



Almond carpophilus beetle

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Robinvale & Loxton PIT Group

June 11-12 2025

Why am I here?

- Pistachios were attacked this year.
- Appears to be 1st commercial damage of pistachios in Australia.
- Damage widespread geographically.
- Similarities with almonds.
- Still a lot unknown.



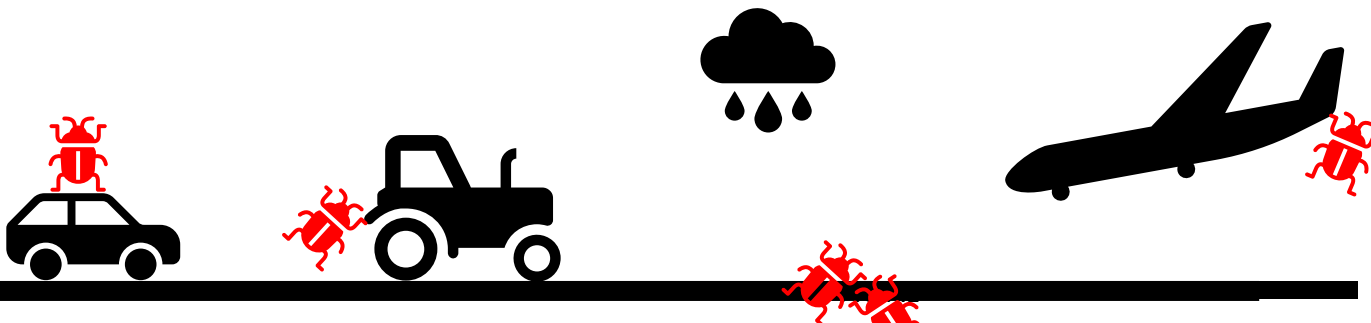
Today's talk



- Where the research began
- Almond industry experience
- History & distribution
- ID, damage, host plants, life cycle
- Seasonal distribution
- Monitoring - traps
- Detection
- Control
- Postharvest

Why carpophilus beetle?

- Significant global pest of almonds
- In field/stored
- Kernel damage (hull/shell)
- 5-10% damage
- Economic issue since 2013/4
- Why?
 - Recently moved/carried into production districts?
 - Always present – recent environmental trigger?



Distribution (Australia)

Ticking along in background,
with populations booming
when resources available

Australia

- In Aus since 1905 (tropical/subtropical QLD)
- 2012 – almond damage
- 2013 – specimens (all life stages) found (5-7% damage)
- 2014 – big problem!

“...unlikely to be a result of a recent exotic incursion, nor is it restricted to areas where commercial nut crops are grown in Australia”

Australia
2013



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Distribution (Australia)

Australia

- In Aus since 1905 (tropical/subtropical QLD)
- 2011 – 6 x rainfall & high humidity (& almonds x 5 in 10 yrs)
- 2012 – almond damage
- 2013 – specimens (all life stages) found (5-7% damage)
- 2014 – big problem!
- 2022 – high rainfall (& pistachios x 4 in 8 yrs)
- 2024 – pistachio damage & specimens found

2 years

2 years

Australia
2013



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Distribution (globally)

- First described from Madagascar in 1864
- 2015 – NW Argentina, in-field & stored walnuts
- Unreported damage levels



Argentina
2015



Australia
2013



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Distribution (globally)

- 2019 – S Italy, stored walnuts (up to 22% damage)
- Likely present since 1800s
- Explosion due to..?
 - Carob moth/other invasion?
 - Pesticide banning
 - Invasion?



