



Manaaki Whenua  
Landcare Research

# ***Volucella inanis* & *Metoecus paradoxus*: new biocontrol agents of *Vespula* wasps**

**Bob Brown**

[brownb@landcareresearch.co.nz](mailto:brownb@landcareresearch.co.nz)



# Wasp biocontrol project committee

- Funded by MPI Sustainable Farming Fund
- Top of the South Island
- Contributors from:
  - Nelson Forests Management
  - The Landcare Trust
  - Friends of Rotoiti
  - Federated Farmers
  - DOC St Arnaud
  - Entecol
  - National Beekeepers Association
  - Rural Women NZ
  - Environment Bay of Plenty
  - Greater Wellington Regional Council
  - Beef and Lamb New Zealand

Funded by Sustainable Farming Fund

Ministry for Primary Industries  
Manatū Ahu Matua



- Tasman District Council
- NZ Wine
- Forest & Bird
- ECAN
- Waikato Regional Council
- Marlborough Wine Research Centre
- Marlborough District Council
- And several others







# Why are *Vespula* so invasive in NZ?

- Life cycle
  - Long overwintering diapause
- Biology
  - **Social**, generalist predators
- NZ environment
  - Mild conditions
  - Honeydew!
- Open niche...no natives in this family
- **No natural enemies**





# Nearest relatives of targets in NZ

## VESPIDAE

*Ancistrocerus gazella* (Panzer, 1798)

*Polistes chinensis* (Fabricius, 1793)

*Polistes dominula* (Christ 1791)

*Polistes humilis* (Fabricius, 1781)

*Vespula germanica* (Fabricius, 1793)

*Vespula vulgaris* (Linnaeus, 1758)

- **No native species in this family**
- **Bumblebees nearest beneficial relatives with similar social behaviour, colony & nesting ecology**
  - *Bombus terrestris*



# How & where to find new agents?

- **Origin:** Both *Vespula* species from southern UK (Lester et al 2014 & Brenton-Rule et al 2018)
- **Literature review:** - compiled list of likely BC candidates
- **Host range:**
  - Taxonomy of closest relatives (centrifugal phylogeny)
  - Similar ecology (social, ground/cavity nesting)
- **Range:** UK naturalists have great records of species & ranges covering a long period of time
- **Survey:** Which candidates are actually found in nests



# Native range tests and surveys

- National Bee Unit (NBU) part of Animal & Plant Health Agency (APHA) UK
  - Surveys of bee hives since 1950's
  - Averaging **35,000** hives/year since 2010
  - <http://www.nationalbeeunit.com>
  - No reported detection of *Volucella inanis* or *Metoecus paradoxus*
- Host tested *Bombus terrestris audax*
  - No attack on brood

