

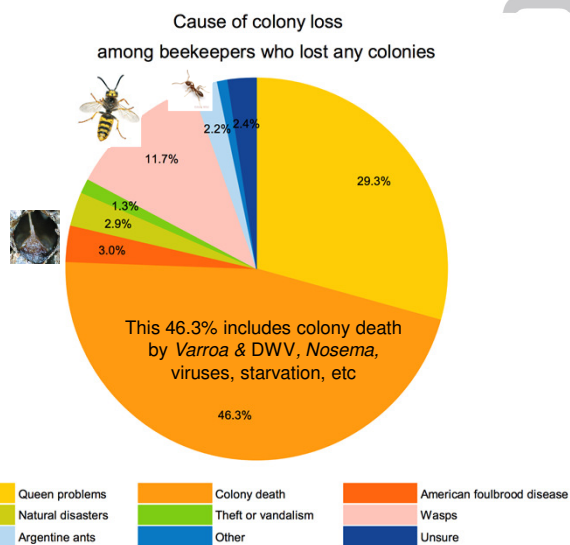
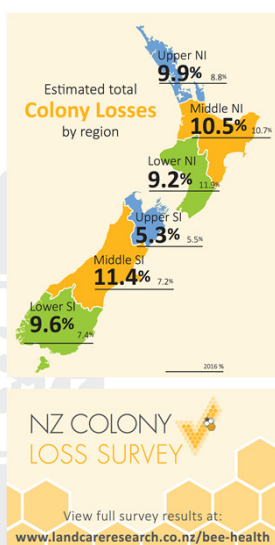
Pathogen dynamics in NZ bees: viruses, *Nosemas* and *Crithidia* (& American Foulbrood)



Phil Lester
School of Biological Sciences, Victoria University
Phil.Lester@vuw.ac.nz

Victoria
UNIVERSITY OF WELLINGTON
Te Whare Wānanga
o te Ūpoko o te Ika a Māui
CAPITAL CITY UNIVERSITY

NZ Colony Loss Survey



NZ Colony Loss Survey: Wasps, predation & viruses

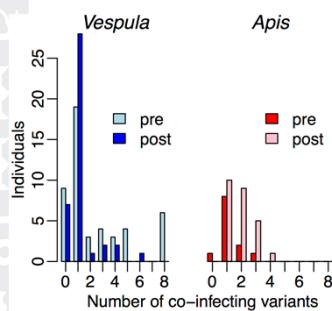


- Each year wasps cost apiculture \$9 million in direct costs (control, replacement) & \$58 million in indirect costs
- Wasps **can** carry *Nosema*, Deformed Wing Virus (DWV), Kashmir Bee Virus (KBV), Acute Bee Paralysis Virus (ABPV), Israeli Acute Paralysis Virus (IAPV), & *Crithidia*

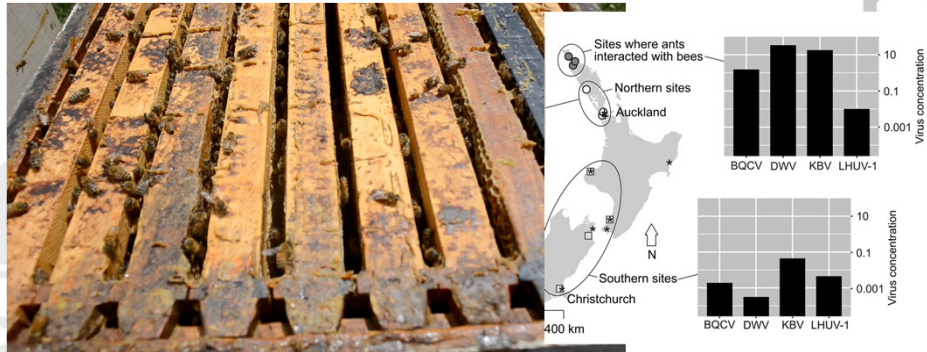
Brenton-Rule et al. (2018) The origins of global invasions of the German wasp (*Vespula germanica*) and its infection with four honey bee viruses. *Biological Invasions* 20: In Press

Wasps carry “bee” viruses

- Our work in Hawaii suggests wasps can carry more DWV viral variants than bees
- DWV was present in Hawaii prior to *Varroa*, but the introduction of *Varroa* changed the viral & pathogen landscape in wasps and bees



NZ Colony Loss Survey: Argentine ants & viruses



- Argentine ants attack and destroy hives
- Hives present with Argentine ants typically have high virus load: DWV, KBV & BQCV

Gruber et al. (2017) Single-stranded RNA viruses infecting the invasive Argentine ant, *Linepithema humile*. Scientific Reports 7: 3304

Previous surveys and odd virus distributions

Journal of Apicultural Research 53(5): 520-527 (2014)
DOI 10.3896/IBRA.1.53.5.03

© IBRA 2014

ORIGINAL RESEARCH ARTICLE

Israeli acute paralysis virus not detected in *Apis mellifera* in New Zealand in a national survey

Andrew M J McFadden¹, Kok-Mun Tham², Mark Stevenson³, Mark Goodwin³, Howard Pharo⁴, Byron Taylor⁵, Grant Munro¹, Katie Owen⁶, Lora Peacock¹, Wlodek L Stanslawek¹, Matthew Stone¹

¹Ministry for Primary Industries, Investigation and Diagnostic Centre, Wallaceville, New Zealand.