Argentina
2015



Australia
2013



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Italy 2019

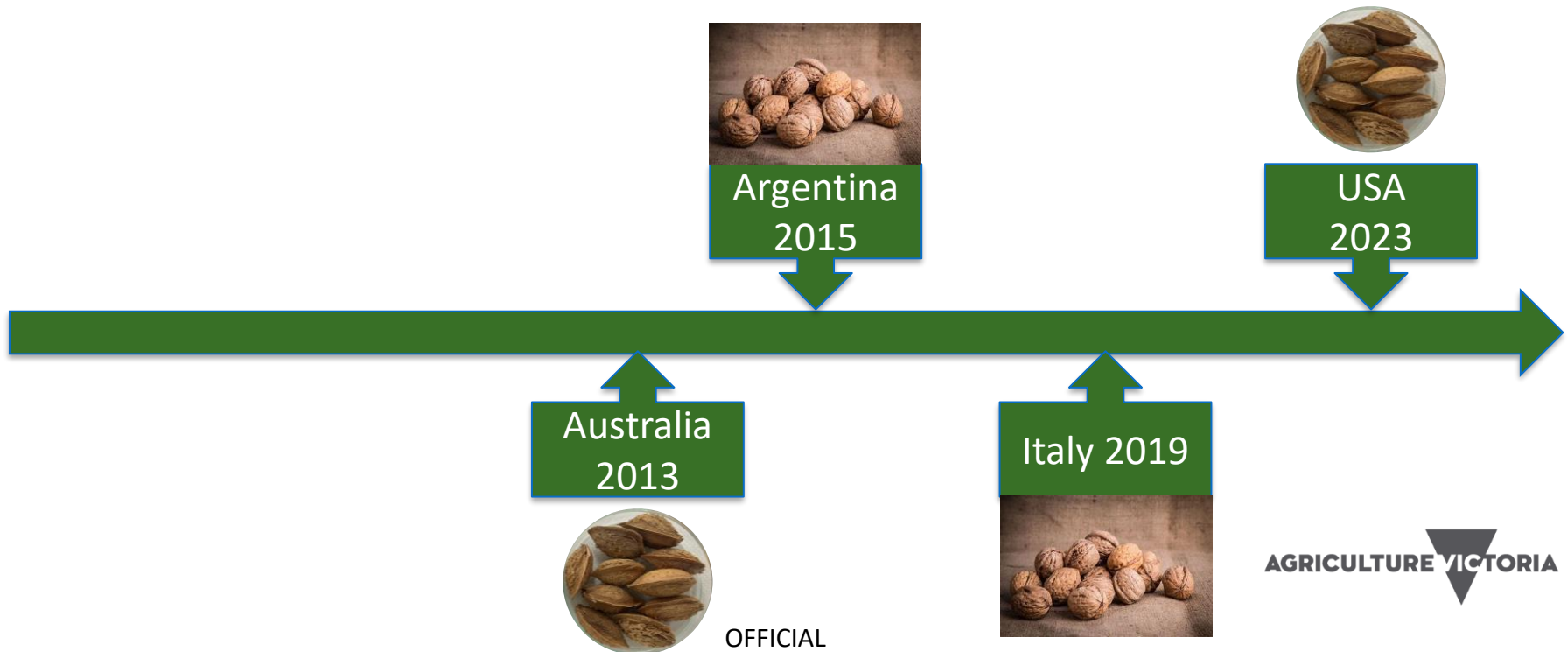


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Distribution (globally)

- 2023 – California, USA, in-field almonds & pistachios
- Houston Wilson (UC Riverside) - collaborator



Distribution (globally)

- Initially found infesting almonds and pistachios in the northern and central part of the San Joaquin Valley.
- Widespread across counties
- Likely present for “a few years”
- Again, 2022 = wet year!
- Damage levels unknown



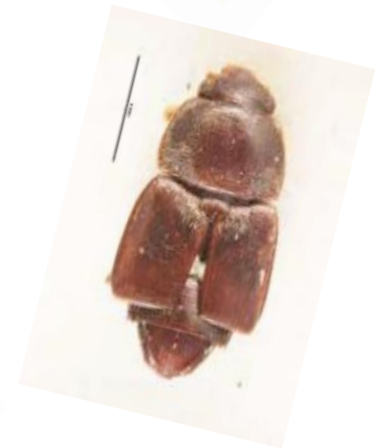
California Pistachio Research Board advice

- *Lack of mummy sanitation in the majority of orchards last fall and winter due to early and heavy rains likely allowed this pest to build numbers in some regions.*
- *Pistachio hulls that remain intact are a barrier to beetle infestation.*
- *Crop sanitation is the most important thing growers...can do to control this new carpophilus beetle.*



What is it?

- Identity confirmed in 2020
- *Carpophilus truncatus*
- Family Nitidulidae (sap beetles)
- >280 *Carpophilus* spp. known globally
- Several in Aus
- 12 spp. in Aus almond orchards



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The pest sap beetle *Carpophilus (Myothorax) truncatus* Murray, 1864 (Coleoptera: Nitidulidae)—a new synonymy and a related new species of *Carpophilus*

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Damage in almonds

- Only species found damaging almond kernels to date
- Lay eggs at hull split
- More damage lower in tree
- 5-10% damage
- Concealed damage
 - Threat to in-shell markets
 - China (50%) & India (67%)
- Facilitate spread of *Aspergillus* fungi
 - Lead to the production of aflatoxins
 - Mould causing lung infections



Damage in pistachios

- Attacks pistachios in a similar manner to almonds
- Bores a hole into the kernel and lays eggs
- Larvae cause damage to kernel once hull is breached
- No evidence of chewing through hull (Aus/US)
- Natural split of the pistachio shell provides easy access to the kernel



Differentiating kernel damage

Carob moth and *C. truncatus* can co-occur



Fine powdery frass



Flattened tunnels



Coarse frass, webbing



Rounded tunnels



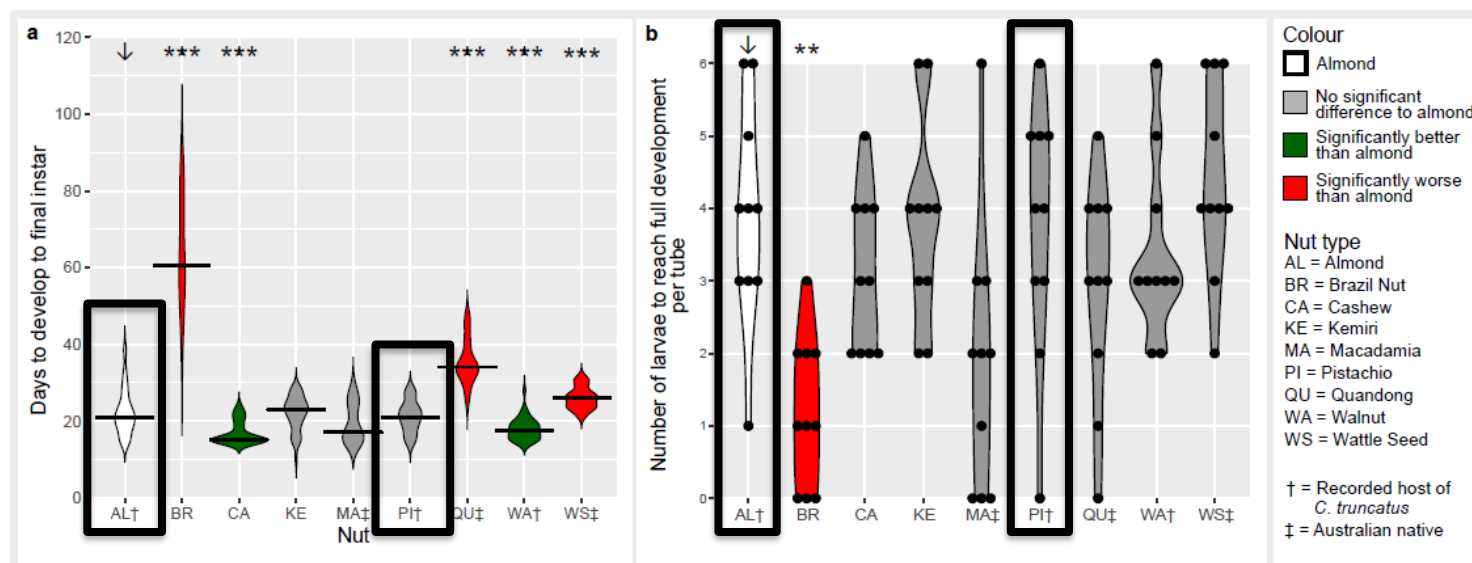
Host plants

- Almonds
- Pistachios (long detected in Aus but low levels and not causing damage)
- Walnuts
- Feeding trials:
 - Brazil nuts, cashews, candlenuts, quandong seeds, acacia seeds, pine nuts, sunflower seeds
- Can feed but not reproduce on other plants
- In Aus, very low numbers in bushland
 - >200 km from almonds
 - Melbourne → Brisbane/FNQ
- Generalist grazer on yeasts



