



Manaaki Whenua  
Landcare Research

# Feasibility for biocontrol of paper wasps

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## *Polistes* in NZ

- *P. humilis* from 1880s
- *P. chinensis* from 1979
- *P. dominula* from 2013



- *P. olivaceus* (?) several sitings, failed to establish (Harris 1979)



## *Polistes* vs *Vespula*: What is the difference?

<i>Polistes</i>	<i>Vespula</i>
Primitively eusocial	Eusocial
Sm to med colony size <500	L (to XXL)* colony ~3,000-4,000 * multi-season > 100,000
Open nest, above ground, <u>often on human structures</u>	Closed nest, in cavities, usually in ground
Generalist predators, nectar feeders	Generalist predators, scavengers, nectar feeders
Throughout NI, still spreading in SI	Throughout NZ











# Impacts of *Polistes spp*

## Human health

- Tendency to nest around human structures > increased risk of a stings
  - Severe allergic reaction known as anaphylactic shock, which can be fatal if not treated promptly
  - most insect stings of Aucklanders 1992/93 survey (Dymock et al. 1994)

## Environmental

### • Predation

- Generalist predators: prey on a wide variety of arthropods, but usually prefer caterpillars (Leps.) (Clapperton 1999)
- Up to 200 nests/ha in Northland can remove ~1 kg of insect prey, per hectare, (Clapperton 1999)
- No native social wasps in NZ
  - Lack of co-evolution for defense, competition, etc

### • Economic/Environmental

- Known to prey on weed biocontrol agents (Paynter et al. 2019)
- May contribute to poor or slow establishment (Paynter et al. 2019)



