

From Varroa to Bumble Bees

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Overview...

- Varroa
 - Description/lifecycle
 - So what's so bad about Varroa?
 - Status – Global, Domestic
 - Impact
- Alternative pollinators
- Bumble bees
 - Why you can't use them (legally)
 - What needs to be done



Species description

- Originated in Java
- Thought to be single spp. (*V. jacobsoni*)
- Original host *Apis cerana*
- *Shown to be two spp.*
- Several strains (haplotypes) of *V. destructor*
- Only 2 are pathogenic to *A. mellifera*
 - *Korean*
 - *Japanese/Thailand*
- Korean strain most abundant
- *A. mellifera* has no natural defence



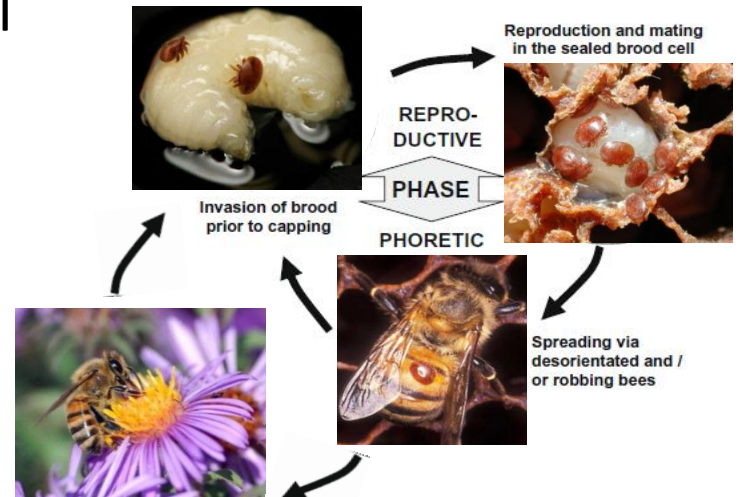
Apis cerana
Asian Honeybee



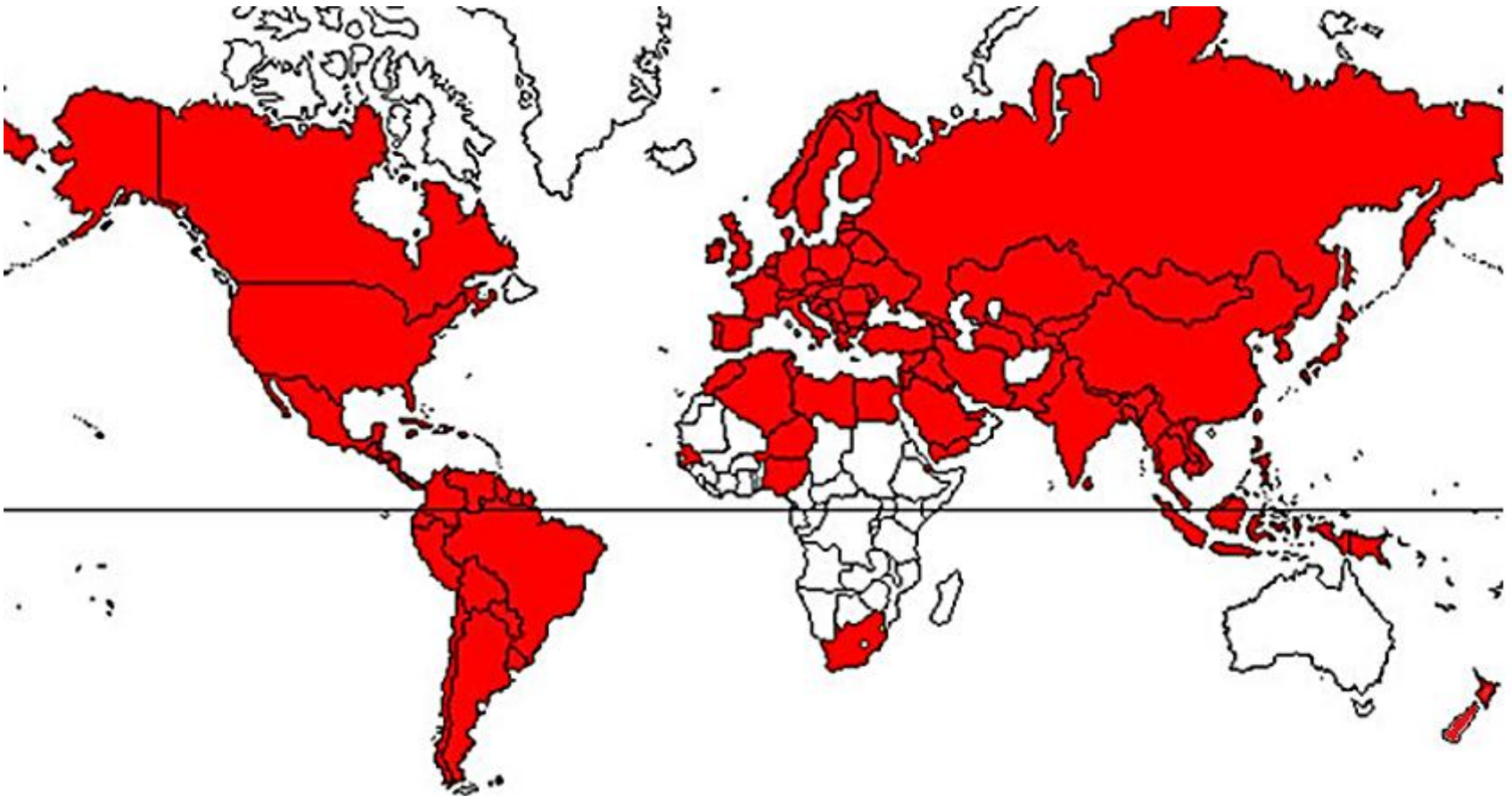
Apis mellifera
European Honeybee

Varroa - Lifecycle

- Reproduction occurs in bee brood cell
- Females lay up to 18 eggs over 7 reproductive cycles
- Drone (male) brood preferred
- Mother lays 1 male egg and several female eggs
- Males and juvenile phases short lived
- Feed on brood haemolymph
- Egg → Adult ca. 6 days
- Spread during hive robbing and foraging flights or on bee keeping equipment



Worldwide distribution



- Acute (0 - 4 years) Chronic (4+ years) infestations
- Stratified dispersal

How much damage could it do?

- **Parasitism**

- Haemolymph feeding - weakens brood

- **Disease vector**

- Deformed Wing virus
 - Kashmiri Bee virus
 - Sacbrood virus
