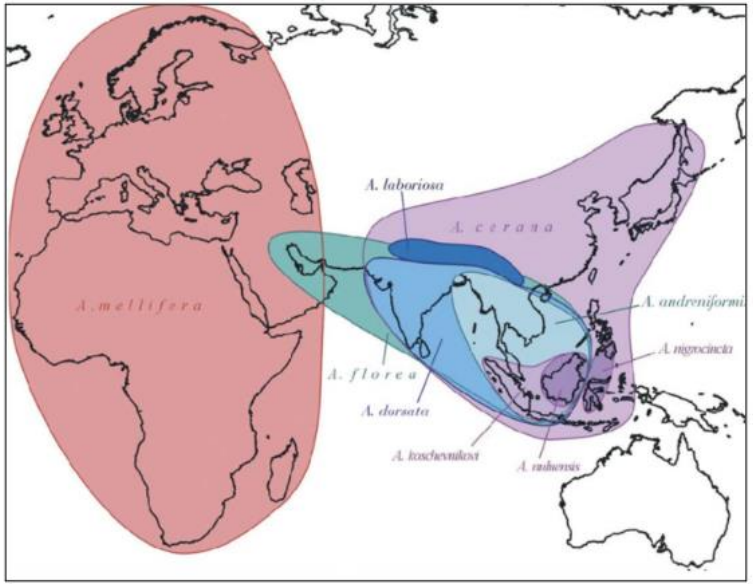
Ken Tan and Ben Oldroyd, Xishuangbanna Tropical Botanical Garden, Yunnan

# *Apis cerana* beekeeping

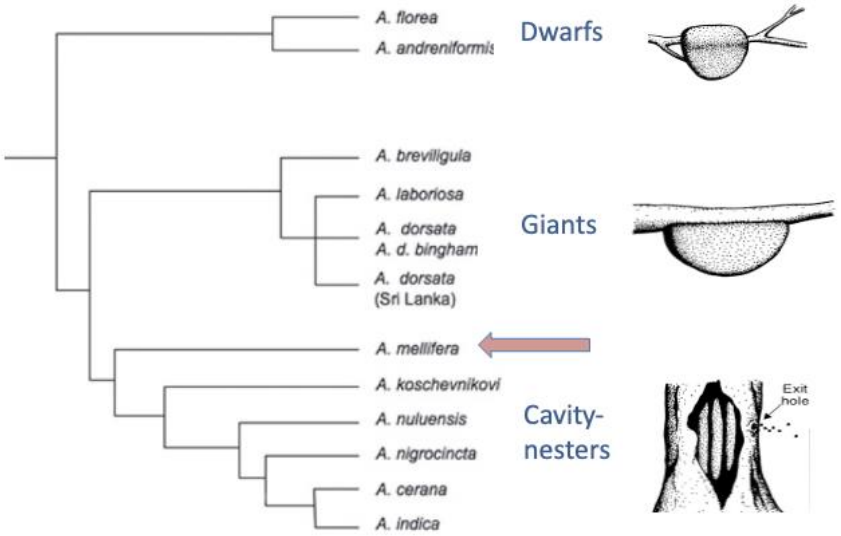
Sulwaesi, Indonesia

# What risks do AHB incursions pose to Aussie beekeeping?

*Apis cerana* and *Apis mellifera:* close relatives that evolved in isolation….




Franck et al 2000




Lo et al. 2007

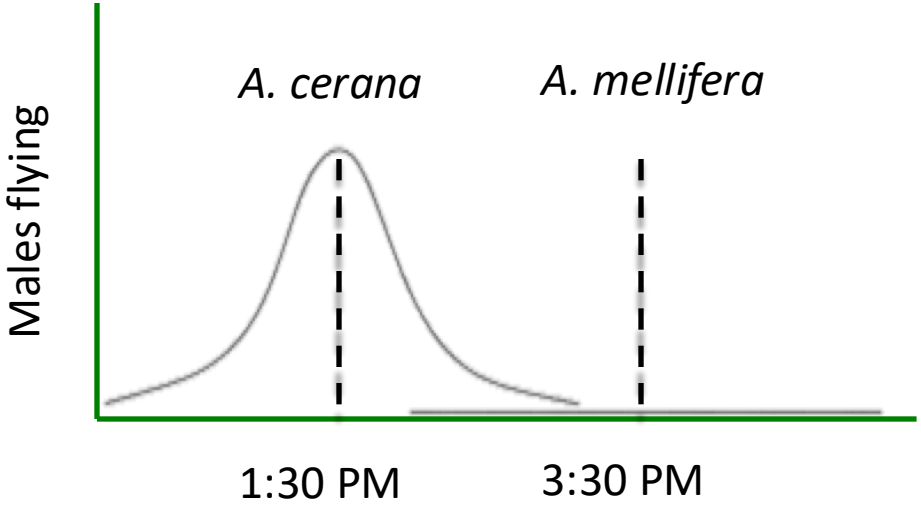
# 1. Transfer of pests and disease

- Native host of *Varroa destructor* and *Varroa jacobsoni*
- Tracheal mites *(Acarapis woodi)*
- *Nosema*
- Viruses