Feeding trials (almonds vs pistachios)

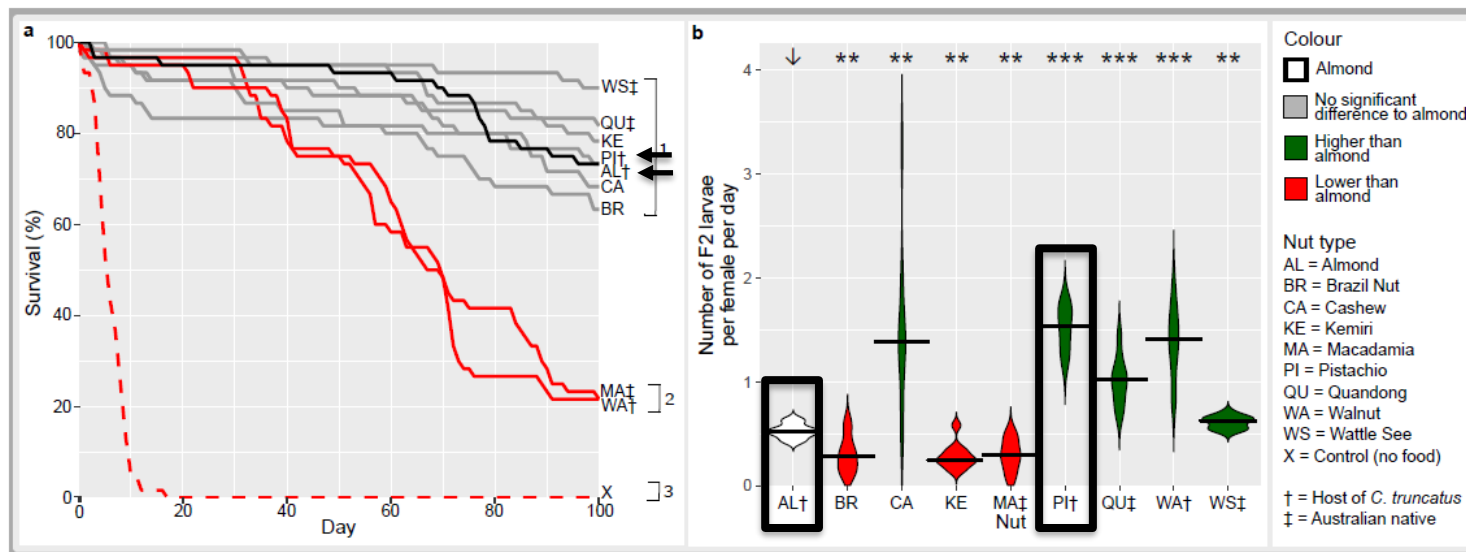
- Larval development time = same
- Larval survival = same



Tobin 2024

Feeding trials (almonds vs pistachios)

- Adult survival = same
- Adult reproductive output = higher than almonds



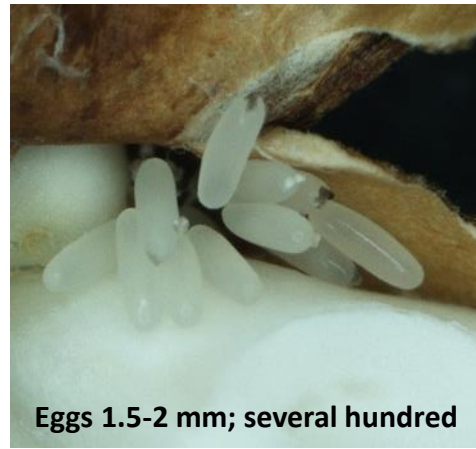
Tobin 2024

Life cycle

9+ months?



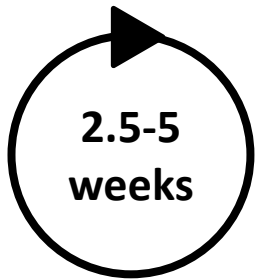
Adult 2-3 mm



Eggs 1.5-2 mm; several hundred

2 to 4 days
Min. 6 °C
Max 46 °C

- Mildura: 7 gens/yr
- Seasonal low temp. appears to be a limiting factor
- Share the same growing areas
- Microclimate