 - Acute bee paralysis virus
 - Israeli acute paralysis virus
 - American and European Foulbrood (bacteria)
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- These viruses deemed minor issue prior to Varroa
 - 95% feral Honeybees killed within 3-4 years
 - Linked to Colony Collapse Disorder (CCD)



Australian Incursions

- 1999** - Brisbane (*V. jacobsoni* on *A. cerana*) – Shipment of earthmoving equipment from PNG
- 2002** - Melbourne (*V. jacobsoni* on *A. cerana*) – Shipping container from PNG
- 2004** - Brisbane (*V. jacobsoni* on *A. cerana*) – ship from PNG
- 2012** - Sydney (*V. jacobsoni* on *A. cerana*) – Bulk Fuel Carrier
- 2015** - Brisbane (*V. jacobsoni* on *A. cerana*) – shipment of cables from Malaysia
- Queen bee imports (*V. destructor* on *A. mellifera*)
- 2016** - Townsville 2 sites (*V. jacobsoni* on *A. cerana*) – shipping container stand

Impact on Agriculture – N.Z: a case study

- Discovered in:
 - 2000 on the North Island
 - 2006 on the South Island
- 47% loss of beekeepers due businesses/hobby becoming unprofitable
- Hive management cost increased by an average of \$40/hive
- Costs passed on to consumers and primary producers
- Due to decimation of feral bees (pollination) and high Manuka prices, number of hives increased
 - 295,000 in 2005 to 650,000 in 2016
- Estimated cost of invasion:
 - Both Islands **\$400 – 900 million** over 30 years
 - South Island **\$198 - 433 million** over 35 years

