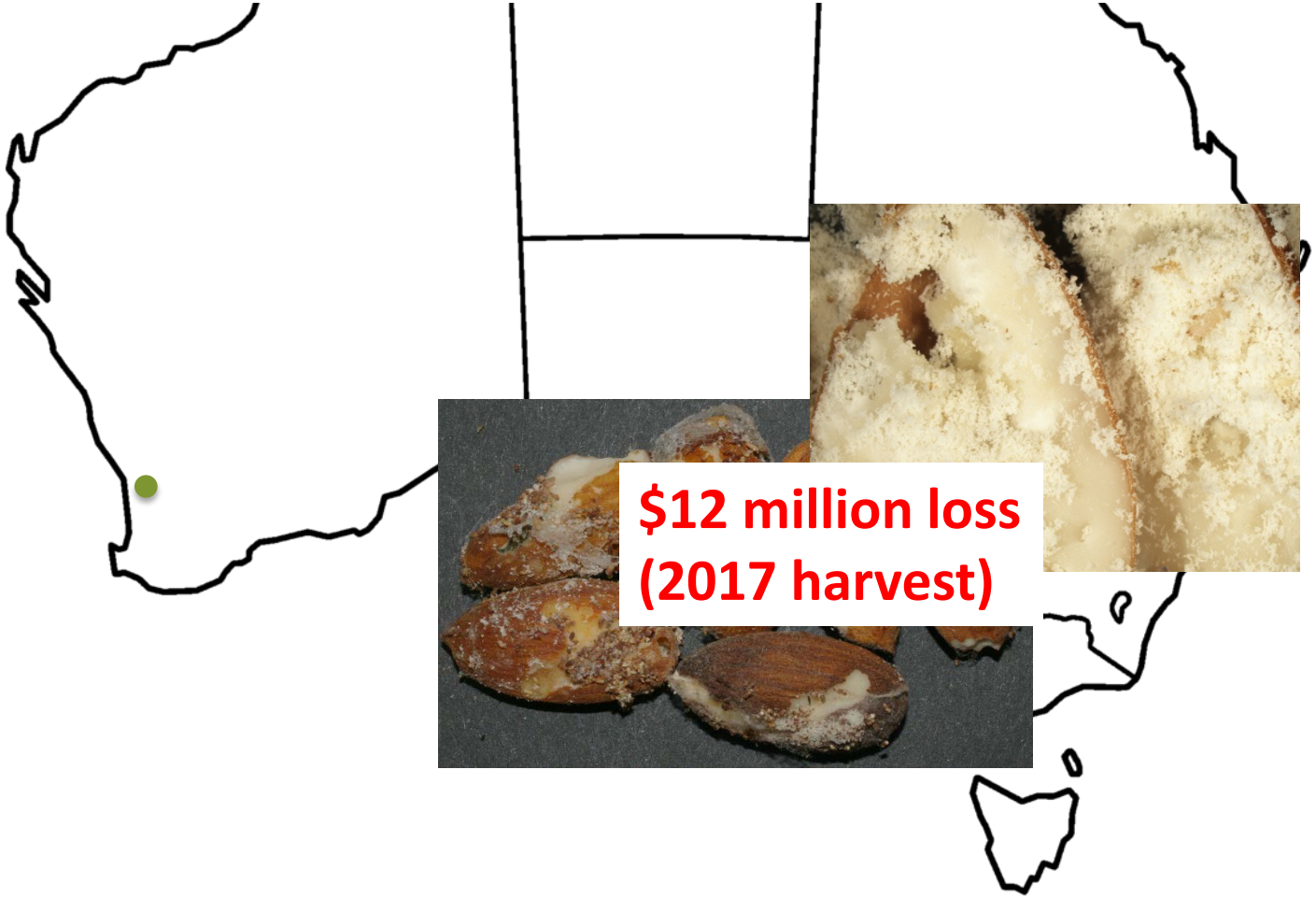
Orchard hygiene – why bother?