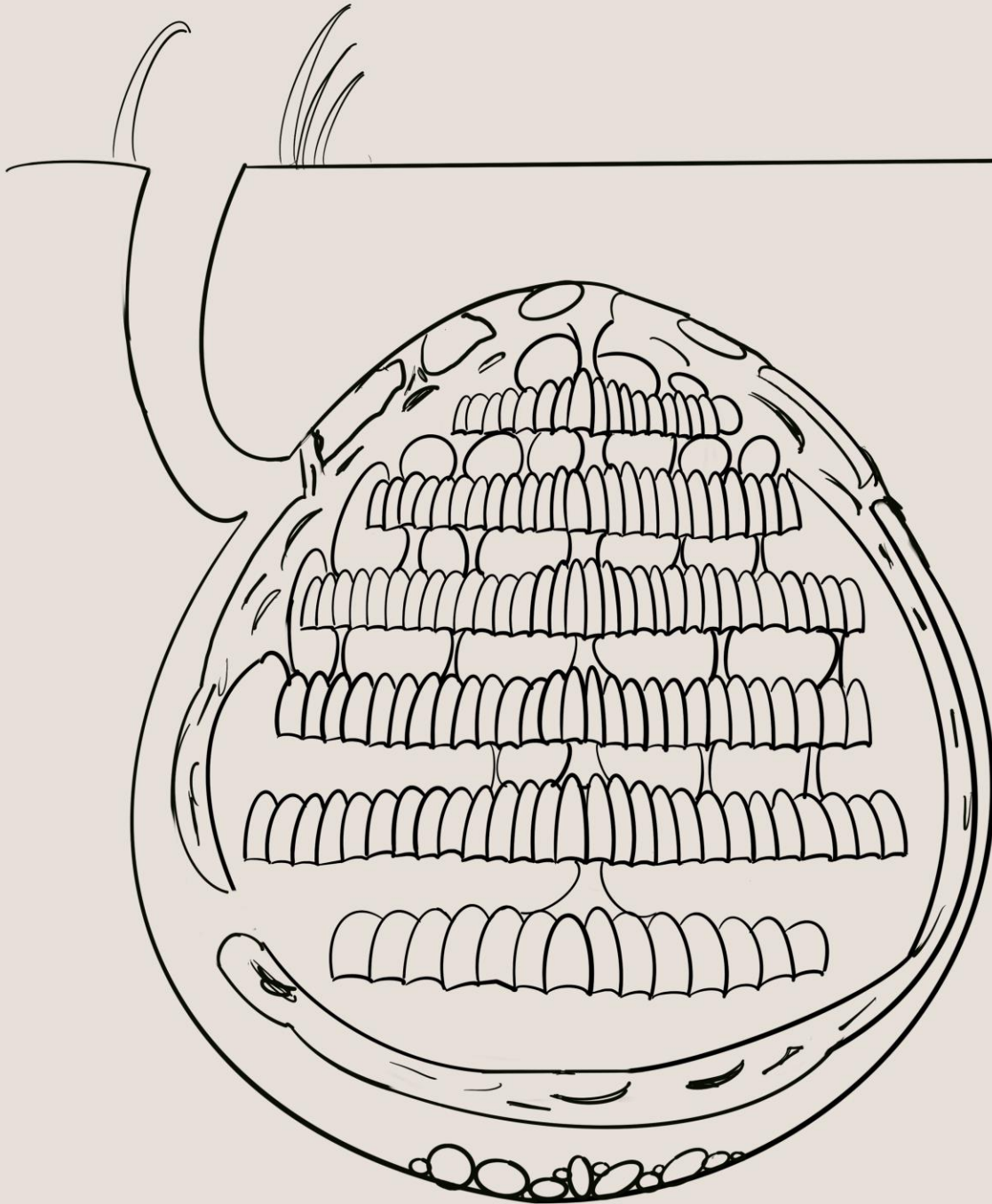




# *Volucella inanis*

- Brood parasitoid of *Vespula*
- Found in most nests in 2016 – 2019 UK surveys ( $\geq 85\%$ )
- High fecundity ( $> 600$  eggs)
- Excellent fliers
- 1 fly larva feeds on multiple wasps ( $> 2$ )
- Morphological adaptations (flattened larval stage)















# *Metoecus paradoxus*

- Brood parasitoid of *Vespula*
- Also found in 50% *V. vulgaris* nests in 2016 – 2019 UK surveys
- High fecundity (up to 700)
- 1 beetle larva consumes 1 wasp
- Chemical adaptations