# Why are Polistes 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**



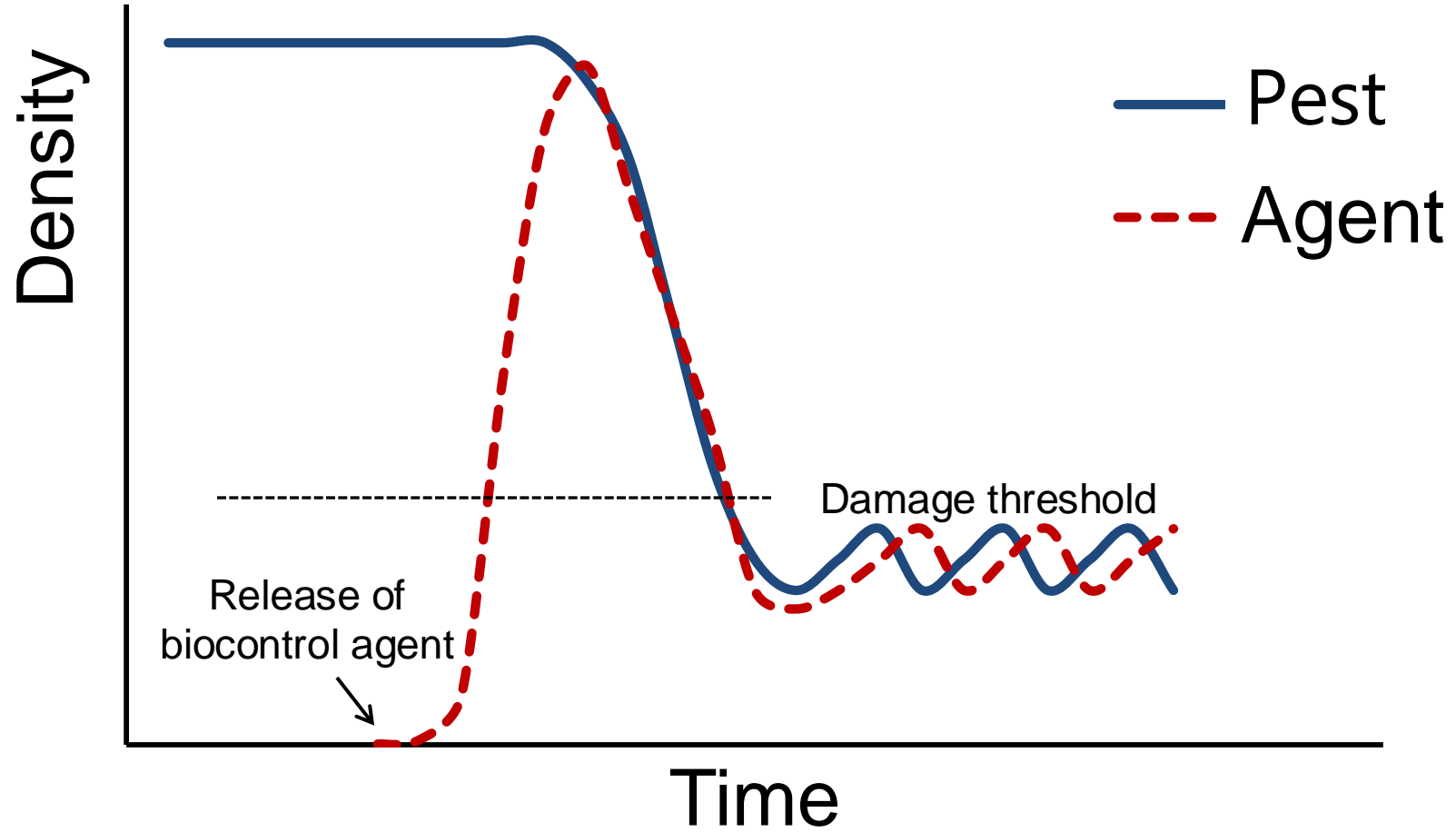




# Why biological control?

- Limited control methods
  - Direct poisoning
  - Sweet bait trapping
- *Polistes* very well studied genus
  - Sociality (NA, SA, EU & Asia)
  - Colony dynamics
  - Natural enemies
    - Literature on parasitoids, predators, other
- Easy to observe
  - Nests can be approached safely for assessments
  - Better to involve citizen scientists
- Best use of funding

# Target – biocontrol agent relationship





# Nearest relatives of targets in NZ

## VESPIDAE

*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**

Can we balance host specificity with increase of biotic resistance to new incursions?

The ability to attack multiple *Polistes* spp. could be particularly useful in New Zealand, where control of three *Polistes* spp. is currently needed.



# Potential biocontrol agents

- Predators/parasitoids from several orders
  - Diptera
    - Tachinidae
    - Phoridae
    - Sarcophagidae
  - Hymenoptera (at least 27spp)
    - Ichneumonidae
    - Chalcidae
    - Eulophidae
    - Plus!
  - Lepidoptera (11+ spp)
    - Crambidae
    - Pyralidae
    - Tineidae
  - Strepsiptera (24+ spp)
    - Xenidae



# Potential biocontrol agents

- Diptera
  - *Anacamptomyia*
  - *Euvesporia*
- Hymenoptera
  - Eulophidae
    - *Elasmus* (4 spp)
      - *E. schmitti* found 8-43% of *P. dominula* nests (Rusina 2013)
      - Very wide host range within *Polistes* (10 spp)
    - Ichneumonidae
      - *Latibulus* (5 spp)
        - Found on *P. dominula* & *P. chinensis*
        - wide host range within *Polistes*
        - Up to 80% nests parasitized, 1/3 had >10% of cells infested (Rusina 2013)
      - *Pachysomoides*
        - Very wide host range within *Polistes* (10 spp)





# Potential biocontrol agents

- Lepidoptera
  - Crambidae
    - *Chalcoela*
      - *iphitalis*
        - » wide host range within *Polistes* (10 spp)
        - » can be very damaging 40-73% (Strassmann 1981)
      - *pegasalis*
        - » wide host range within *Polistes* (9 spp)
        - » can be very damaging up to 50% of cells (Rau 1941)
- Strepsiptera
  - Xenidae
    - *Xenos*
      - Can be very specific





## Summary

- Many potential biocontrol options are available for further investigation
- NZ has no native Vespidae species
  - Host specificity at subfamily level could be viewed as a positive attribute
  - Balance host specificity with increase of biotic resistance to new incursions
  - Could be instrumental in slowing establishment of any new *Polistes* arrivals in New Zealand
- Classical BCAs capable of attacking multiple species of *Polistes*, might be more cost-effective than species specific to each *Polistes* species
- Ability to attack multiple *Polistes* spp. would not only be useful in New Zealand, but through the Pacific Islands, where *Polistes* spp. control is currently needed



## Next steps

- Is there enough demand?
- Develop a biocontrol programme with a community
- Funding