*Acarapis woodi*

# 2. Interspecific mating

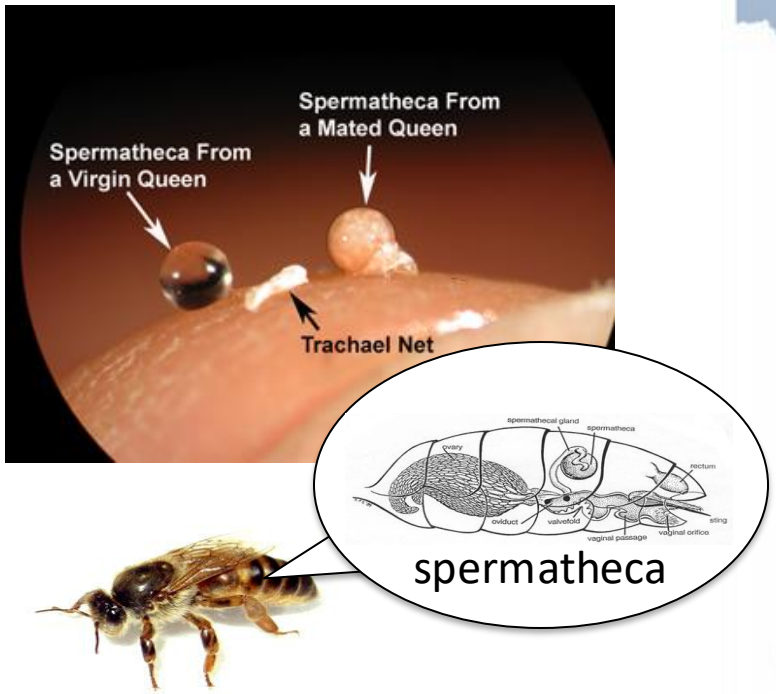
Different mating times, different mating places, and yet….