Impacts on Australia

- Predicted impact changes according to point of incursion due to area of production of and crops susceptibility to loss of pollinators
- It is estimated that a 10% decrease in pollinators could lead to a 23% decrease in production

Table 2 Present value of economic losses over 30 years, by port of entry and spread scenario

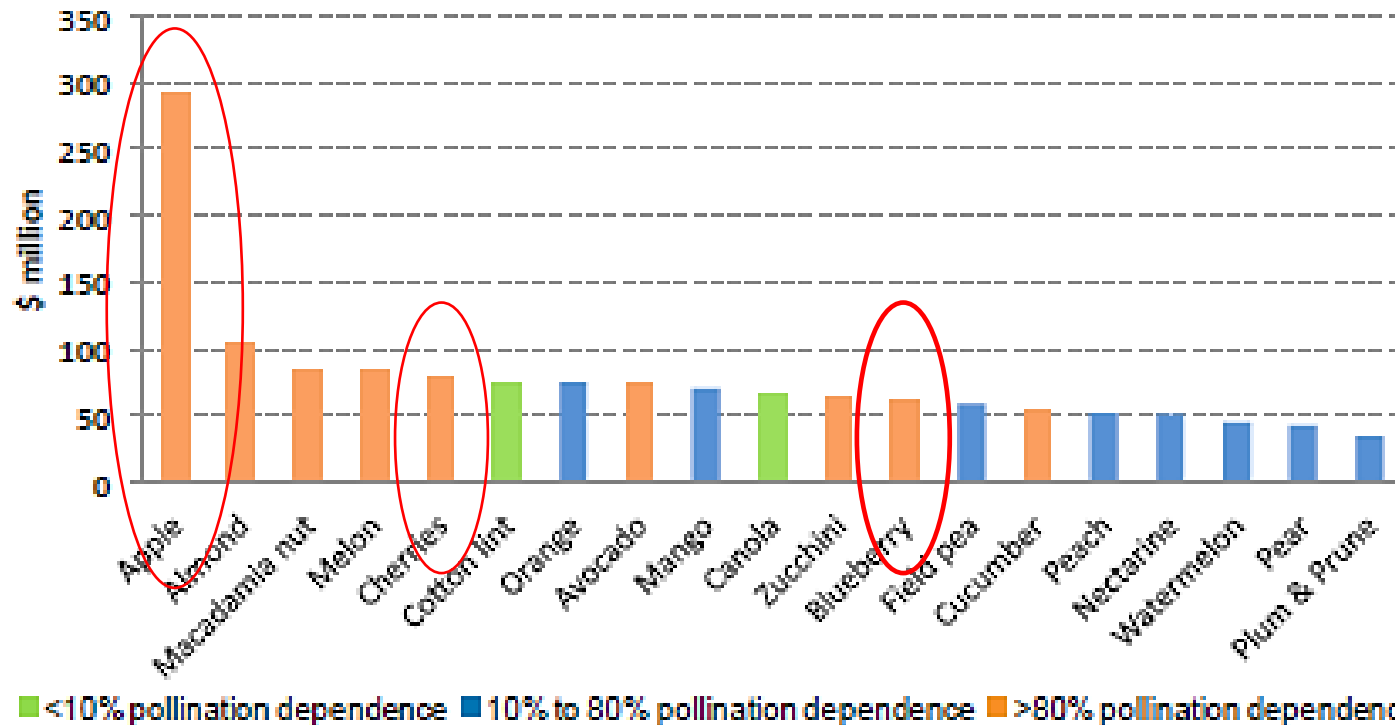
Port of entry and spread scenario	Economic losses		
	Producer (\$m)	Consumer (\$m)	Total (\$m)
<i>Sydney</i>			
Unhindered	647	604	1 251
Contained	427	398	825
<i>Melbourne</i>			
Unhindered	679	634	1 313
Contained	483	450	933
<i>Cairns</i>			
Unhindered	324	303	627
Contained	184	171	355

Note: Present value calculated at a discount rate of 7 per cent.