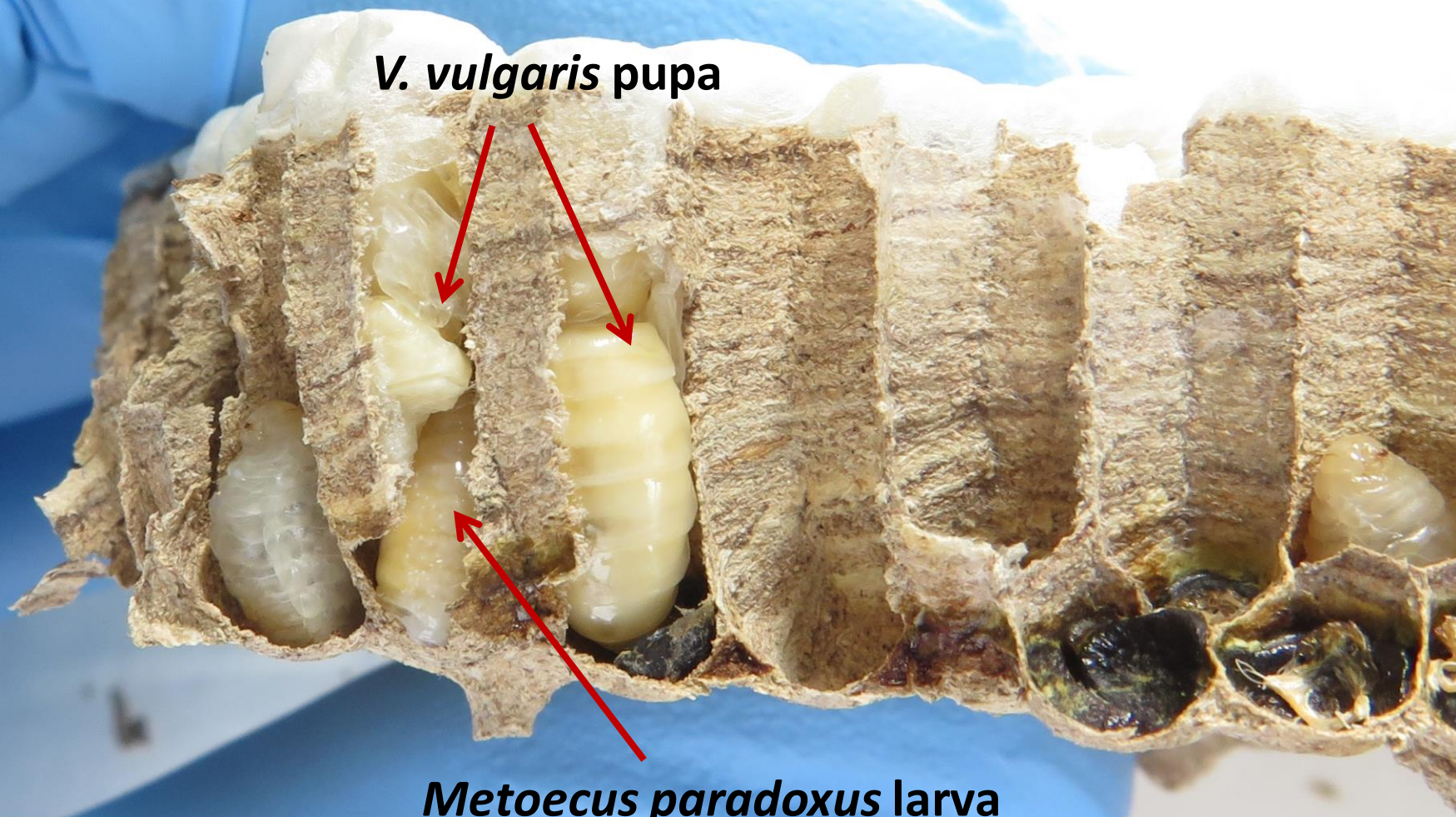






***V. vulgaris* pupa**

***Metoecus paradoxus* larva**





# Food webs & ecosystem effects

- No shared parasitoids with native insects
- Impacts within nests
- Pollen & nectar feeding by adults will be minor
- Some will be preyed on by generalist predators (spiders, mantids)
- Any indirect ecosystem effects will be miniscule compared to wasps current effects



# Not a silver bullet

- Landscape scale
  - Self perpetuating (once established)
- IPM
  - Biocontrol considered part of a larger suite of tools
  - Lower population densities => other tools more effective (mating disruption, localised chemical control)



# Next steps

- Collect/import agents from UK
- Develop mass rearing techniques
  - 1,000s of each species needed
- Release sites
- Small releases at first
- Monitor establishment
- **Get funding support**





# Please get in touch

- [brownb@landcareresearch.co.nz](mailto:brownb@landcareresearch.co.nz)