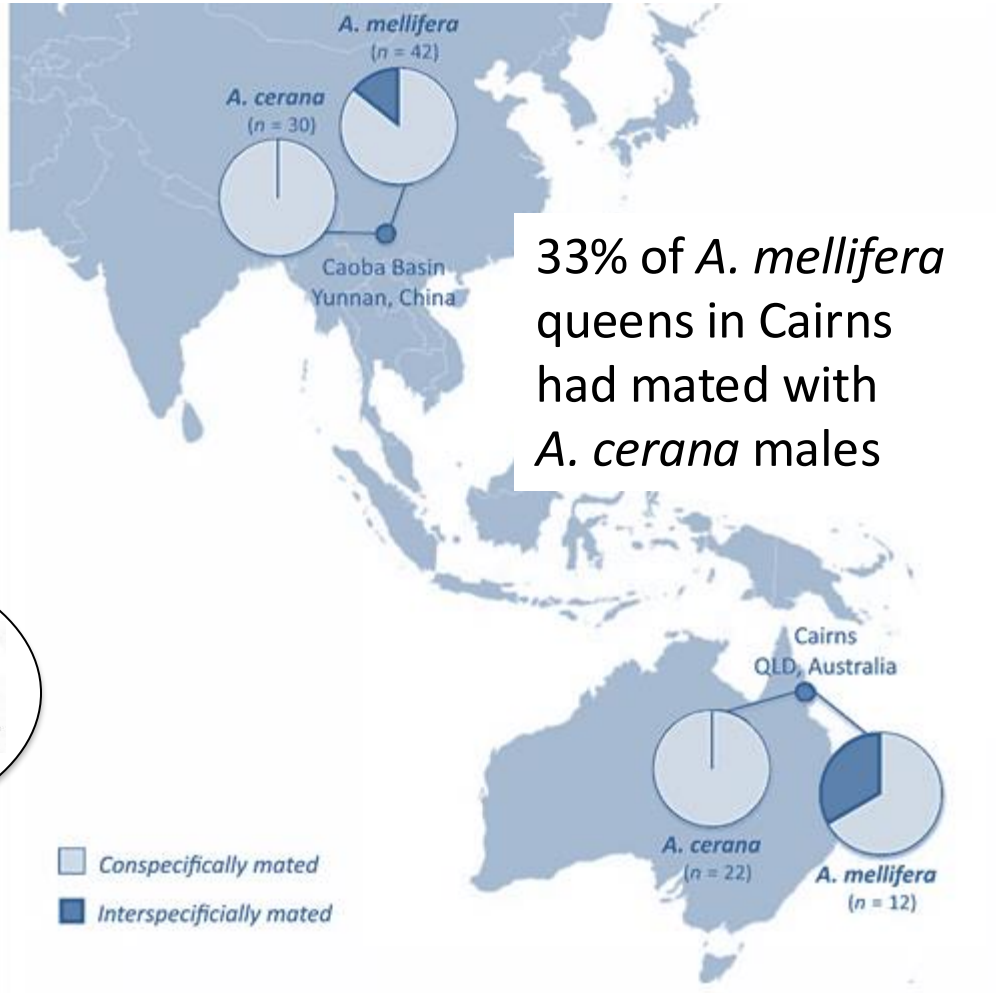



Sheltered

Open

# Interspecific mating




33% of *A. mellifera* queens in Cairns had mated with *A. cerana* males

Remnant et al 2014

# Interspecific mating but no hybridization

Based on artificial insemination experiments, interspecific mating gives:

- Unfertilized eggs (males)
- Hybrid offspring that fail to develop beyond larval stage (shot brood)

Remnant et al 2014; Gloag et al 2016

# This talk

- Who are the Asian honey bees?
- Risks posed by *Apis cerana* (AHB) incursions
- **Australia's resident AHB: Biosecurity lessons**