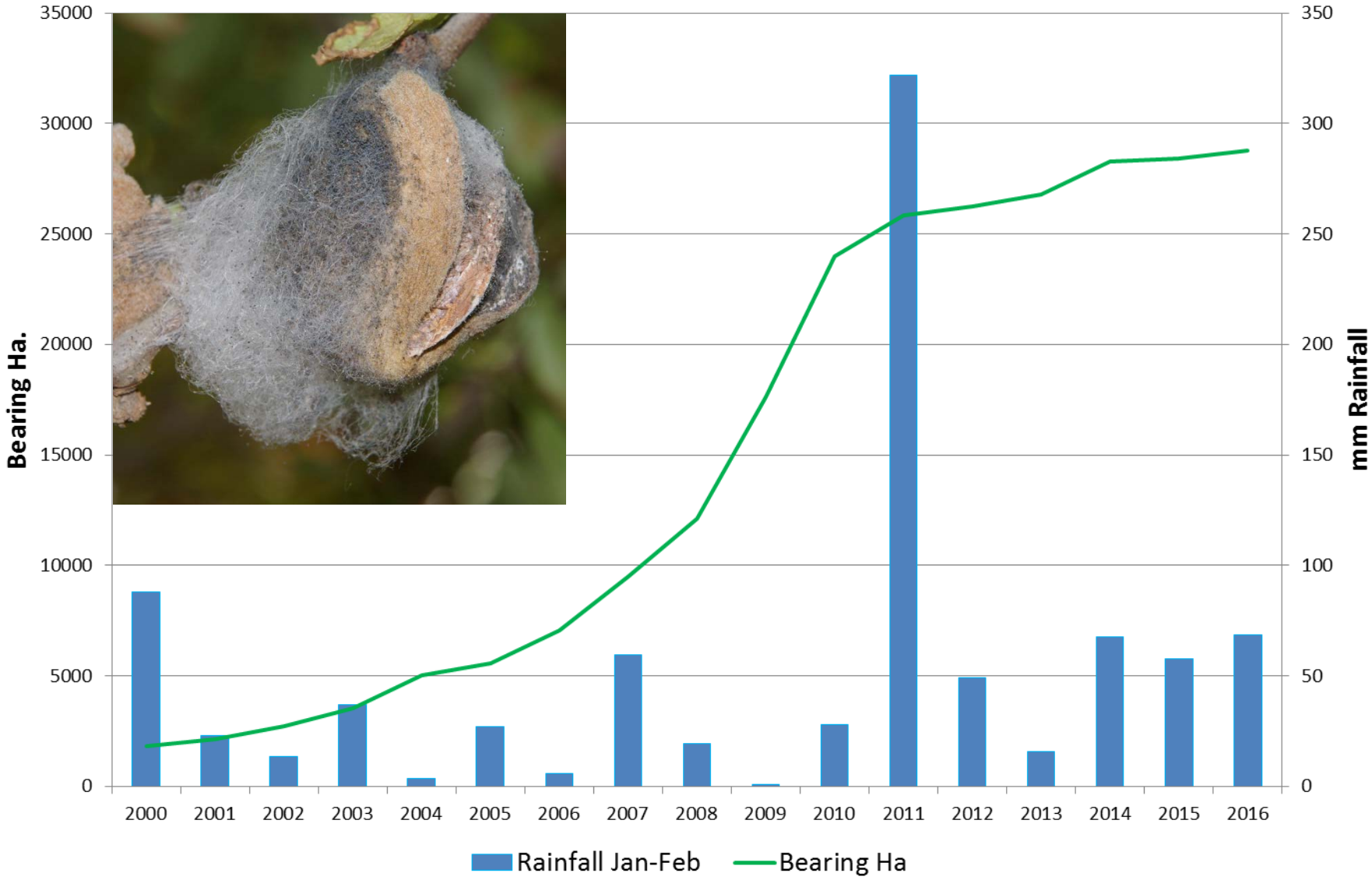
AGRICULTURE VICTORIA

Breeding ground for pests

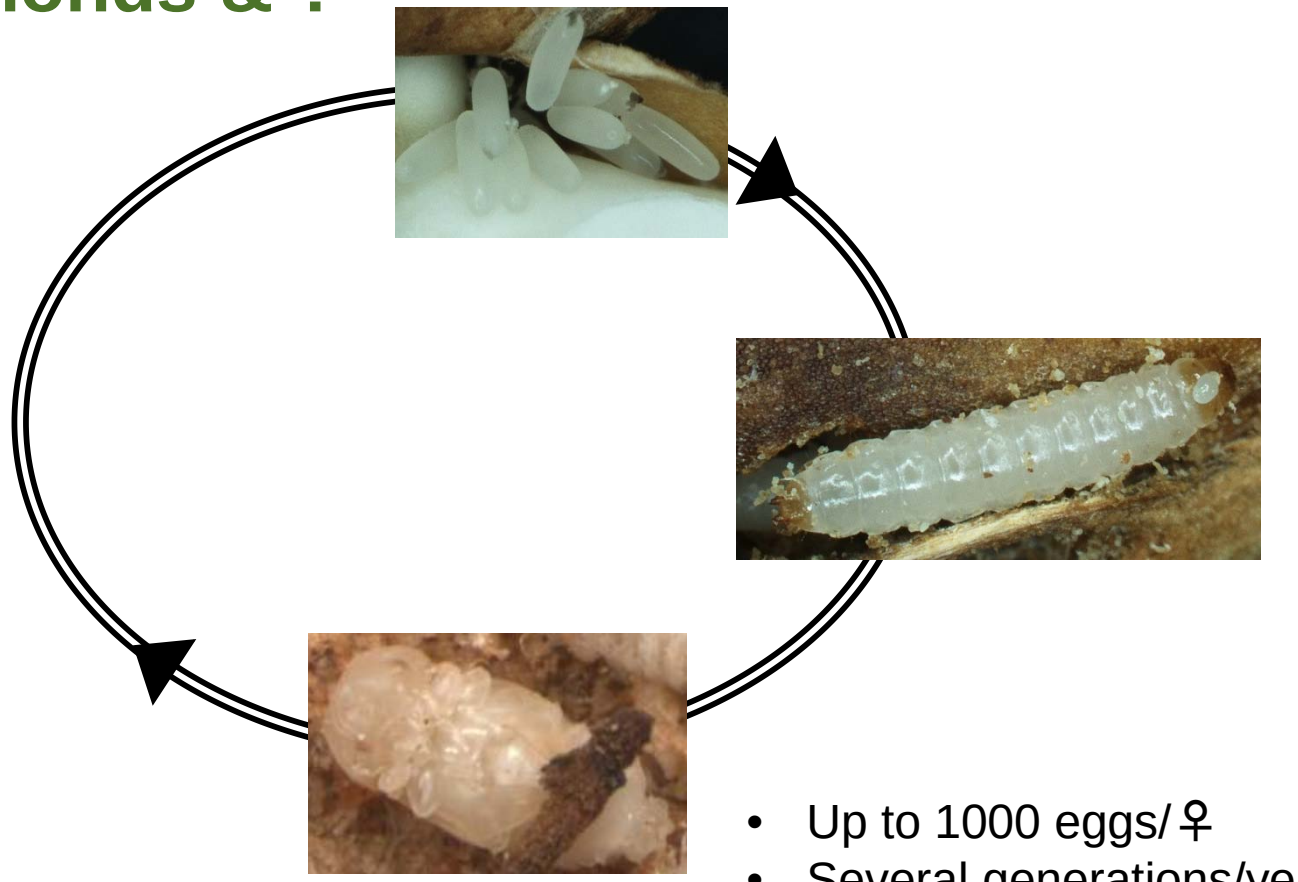
Almonds
Major horticultural crop
$464M export value 2016/17



Both pests survive winter and breed in mummy nuts


35000
30000
25000
20000
15000
10000
5000
0
Bearing Ha.
350
300
250
200
150
100
50
0
mm Rainfall
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Rainfall Jan-Feb
Bearing Ha

Carpophilus beetle (*Carpophilus sp*)
Australian native?
Hosts: Almonds & ?