2.5-5 weeks



Pupa 3.5 mm



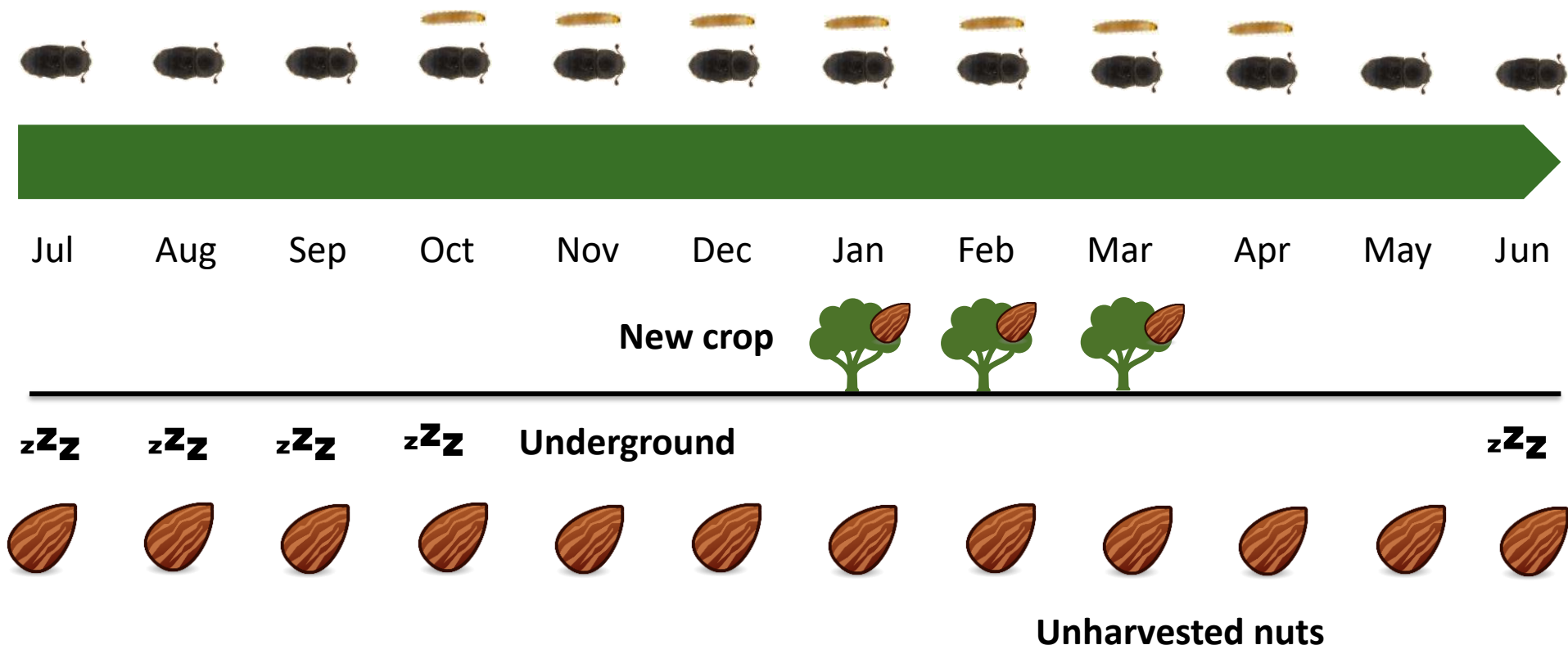
Larvae to 5 mm

12 to 20 days
Min. 10 °C
Max 42 °C

4 to 14 days
Min. 10 °C
Max 42 °C

Tobin 2024

Seasonal distribution in almonds



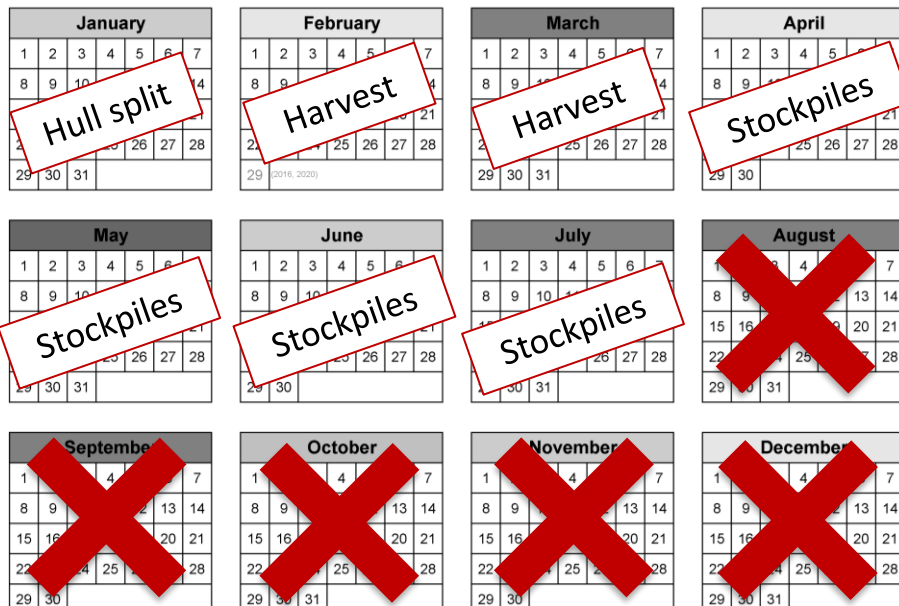
No evidence of seasonal fly in from native veg

Seasonal distribution

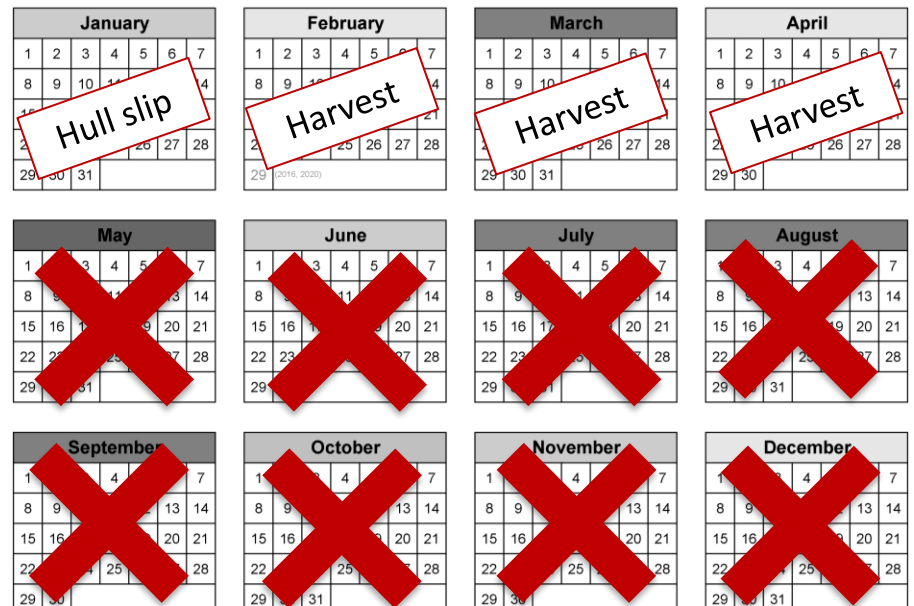
- Similar situation in pistachios
- Unharvested nuts on ground, rather than tree
- No stockpiles
- Quick turnaround time between harvest and processing



Almonds



Pistachios



Seasonal distribution

- Similar situation in pistachios
- Unharvested nuts on ground, rather than tree
- No stockpiles
- Quick turnaround time between harvest and processing
- Still nuts on ground...