*Apis cerana*

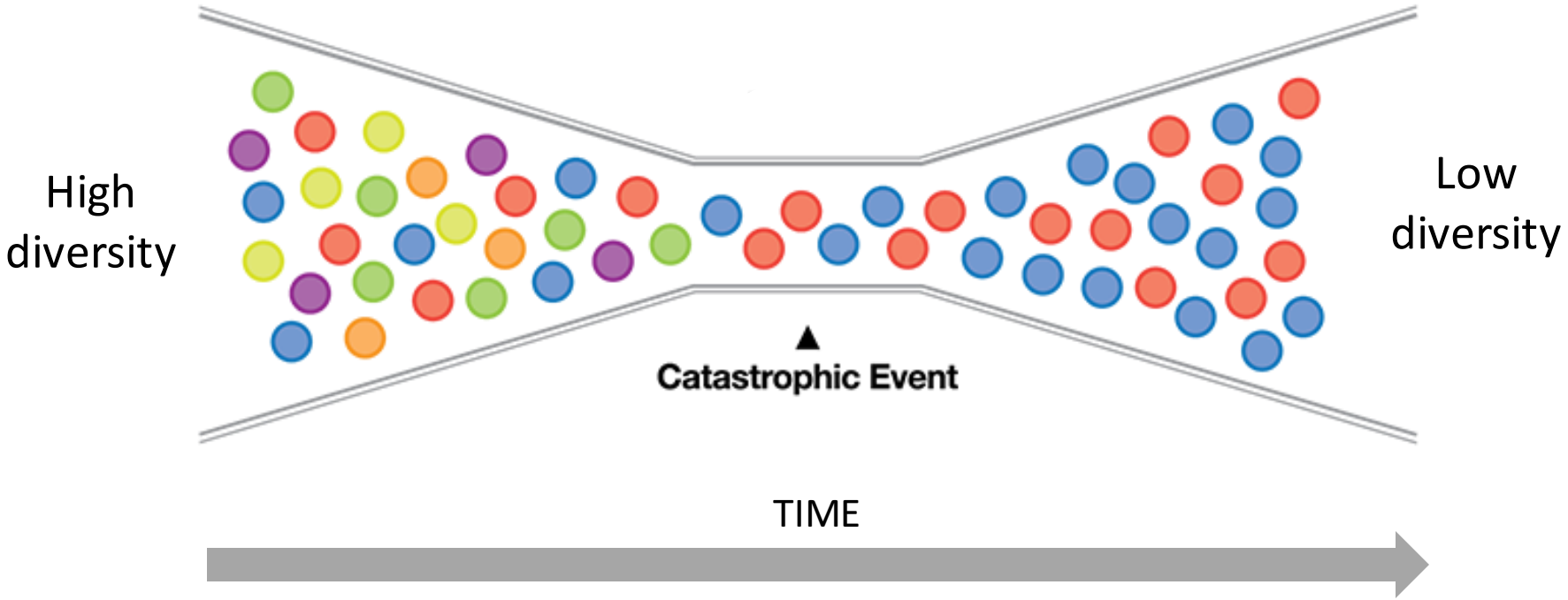
Native range

Invasive range

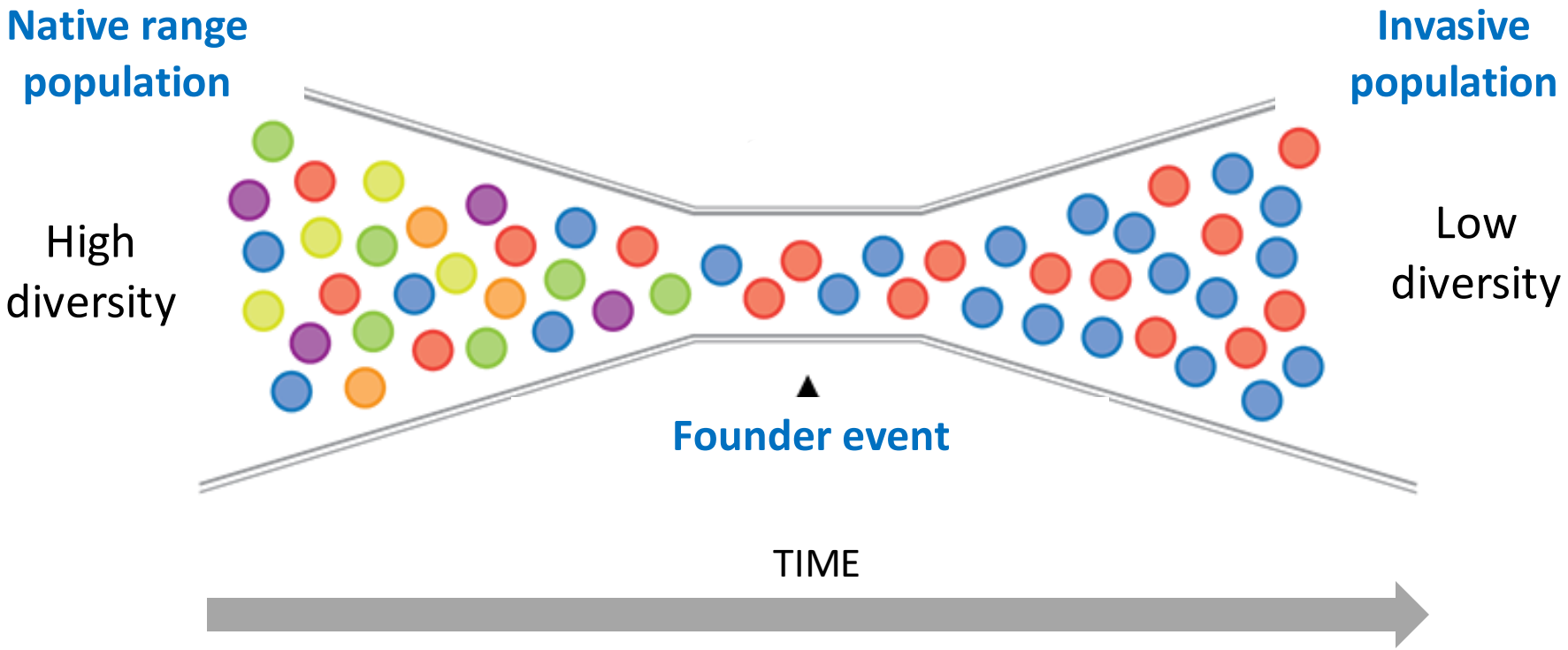
Russia
North Korea
Japan
South Korea
China
Afghanistan
Pakistan
Nepal
Bhutan
India
Bangladesh
Myanmar
Laos
Taiwan
Thailand
Cambodia
Vietnam
Philippines
Sri Lanka
Brunei
Malaysia
Indonesia
Timor-Leste
1970s
Papua New Guinea
Solomon Islands
Cairns
2007
Australia