²Epicentre, Massey University, New Zealand.

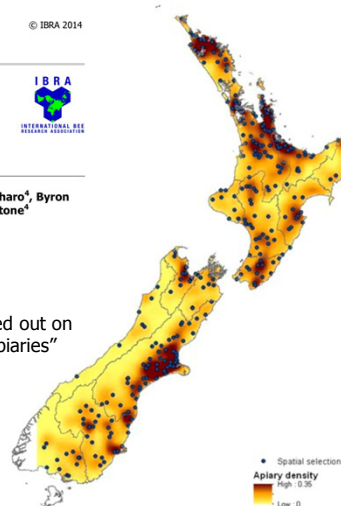
³Horticulture Research, Auckland, New Zealand.

⁴Ministry for Primary Industries, Pastoral house, Wellington, New Zealand.

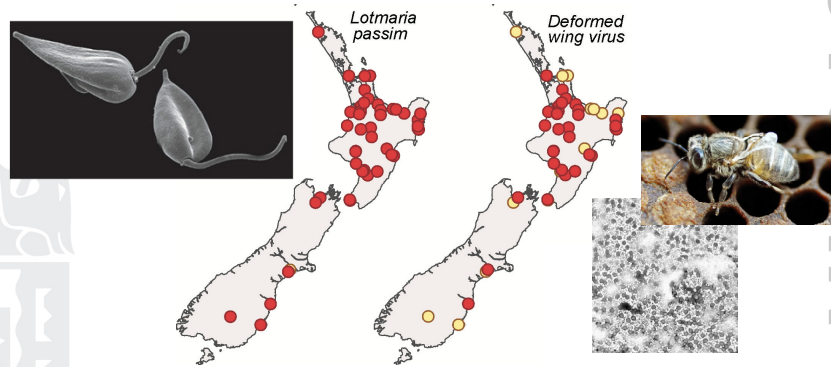
⁵AssureQuality, Hamilton, New Zealand.

"In total, 1050 tests were carried out on honey bee samples from 499 apiaries"

- Why isn't IAPV in NZ?
- Why isn't DWV in Australia?

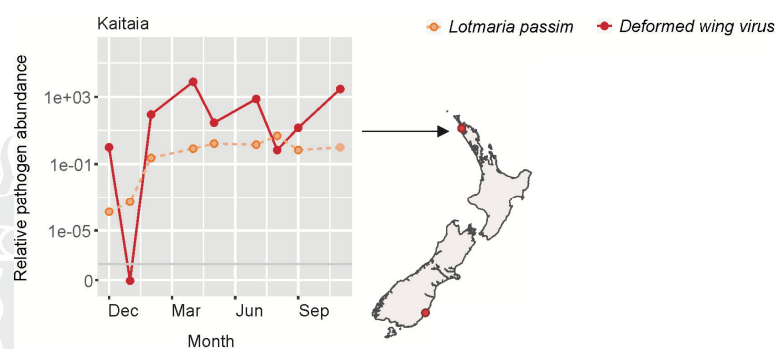


Distribution of *Crithidia mellificae*/ *Lotmaria passim* & DWV



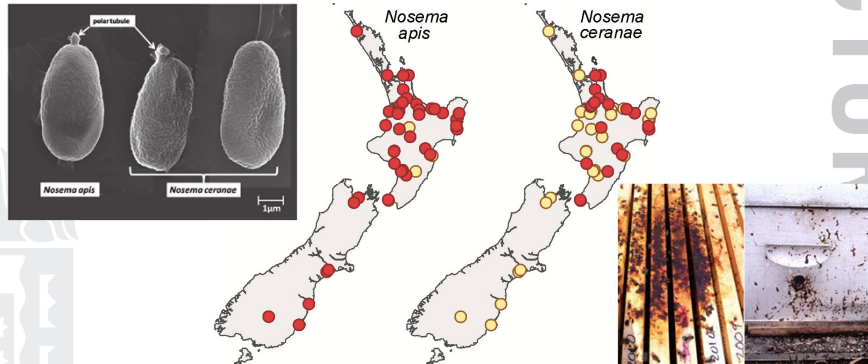
- Our survey found only *Lotmaria passim* (no *Crithidia*) as THE most abundant and widespread pathogen
- Deformed wing virus (DWV) is everywhere