Impacts on Tasmania

Tasmania (2010/11) - Fruit \$88.5 million (apples \$40-50 million/year!)
- Vegetables \$93.5 million

Figure 6 Value of pollination-dependent production for top 20 crops: Australia



Note: Value of production dependent on honey bee pollination is the product of annual crop value and the percentage of crop dependent on honey bee pollination.

Alternative Pollinators

- Little research has been done on most of Australia's native bee species as pollinators
- The mainland has several known, commercially useful alternative pollinators
 - Solitary
 - Blue-banded bees (mainland wide)
 - Carpenter bees
 - *Megachile rotundata**
 - Stingless social bees
 - *Tetragonula carbonaria* (Northern NSW – Southern Qld)
 - *Tetragonula hockingsi* (N QLD)
- Tasmania doesn't!
 - Only bumble bees...



* Imported in 1987 to pollinate lucerne

Bumble Bees in Tasmania

- Accidentally introduced into Tasmania in ca. 1991
- First recorded at Battery Point, Hobart
- Introduced from New Zealand
- Possibly only 2 genetic lines present in the state
- Well established around the state including the World Heritage Area
- Known to be better pollinators of numerous horticultural crops than honey bees
 - Buzz pollinators
 - Active in cooler climates



Issues with using Bumble bees

1. It's currently illegal!
2. Timing of population peak size
3. Low genetic diversity in Tasmania
4. A lot of IP locked up commercially viable rearing techniques



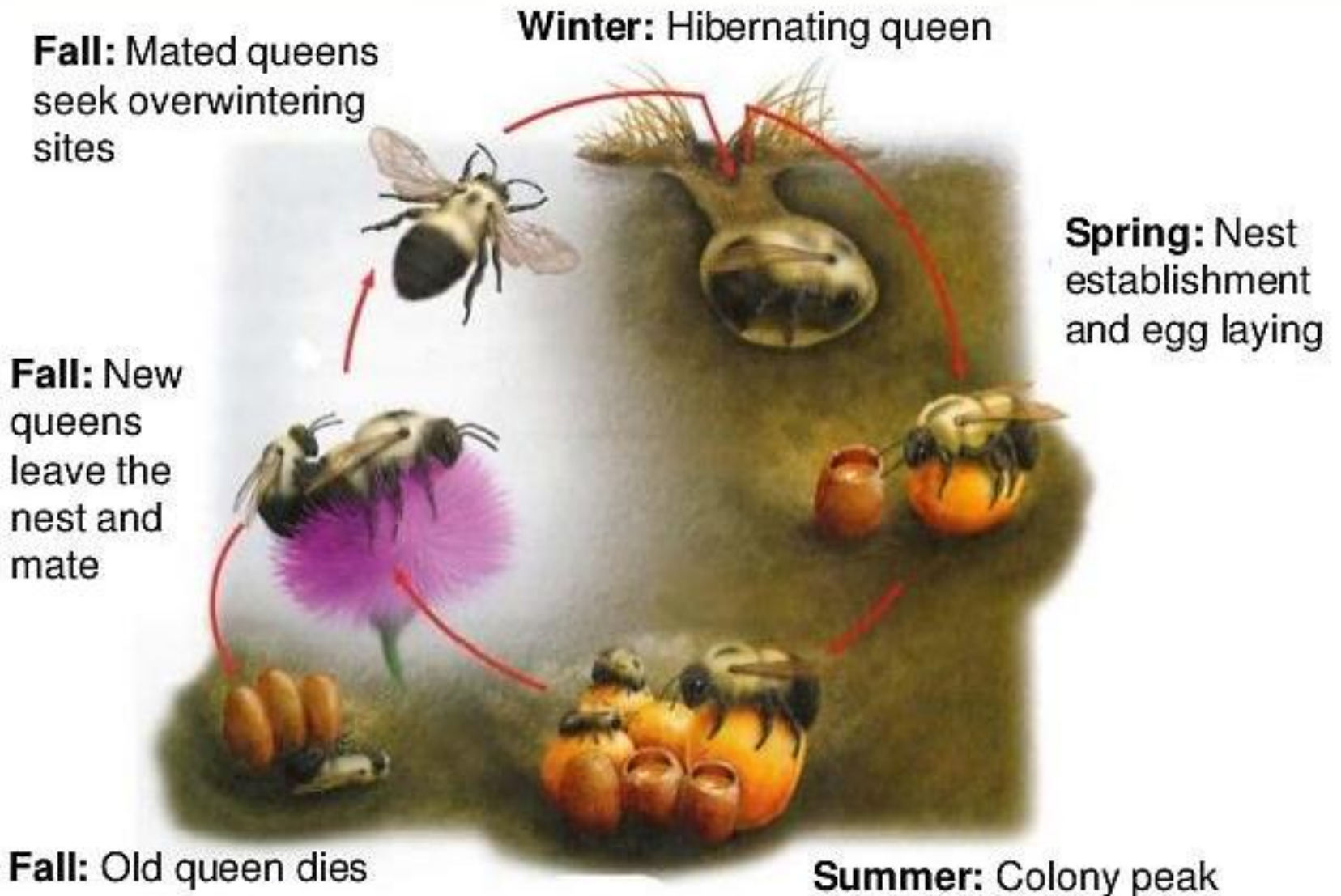
Economic Benefits compared to *A. mellifera*