- Up to 1000 eggs/♀
- Several generations/year

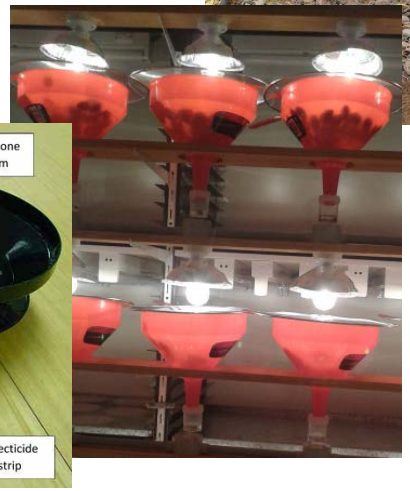
Carpophilus biology and Behaviour

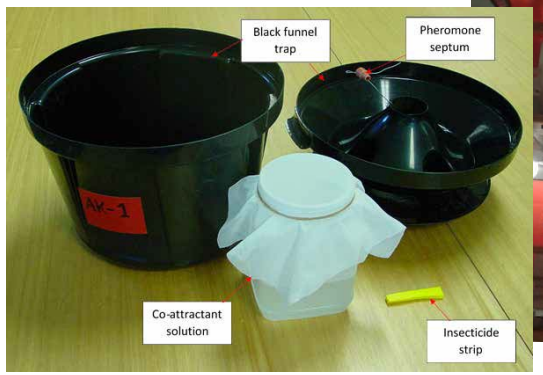
- Several generations per year
- Average 1071 eggs/ female
- Eggs hatch in 1-4 days
- Larval development takes 4-14 days
- Hibernate as mature larvae, pupae, and adults
- Mechanical carriers of fungal spores