Hagan et al 2024; adapted from Koetz 2012

# Genetic bottlenecks



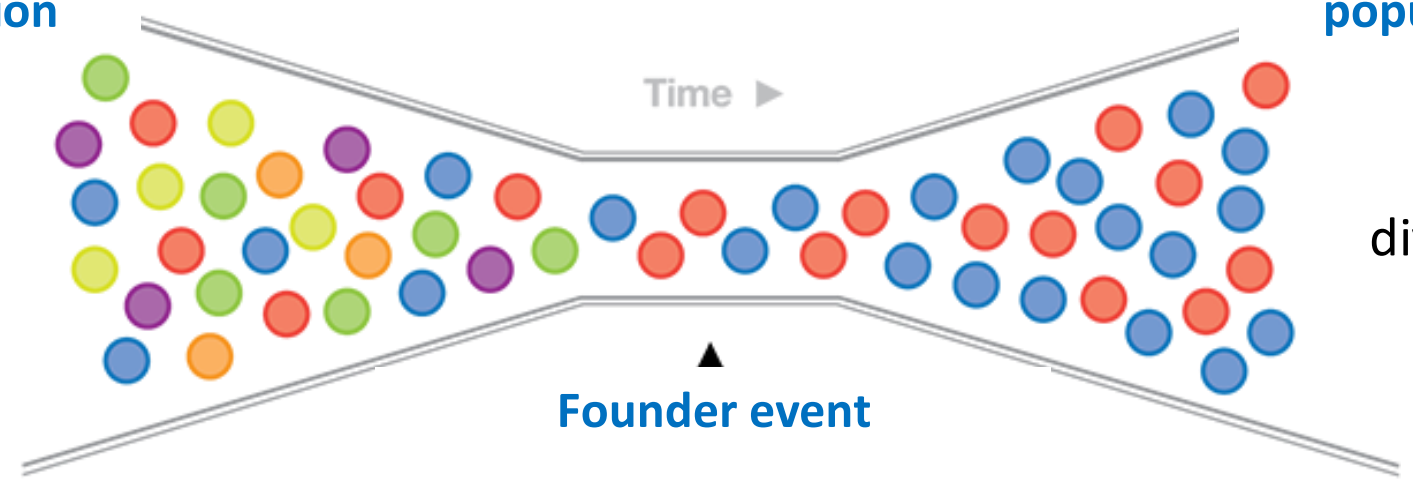
# Genetic bottlenecks



# Genetic bottlenecks

**Native range population**

High diversity



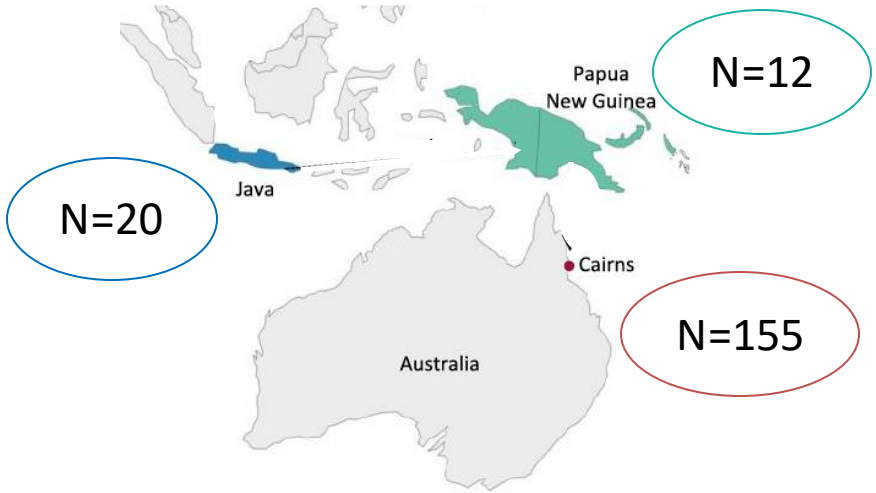