- Tomatoes - 19%
- Blueberry - 3.4x*
- Raspberry - 8%
- Strawberry - 13%
- Capsicum - 6%
- Eggplant - 25%
- Pear - 13%



* Pollination success *B. terrestris* 24% v's *A. mellifera* 7%

Lifecycle



Environment Protection and Biodiversity Conservation Act 1999

A process is a ***threatening process*** if it threatens, or may threaten, the survival, abundance or evolutionary development of a native species or ecological community

- **Nationally** – Not listed as a key threatening process ¹
- **NSW** – Listed as a Key Threatening Process in 2000 ²
- **Victoria** – Potentially Threatening Process in 2000 ³
- **Tasmania** – Not listed

¹ <http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl>

² <http://www.environment.nsw.gov.au/determinations/BombusTerrestrisktpDeclaration.htm>

³ Victorian Scientific Advisory Committee. 2000. Final Recommendation on a Nomination for Listing: the Introduction and Spread of the Large Earth Bumblebee *Bombus terrestris* L. into Victorian Terrestrial Environments.

Tas. Gov's position – EPBC 1999

Section 303GN

Possession of listed regulated live specimens

(6) A person commits an offence if:

(a) the person has in the person's possession, in the Australian jurisdiction, a specimen; and

(b) the specimen is a regulated live specimen that is included in Part 2 of the list referred to in section 303EB, and the person is reckless as to that fact; and

(c) the specimen does not belong to a native species; and ...

Penalty: Imprisonment for 5 years or 1,000 penalty units (\$18,000), or both.

Senate hearing 2016

Several issues were raised from various parties:

1. Increased likelihood of introduction onto the mainland
2. Increased weed issues due to buzz pollination
3. Transmission of diseases to honey bees
4. Increasing the Tasmanian genetic pool
5. Encourage illegal introductions of other species
6. Tasmania's industries are too small to consider changing the ruling for!

What needs to be done?

- Wait for the Senate?
- Apply for a research permit...
 - Requires Ministers approval
 - Strong industry support will be crucial
- Investigate:
 - Viability of current genetic pool
 - Can we rear them on a commercial scale?
 - Is there a fitness cost?
 - Cost benefit analysis
 - Can mainland incursions be prevented?
 - Male sterility (diploid males)



Summary

- *V. destructor* will eventually arrive in Australia
- It will decimate feral European honeybee populations
- Complete loss of free pollination services
- Need for alternative pollinators
- Bumble bees should be available commercially
- Needs approval from the Federal Government

Thank you, Questions?