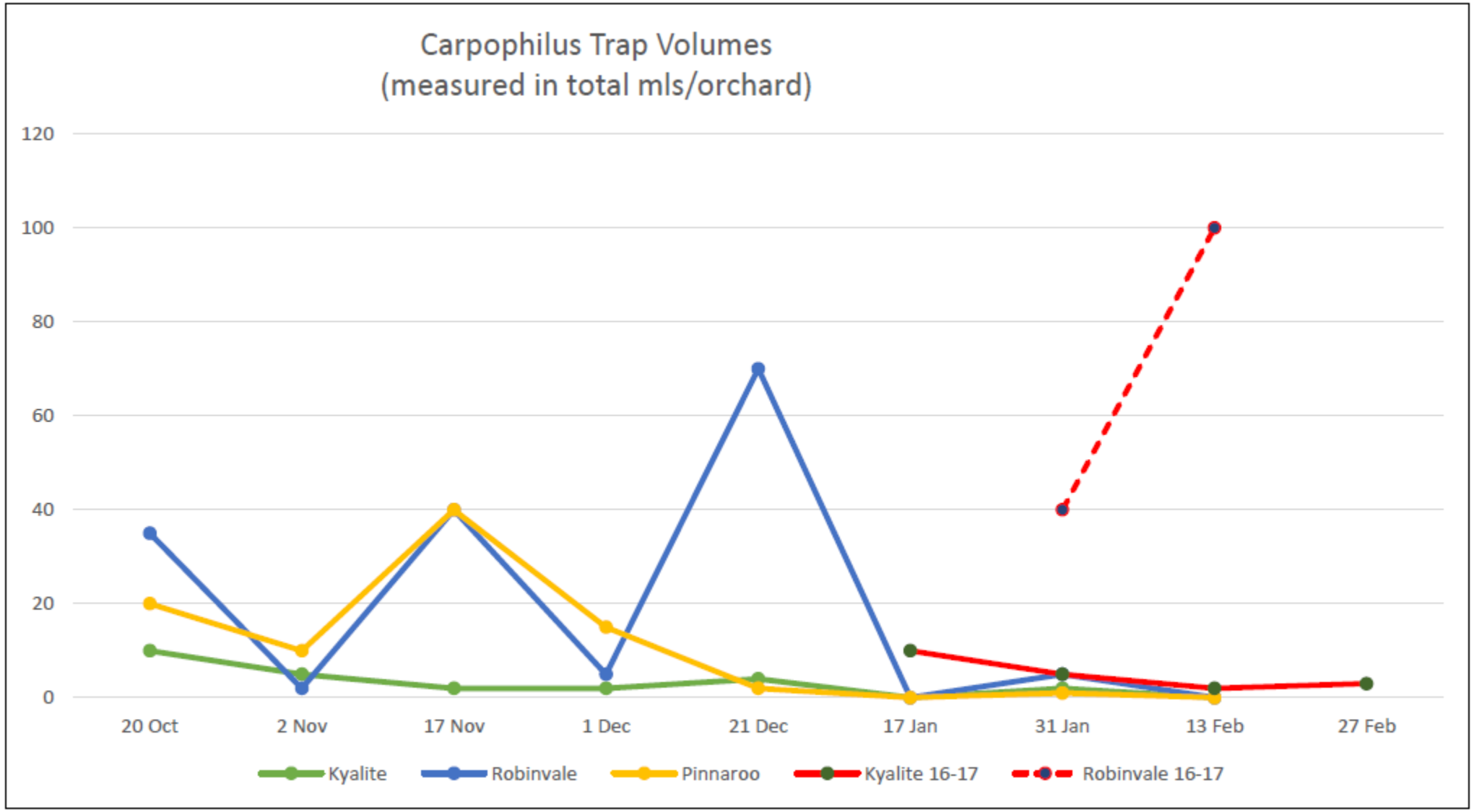
Carpophilus beetle

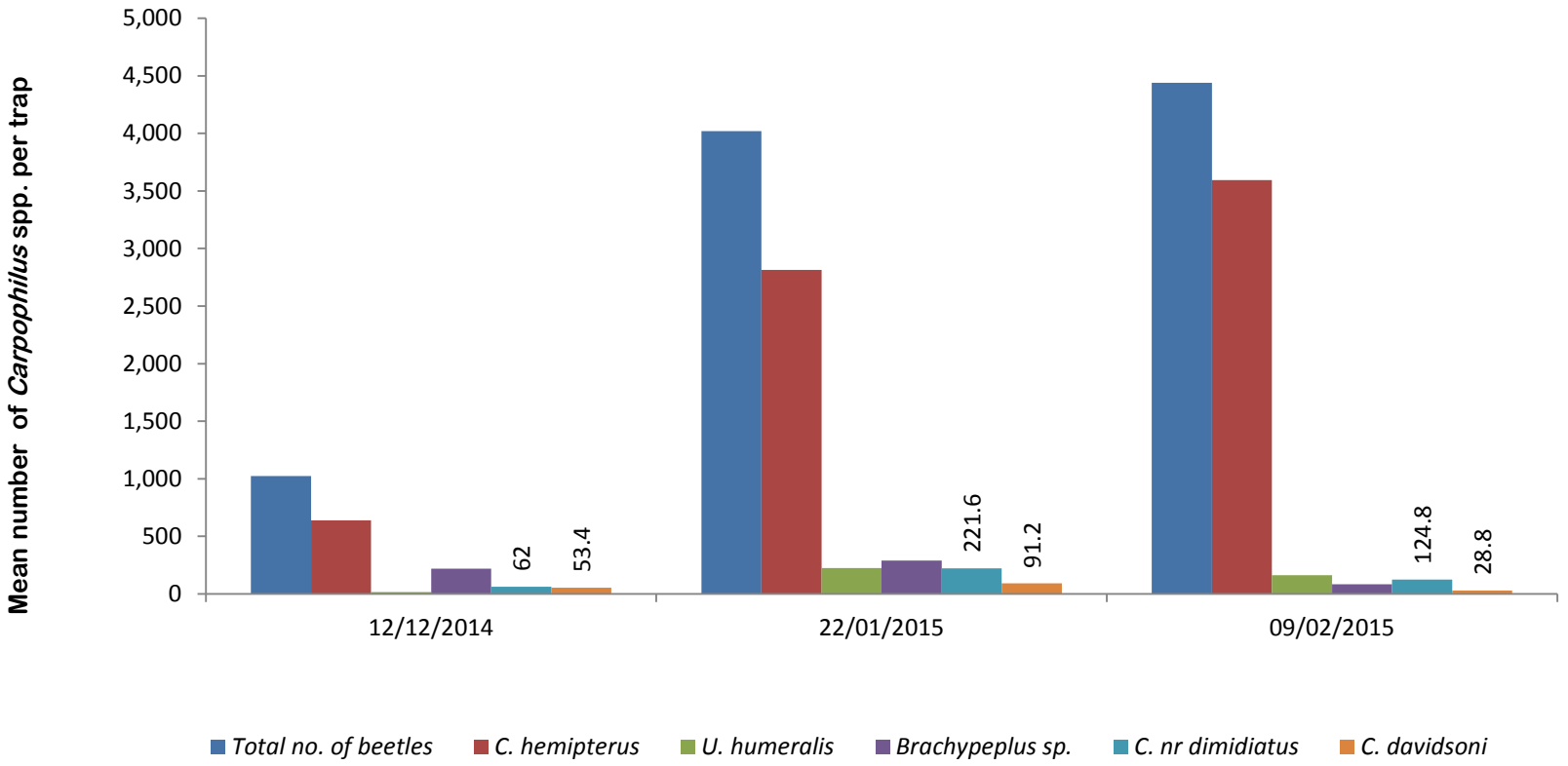
Research project 2015/16-17/18

- Seasonal abundance, species, distribution & behaviour
- Taxonomy
- Pesticide (industry)
- Mass ‘attract & kill’
- <u>Importance of mummies</u>