**Invasive population**

Low diversity

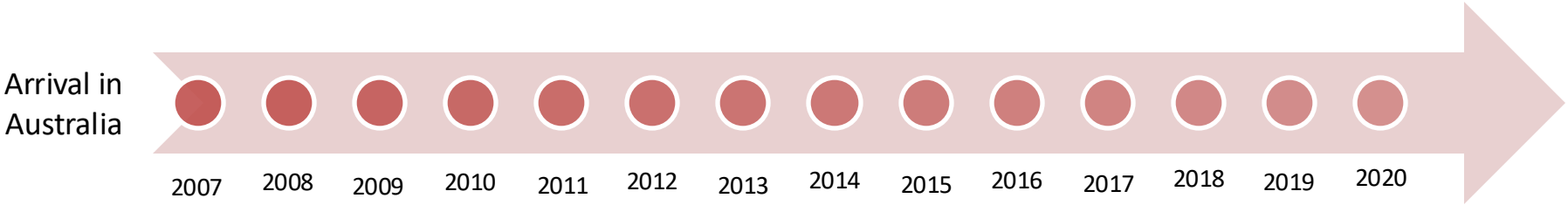
**Founder event**

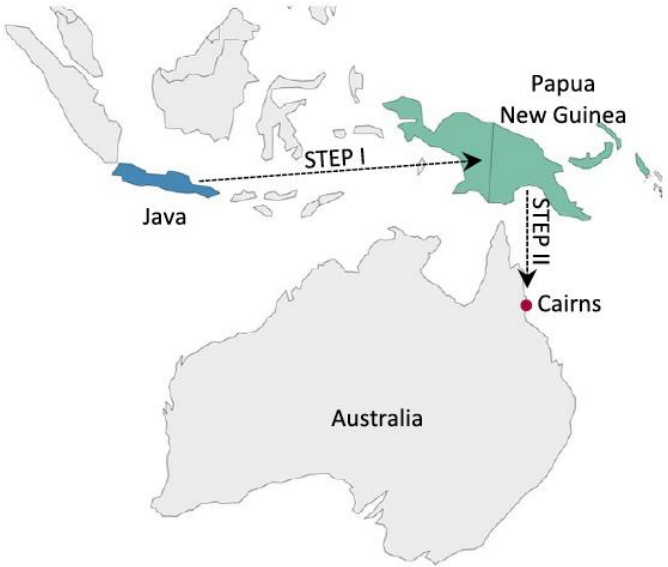
→ reduced adaptive potential
→ inbreeding depression

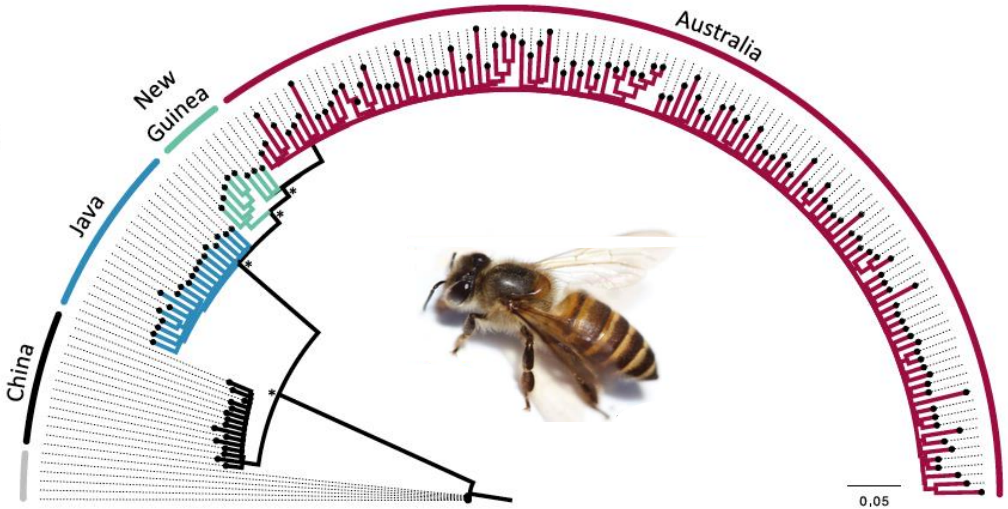
# The Cairns population: genomic time-series