Almonds



Pistachios



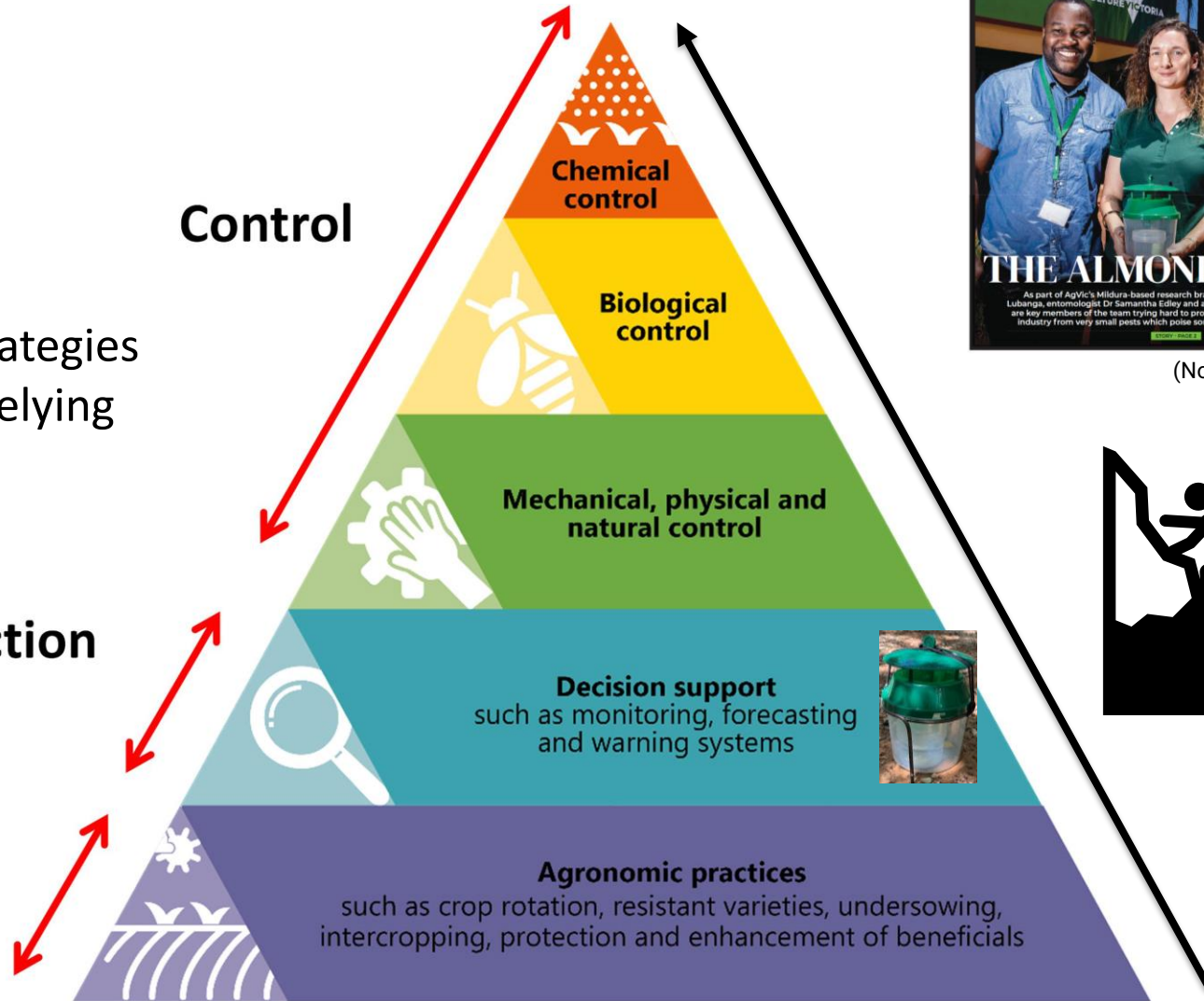
IPM

Variety of strategies rather than relying on chemicals

Detection

Prevention

Control



(Collier 2023)

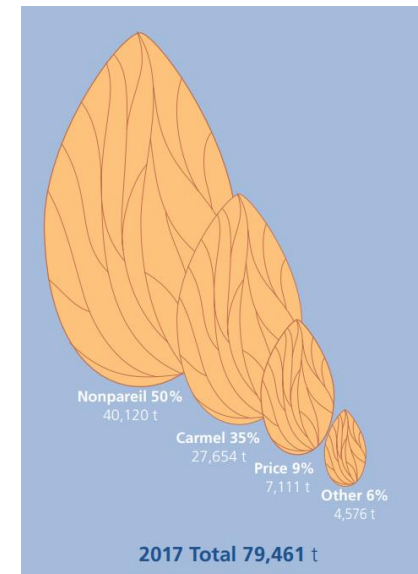


(Northwest Farmer)