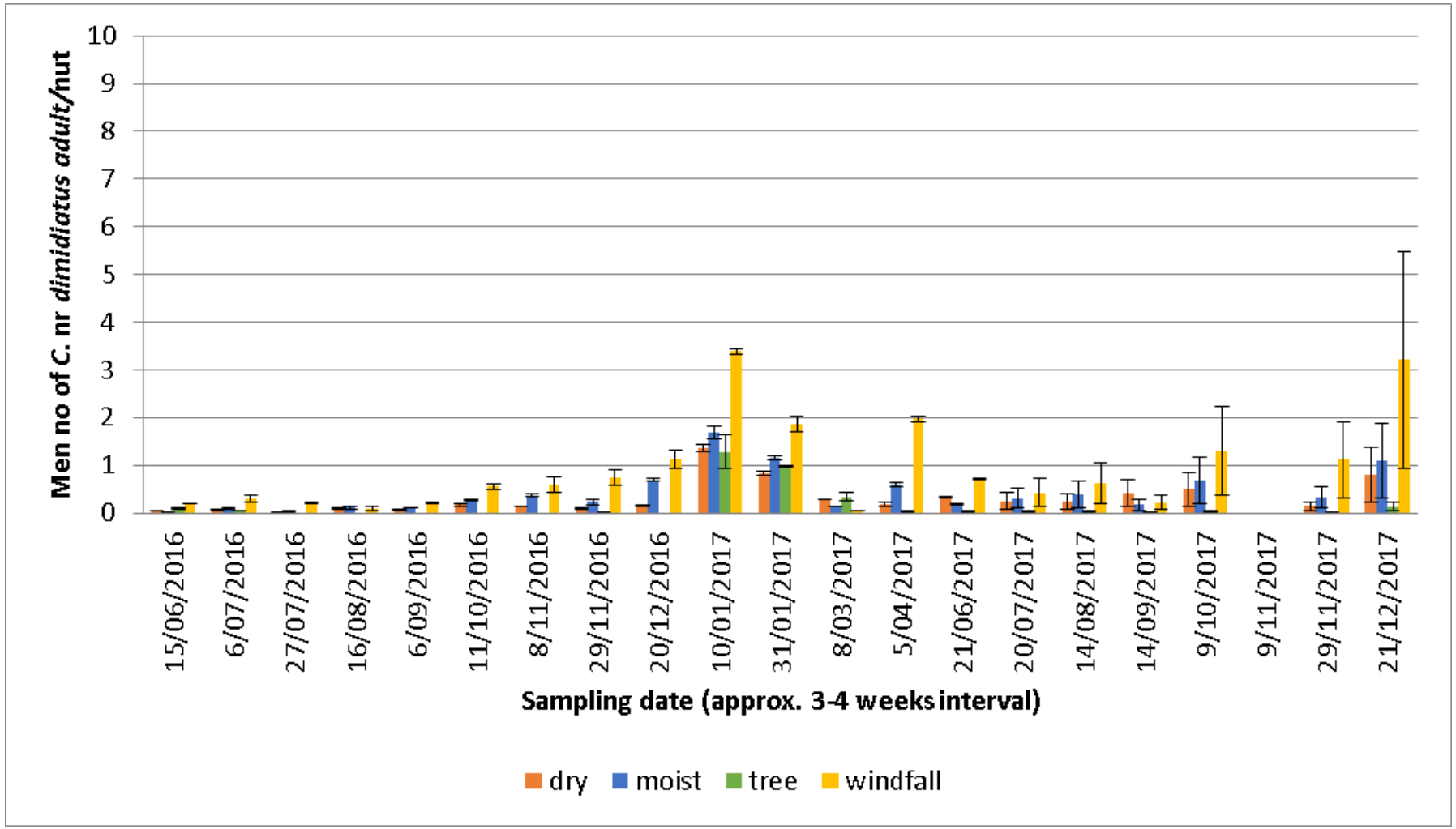


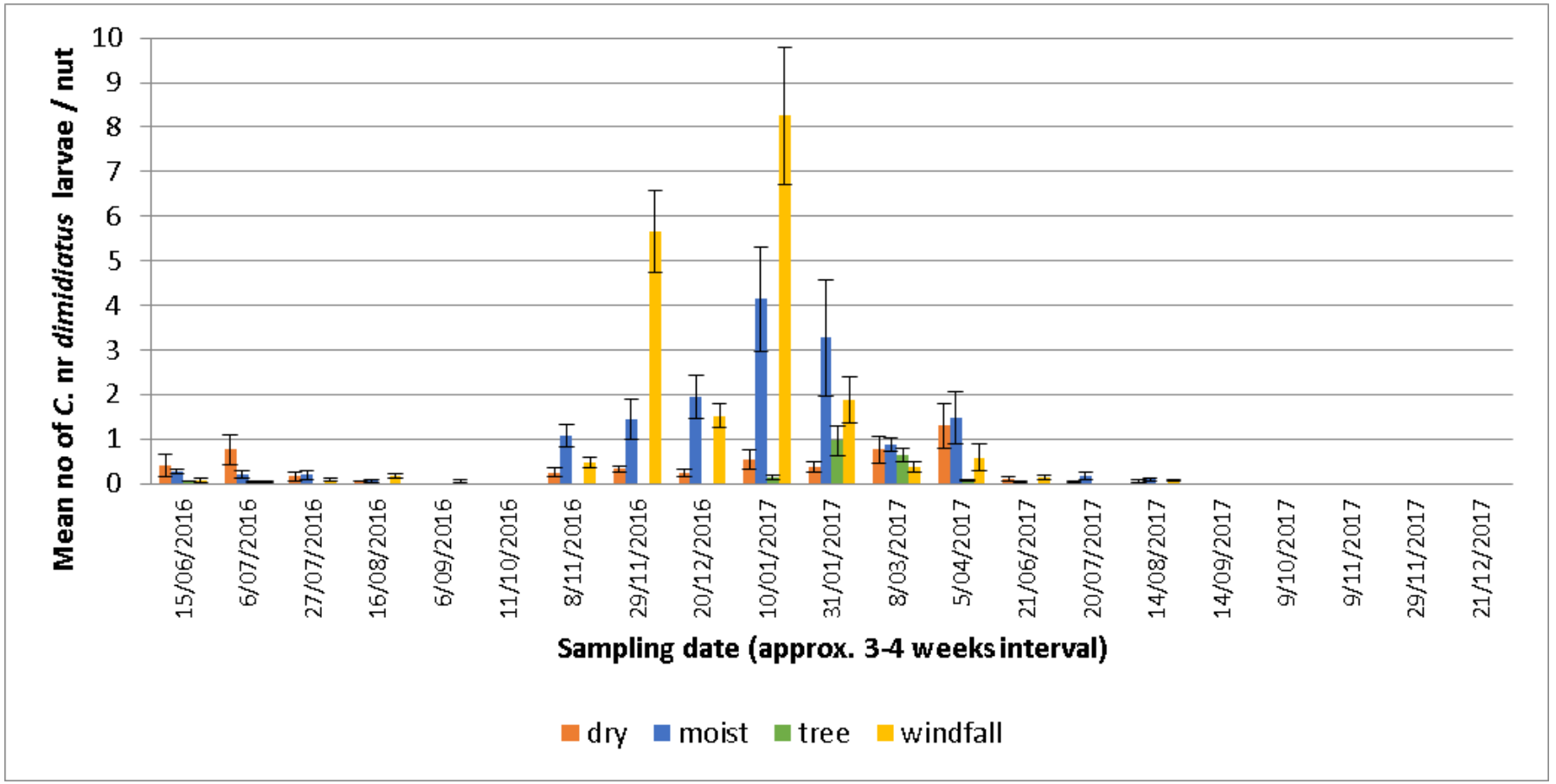

Carpophilus Trap Volumes
(measured in total mls/orchard)
120
100
80
60
40
20
0
20 Oct
2 Nov
17 Nov
1 Dec
21 Dec
17 Jan
31 Jan
13 Feb
27 Feb
Kyalite
Robinvale
Pinnaroo
Kyalite 16-17
Robinvale 16-17