Sampling on Java, Indonesia, 2018



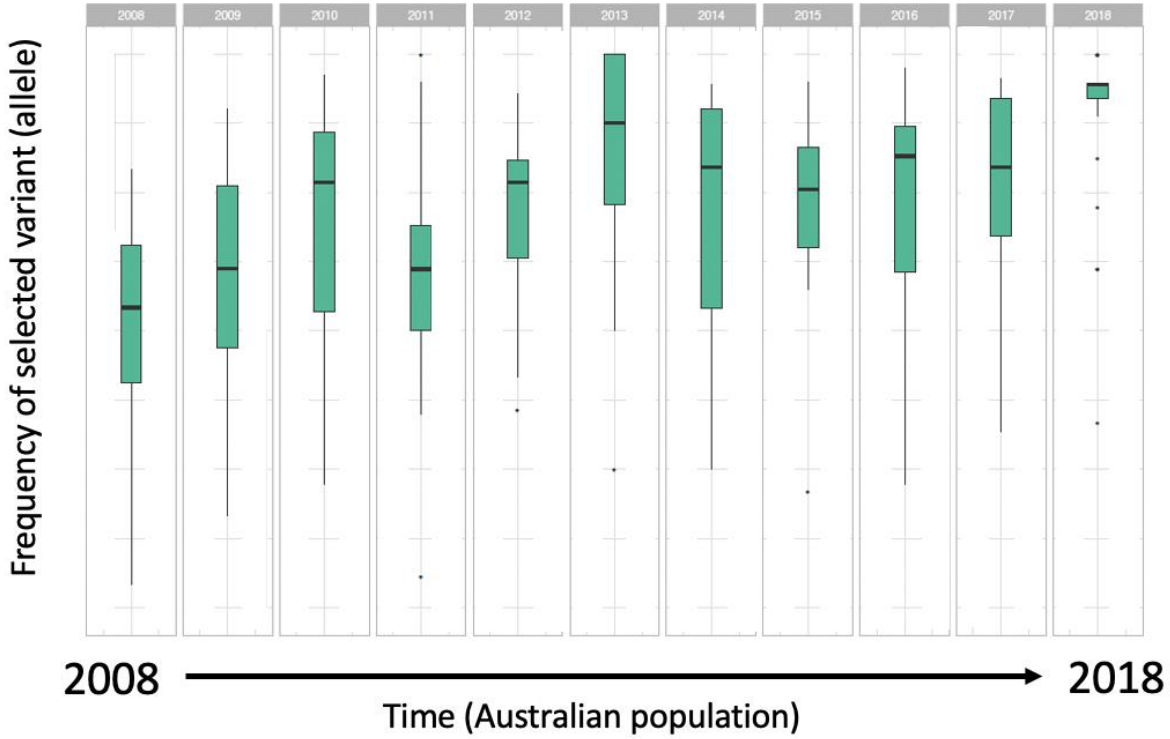



- Single incursion: **one founding colony** (mated queen and her workers)
- Low genetic diversity and genetically distinct to Javan and New Guinean populations

Dogzantis et al 2024

# Genomic evidence of rapid adaptation




Adaptation at genes associated with reproduction and foraging behaviour

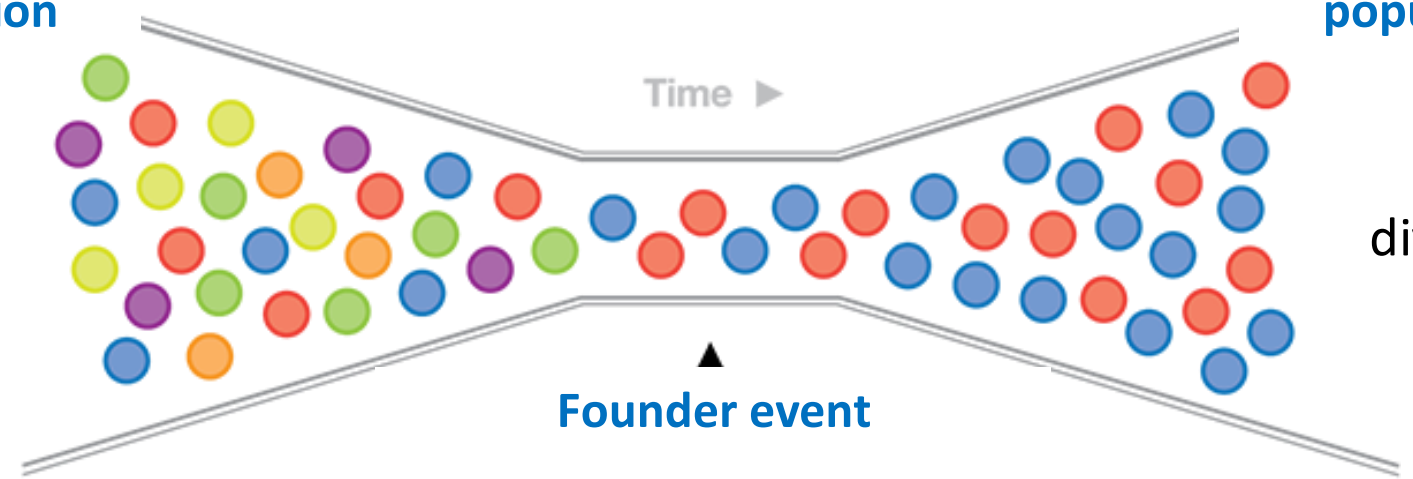
+ many genes with unknown function!

Dogzantis et al 2024

# Genetic bottlenecks

**Native range population**

**Invasive population**




High diversity

Low diversity

**Founder event**

= inbreeding depression ?

# Inbreeding is a problem for honey bees

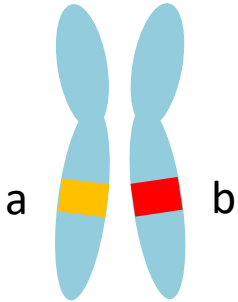
Because sex (male or female) is determined by zygosity at a single gene

Unfertilized egg (haploid)

Normal Male

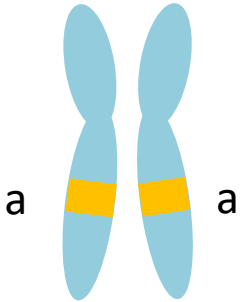

Fertilized egg (diploid)