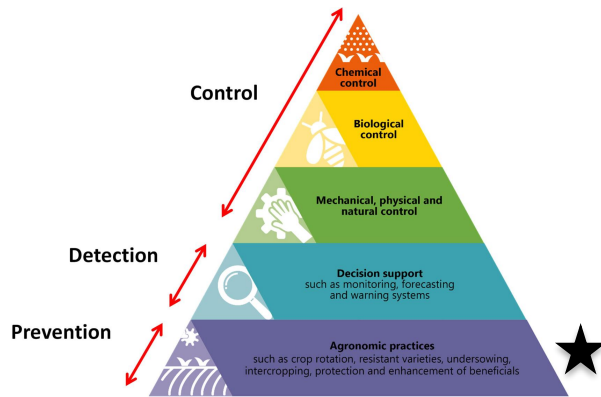
Prevention: Agronomic Practices

- Few relate to almonds/pistachios (e.g. crop rotation)
- Varieties (harder & sealed)
- Enhancement of beneficials
 - ‘Conservation biological control’
 - Natural pest control
 - No high impact sprays
 - Habitat management
 - Refuges or cover crops (trade off with hygiene)



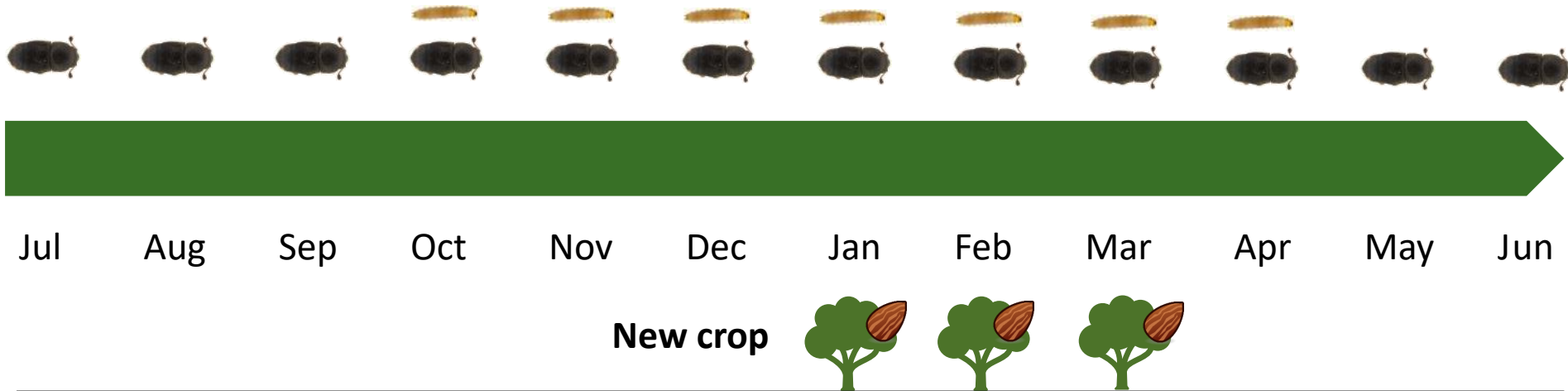
(Hort Innovation/ABA)

Sirora 97% - longer window & shell split

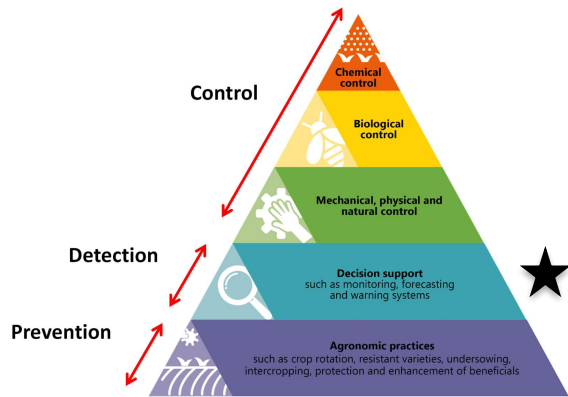


Detection: Forecasting

- No models to date
- Tree phenology (hull split)



Seasonal presence



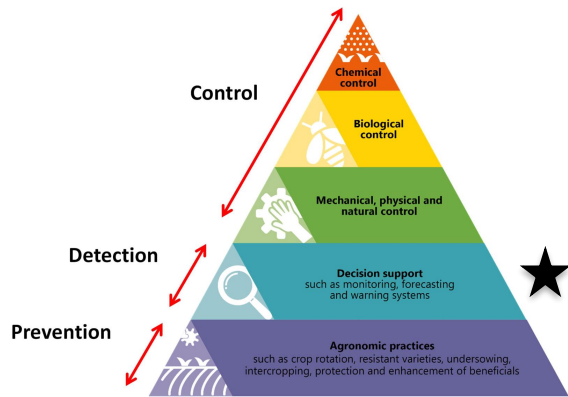
Detection: Monitoring

Hotspots in orchard!

Check nuts on tree prior to harvest
(damage levels)

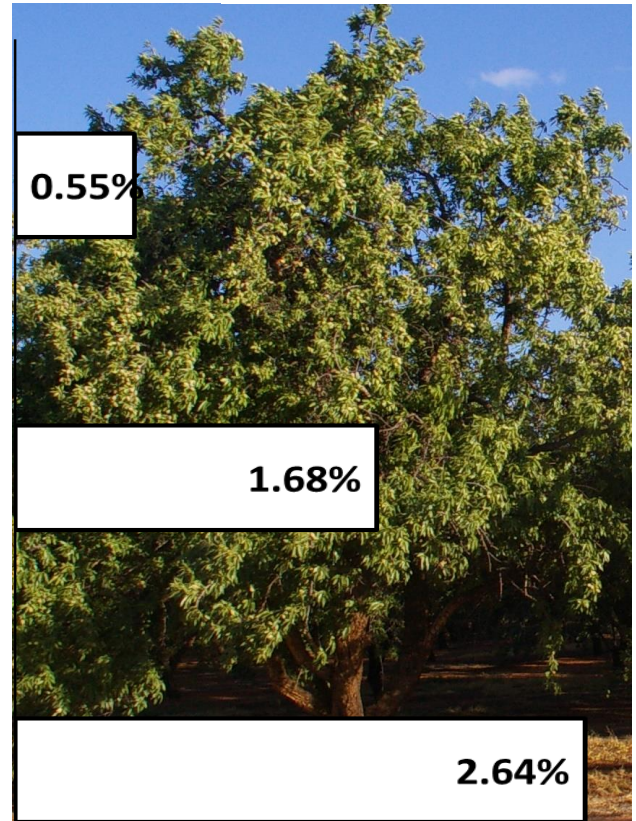
Primarily check nuts on ground for
beetle for the rest of the season...