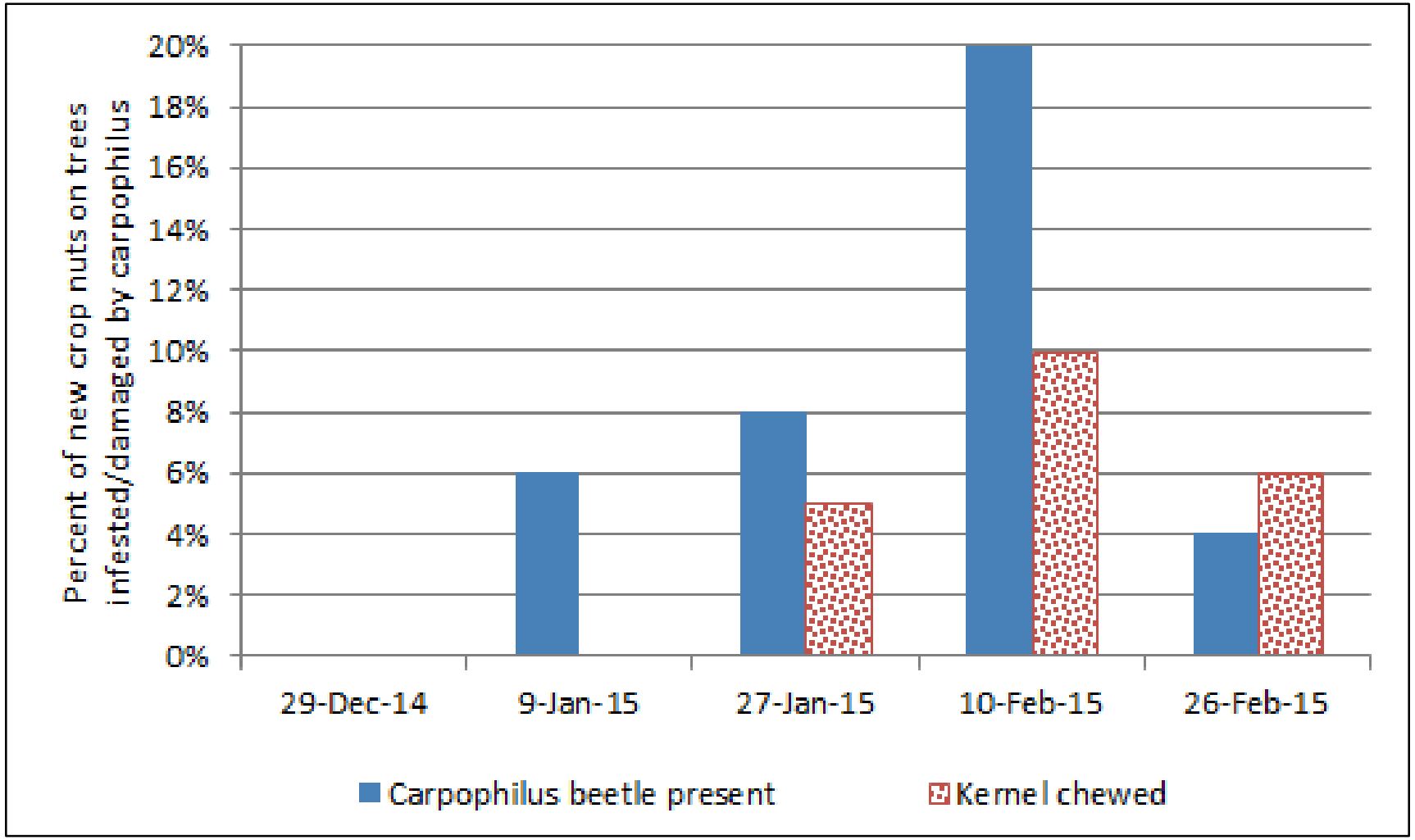
Carpophilus near dimidiatus has been the only species found damaging almonds so far.

The stone fruit A&K traps catch mostly other species.


Men no of C. nr dimidiatus adult/hut
10
9
8
7
6
5
4
3
2
1
0
15/06/2016
6/07/2016
27/07/2016
16/08/2016
6/09/2016
11/10/2016
8/11/2016
29/11/2016
20/12/2016
10/01/2017
31/01/2017
8/03/2017
5/04/2017
21/06/2017
20/07/2017
14/08/2017
14/09/2017
9/10/2017
9/11/2017
29/11/2017
21/12/2017
Sampling date (approx. 3-4 weeks interval)
dry
moist
tree
windfall



There is a very high potential for residual nuts to maintain high carpophilus populations within almond orchards. A planting density of 255 trees/ha together with the peak infestation level shown above (8.25 larvae/nut) and conservative figures of five windfall nuts/tree and 500 eggs/carpophilus female, could yield over 2.6 million eggs/ha, one egg for every nut in a 3 t/ha crop.