Female

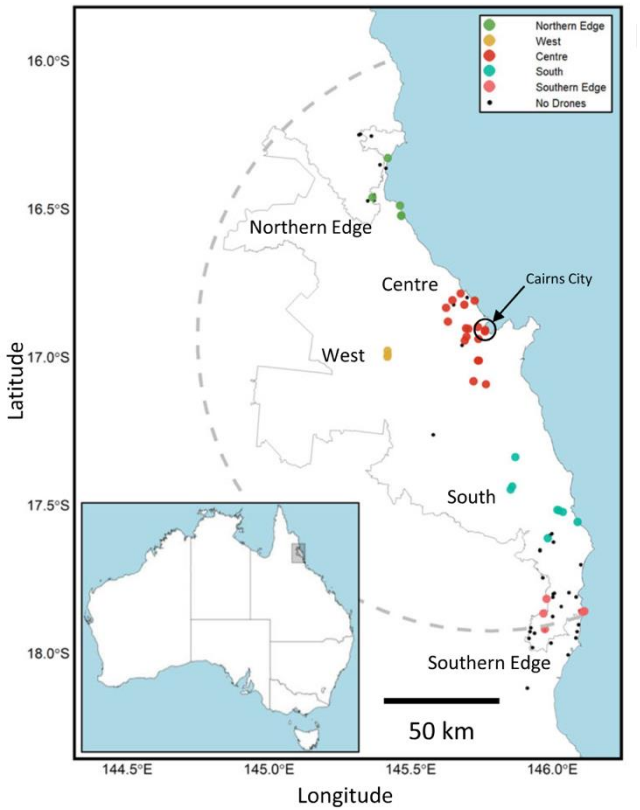




Diploid Male



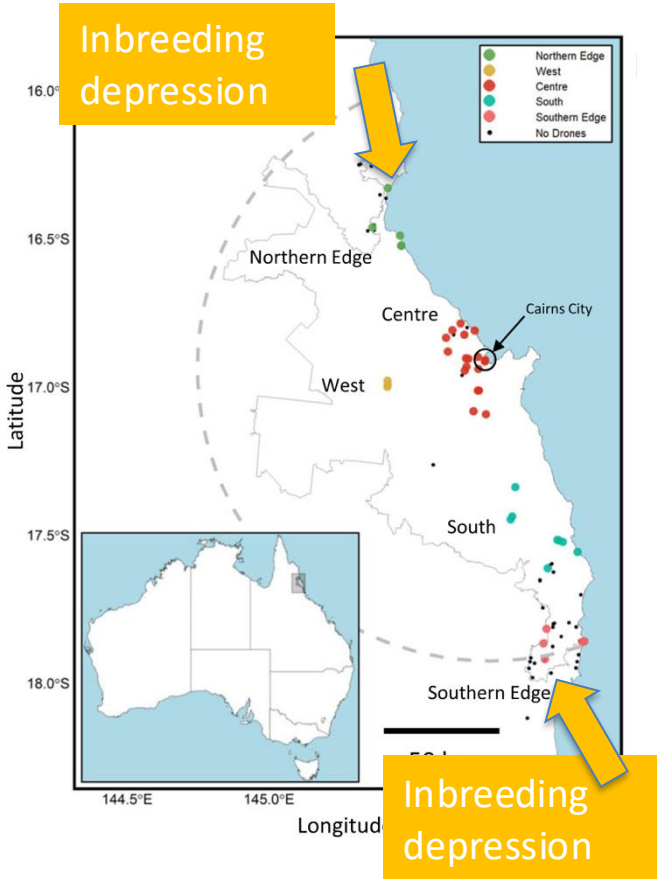
# Inbreeding depression at range edges = slow rate of spread




Sampled drones and colonies at centre and edges of invasive range

Hagan et al 2024

# Inbreeding depression at range edges = slow rate of spread




Sampled drones and colonies at centre and edges of invasive range

Hagan et al 2024

# Biosecurity lessons from the Cairns *Apis cerana* incursion

- Preventing incursions is extremely challenging!
  - A single colony can found a new population
- Once established, populations will rapidly adapt (even if genetic diversity very low!)
  - AHB in Cairns is already “Australia type”
- Inbred populations spread slowly
  - 2nd incursion may cause rapid expansion
  - Detecting secondary incursions into established populations also challenging

# Acknowledgements


QLD Department of Agriculture and Fisheries
DAWE
Cairns Beeclub
Cairns Regional Council

Australian Government
Australian Research Council

THE UNIVERSITY OF SYDNEY

Tom Hagan
Ben Oldroyd
Guiling Ding
Madeleine Beekman
Nadine Chapman
Rika Raffiudin
Amro Zayed
Katie Dogzantis