Dynamics of *Lotmaria passim* & DWV



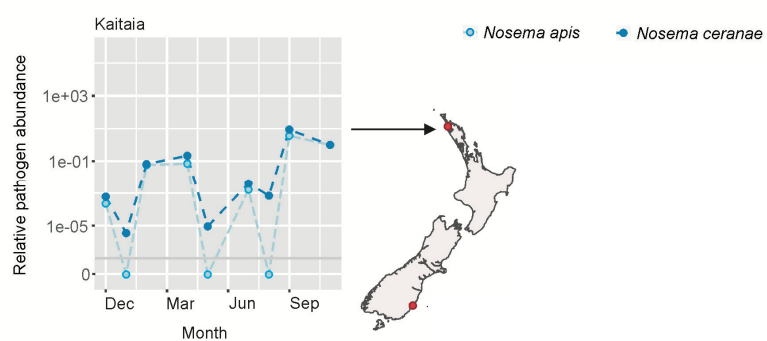
- Similar *Lotmaria* abundance throughout the year and between locations
- Slightly higher abundance of DWV in North Island, but no consistent seasonal dynamics

Distribution of *Nosema apis* & *Nosema ceranae*



- *Nosema apis* is everywhere
- *Nosema ceranae* seems limited (currently) to the North Island

Dynamics of *Nosema apis* & *Nosema ceranae*



- Little evidence of seasonal trends in the data
- *Nosema ceranae* seems limited (currently) to the North Island

Bee colonies wiped out as new parasite spreads through New Zealand

ROB TIPA
Last updated 07:04, June 22 2015



ROB TIPA/FAIRFAX NZ

Large numbers of bees are disappearing from hives.

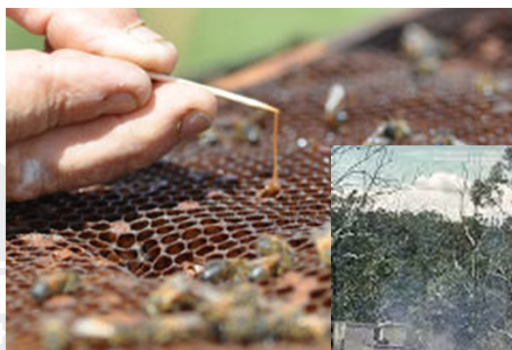
Independent scientists have identified a new parasite in bees on the Coromandel peninsula, one of several regions around New Zealand that have reported the loss of thousands of colonies of honey bees since last spring and a substantial drop in honey harvests since.

Lotmaria passim, a parasite that attacks the gut of honey bees, was only discovered by a team of American researchers about six months ago.

Its confirmed presence in Coromandel hives has rung alarm bells for beekeepers who fear another major biosecurity challenge for their industry, hard on the heels of the varroa mite which arrived in the North Island in 2000.

- *Nosema ceranae* 1st observed in Coromandel in 2010
- Outbreak of *Lotmaria* and *Nosemas* in Coromandel caused death of “thousands” of hives
- No antibiotic use allowed in NZ hives

American Foulbrood strains in NZ bees



American Foulbrood strains in NZ bees

- The four AFB genotypes differ in phenotype, including virulence at the larval level
- **“ERIC I”** takes ~ 12 to 14 days to kill all infected individuals.
 - ERIC I considered to be less virulent and the other three genotypes
 - The most frequent genotype and is present in Europe and in America
- **“ERIC II” to “ERIC IV”** larvae are killed within only 6 to 7 days
 - are considered to be highly virulent on the larval level.
 - *“ERIC II seems to be restricted to Europe”*
- **“ERIC III” and “ERIC IV”** have not been identified in field for decades, but exist in culture collections

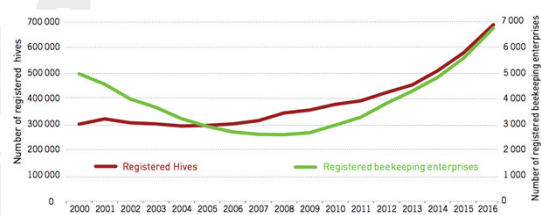
American Foulbrood strains in NZ bees

- Our results, so far, show that New Zealand has:
 - **“ERIC I”** (takes ~ 12 to 14 days to kill all infected individuals, less virulent and the other three genotypes, & most frequent genotype and is present in Europe and in America)
 - **“ERIC II”** (larvae are killed within only 6 to 7 days, considered to be highly virulent on the larval level, & *“ERIC II seems to be restricted to Europe”*)
 - (Plus an odd strain, or sub-genotype)



A few take-home messages

- Your bees carry multiple pathogens at any one time
- Your bees carry multiple strains of these pathogens
- The same can be said for wasps, ants and other insects that are around your hives
- High hive (or wasp, etc.) densities are likely to mean high disease prevalence and exchange



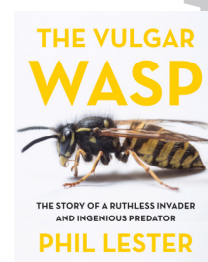
Notes
 1 Registered beekeeping enterprises and hives under the National Pest Management Plan for American Foulbrood.
 Varroa was discovered in hives in New Zealand in 2003.
Source:ASUREQuality Limited.



Thanks!



Tammy Waters



A "great, spectacularly awesome book"
 I have a few copies with me, but also available from
 Victoria University Press <http://vup.victoria.ac.nz>