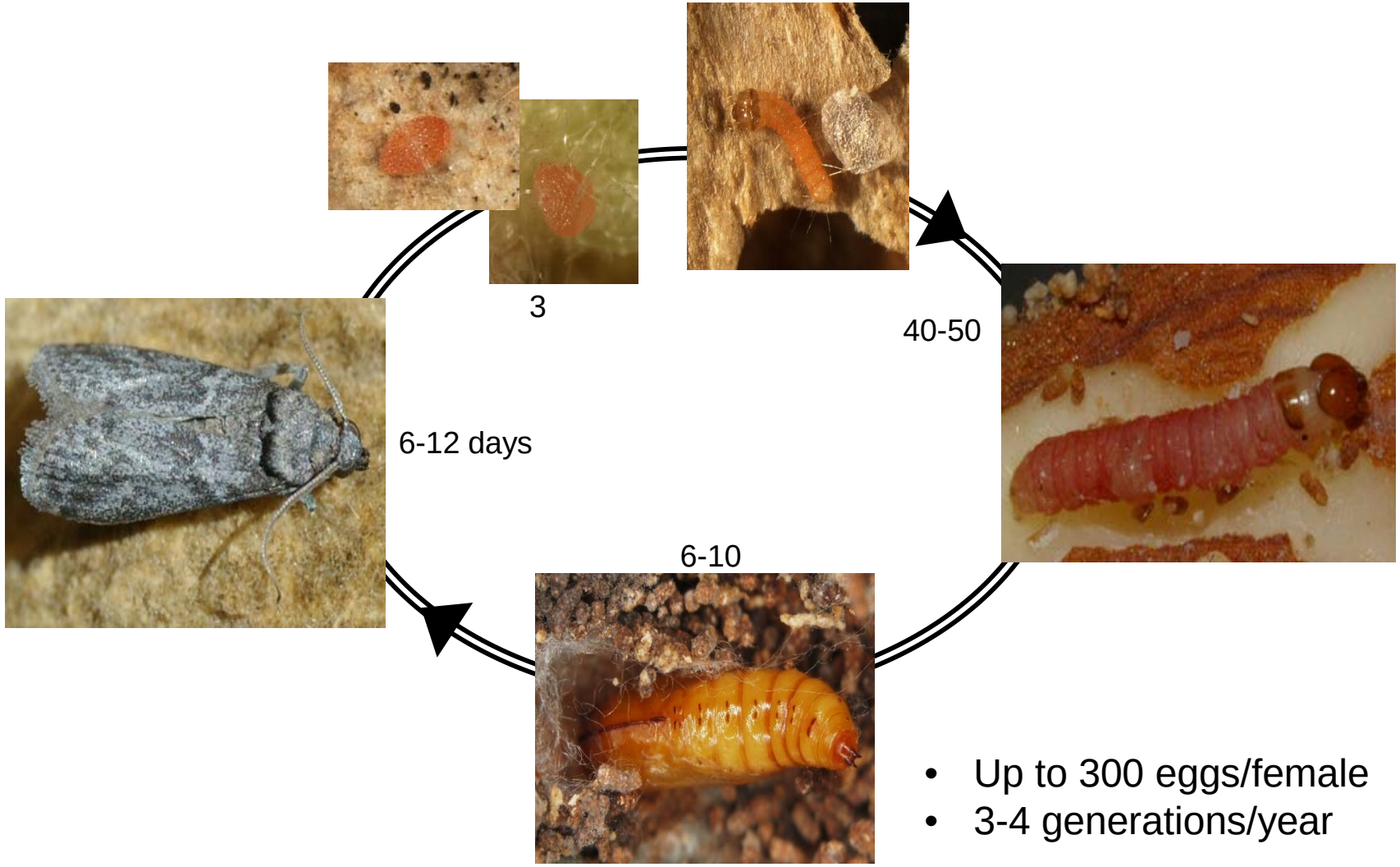


Presence of Carpophilus beetle life stages in new season nuts, in 2014/15.

Carob moth: overview

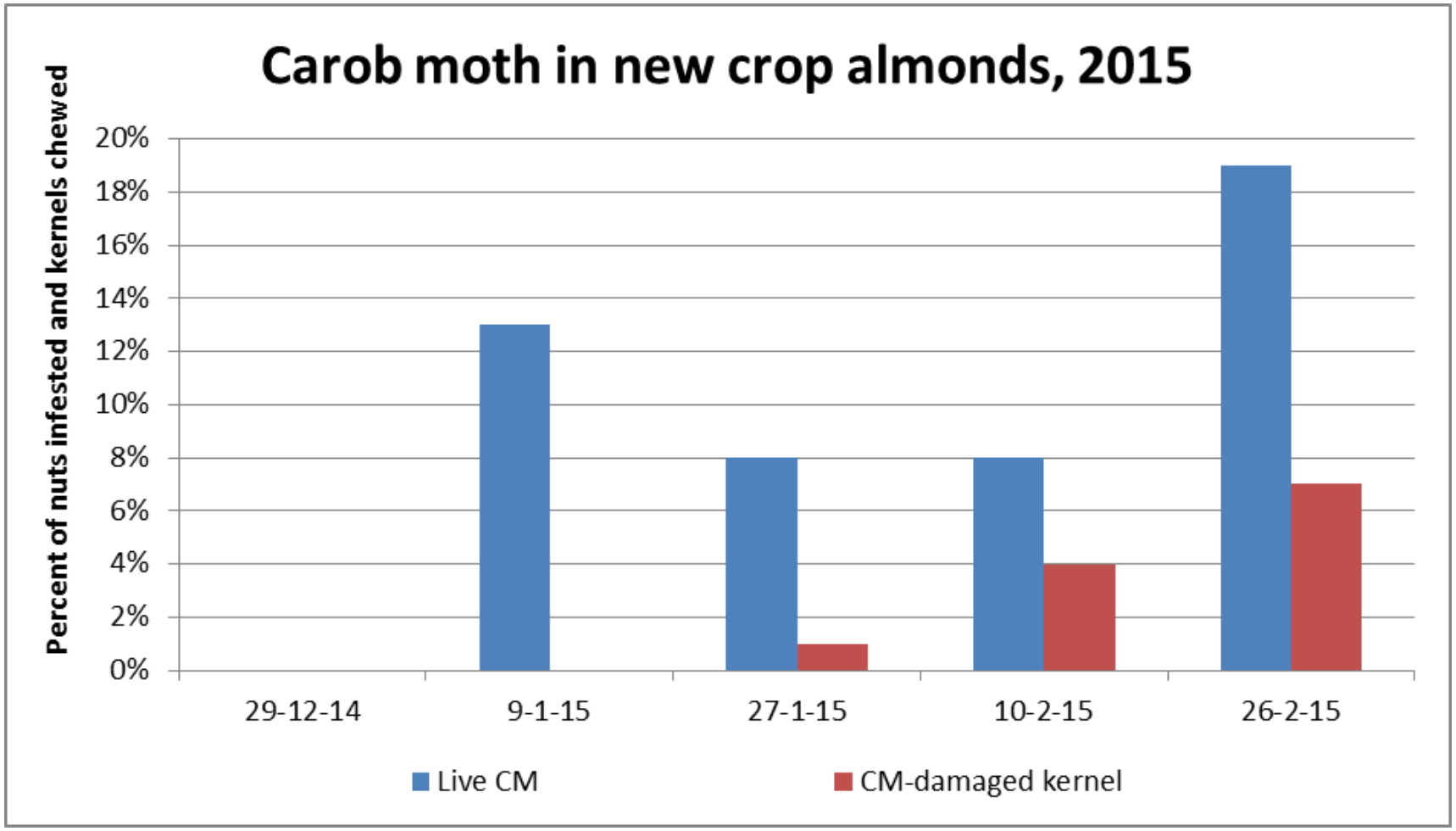
- *Ectomyelois ceratoniae*
- Family Pyralidae (NOW & IMM)
- Mediterranean origin
- Global pest of economic crops
  - Carob, dates, citrus, stone fruit, pistachio, pomegranate, macadamia, almonds…
- Recorded in Australian almonds in 1960's
- Major issue after wet summers of 2009-11

Carob moth: lifecycle



- Up to 300 eggs/female
- 3-4 generations/year

Carob moth: Damage to crops



Monitoring for carob moth

- Checking mummy nuts for signs of carob moth activity in winter and prior to hull split
- Sticky traps in the spring when moths begin emerging

Management of carob moth in almonds:

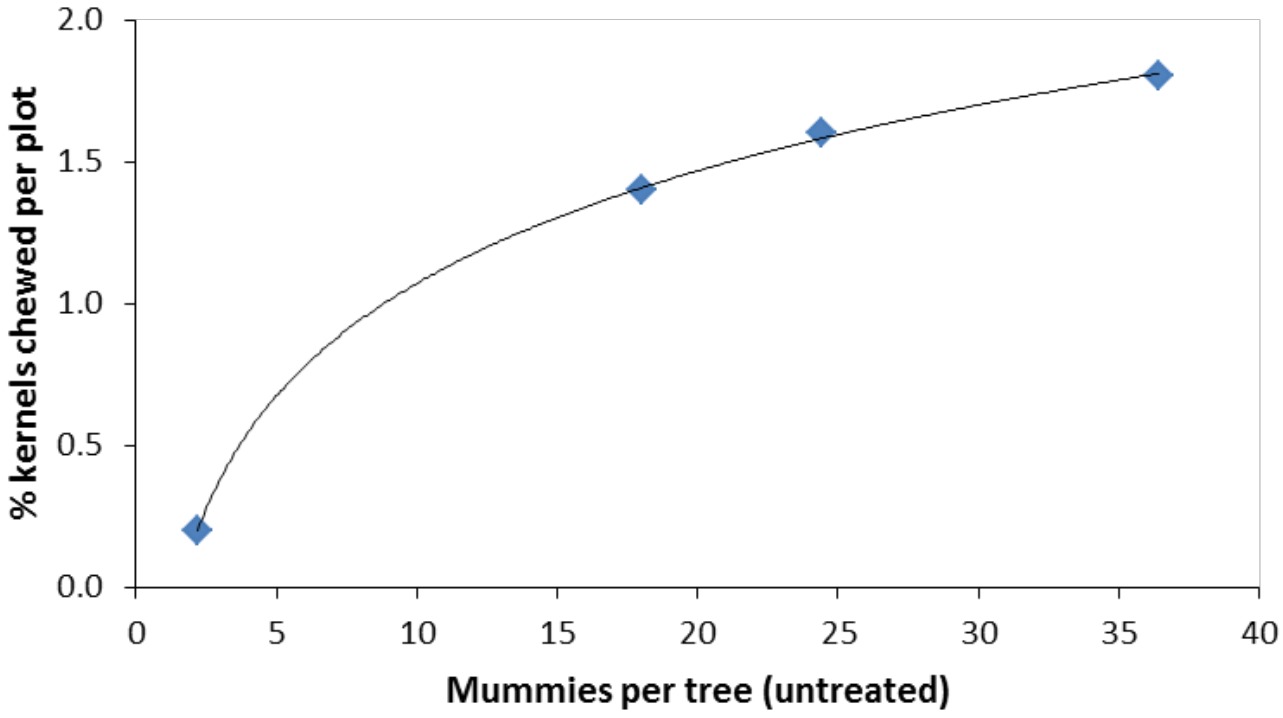
- **Orchard hygiene**

Other potential management tools

- Insecticides?
- Mating disruption?
- Biocontrol?

Carob moth management

Orchard hygiene - mummies



For NOW management, 2 mummies/tree, 4 mummies/tree on ground

Carob moth management

Insecticides

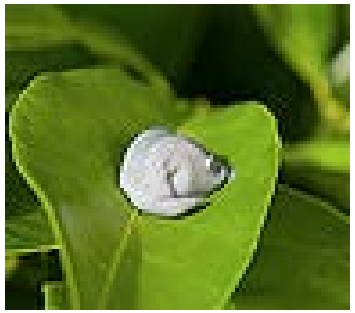
- Altacor®
- Emergency permits

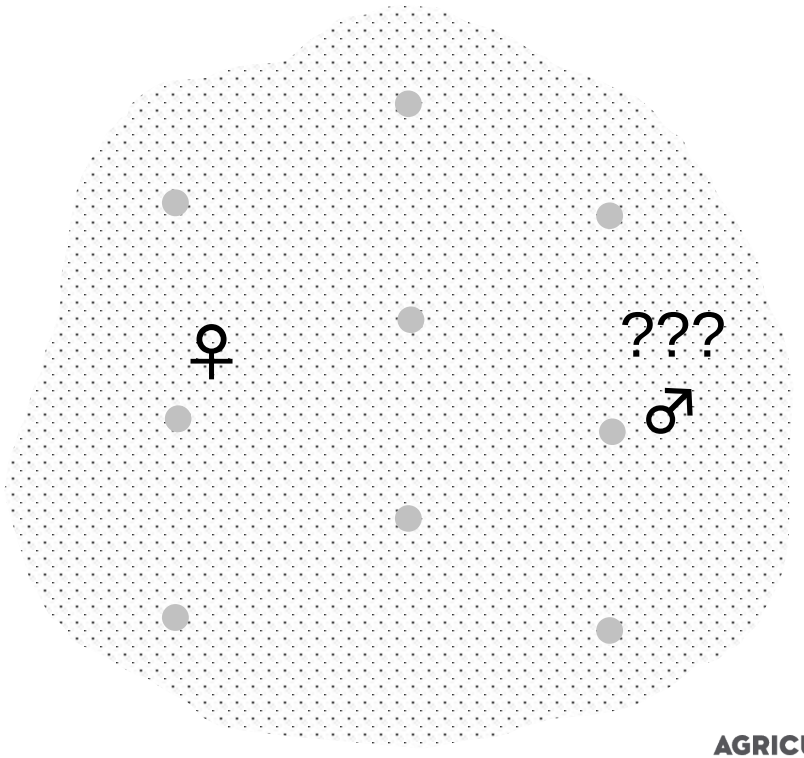
- Questions
  - Timing (Spring vs hull split)?
  - Tree coverage?
  - Off target effects?

Carob moth management

Mating disruption

- Sex pheromone mimic in ‘putty’
- ‘Floods’ orchard with female pheromone
- Disrupts location of ♀ by ♂
- Rapid mechanical application a possibility
- No off-target impacts





Carob moth management

Biocontrol

Predatory bug: *Orius* sp.

Red & Blue beetle

Egg parasitoids: *Trichogramma*

European earwig

Green lacewing

Larval parasites

Conclusions

- Many different management tools will become available in the coming years

- Currently, **orchard hygiene** and reducing the number of mummies is the **most effective** management option for controlling both carob moth and *Carpophilus* beetle

Orchard hygiene – why bother?

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Breeding ground for pests