...but hygiene should target nuts
everywhere!



% mummies with
carpophilus beetle

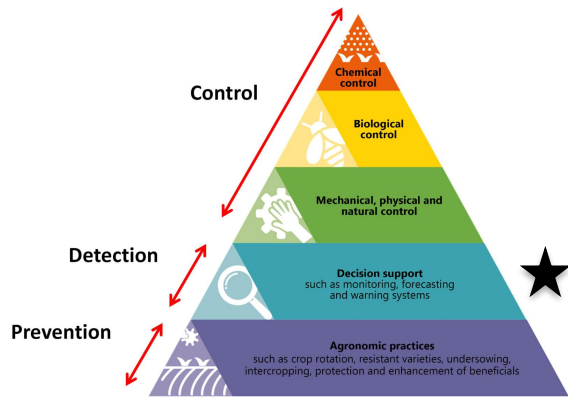
Summer



Detection: Monitoring

Sample nuts in the field

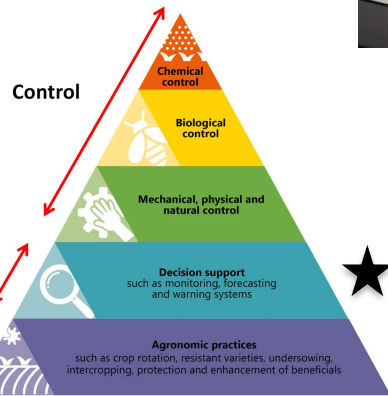
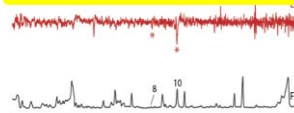
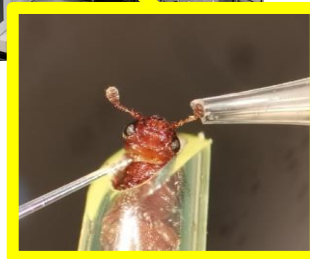
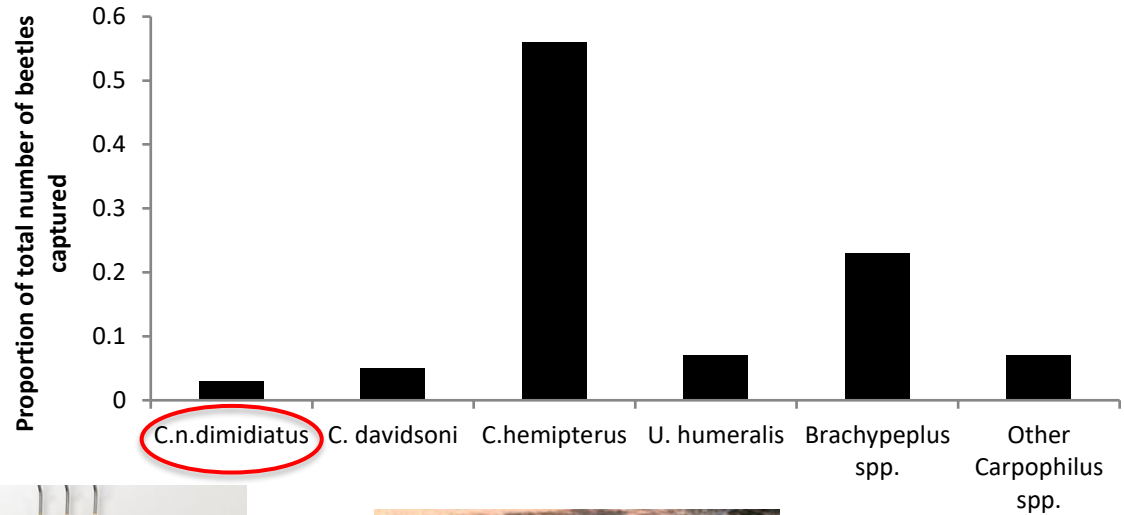
- 4% damage postharvest = 10% in field
- Nuts lost along the way (almonds reported later than pistachios)
- Insect damage lumped together



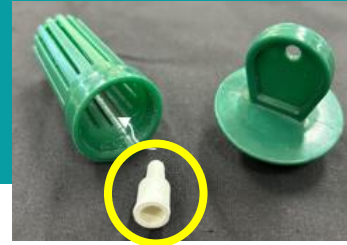
Detection: Monitoring

Developing trap

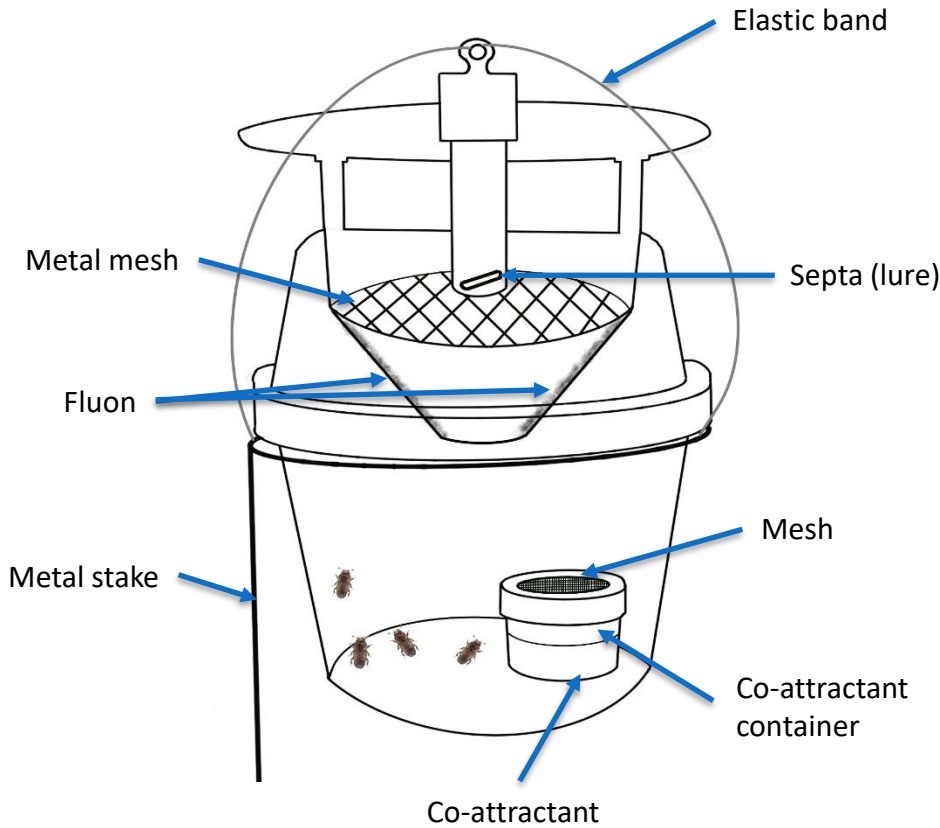
- Stonefruit trap:



Detection: Monitoring



Developing trap



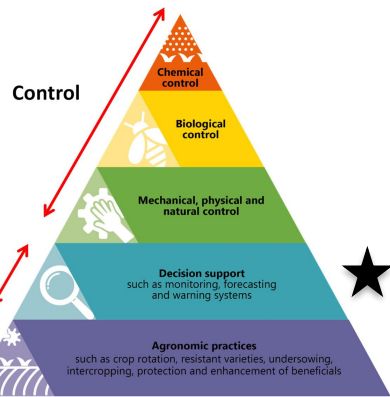
DDVP (pesticide strip)



New pheromone and revised coattractant

Detection: Monitoring

- Trapping in almonds
 - 95+% *C. truncatus*
 - Variation (seasonal/location in orchard)
 - Orchard edges 50% *C. truncatus*
 - Predominantly ♀
- Bycatch (ants/earwigs):**
- Dried-fruit beetle (*C. hemipterus*)
 - Other sap beetles



Detection: Monitoring

- The only species found damaging almond kernels to date.

Carpophilus truncatus



Gold shoulders!

Carpophilus hemipterus



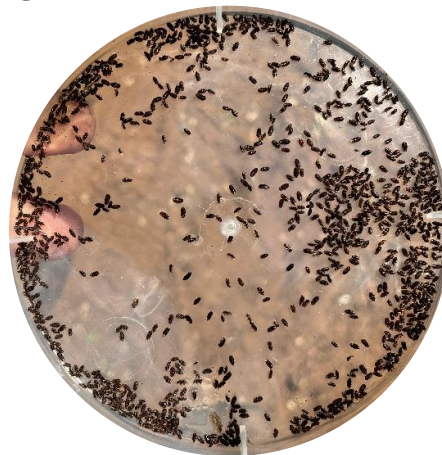
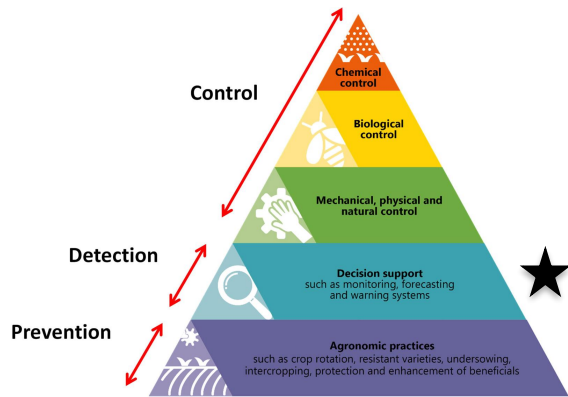
M-shaped gold markings (of variable brightness) on brown body

Detection: Monitoring

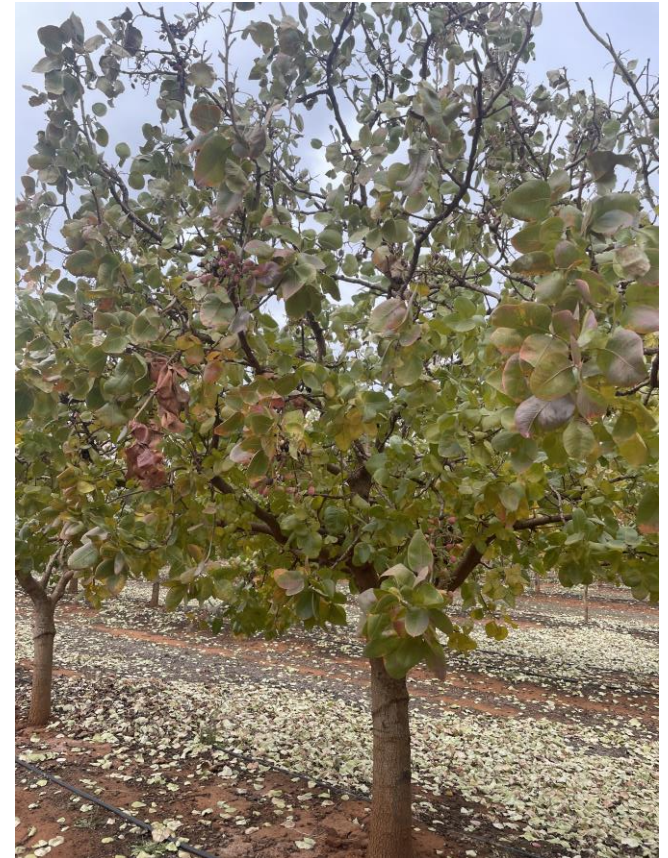
- Trapping in pistachios (one site)
 - 83% *C. truncatus*
 - Variable (62-96%)
 - Predominantly ♀

Bycatch:

- Dried-fruit beetle (*C. hemipterus*)
- Other sap beetles



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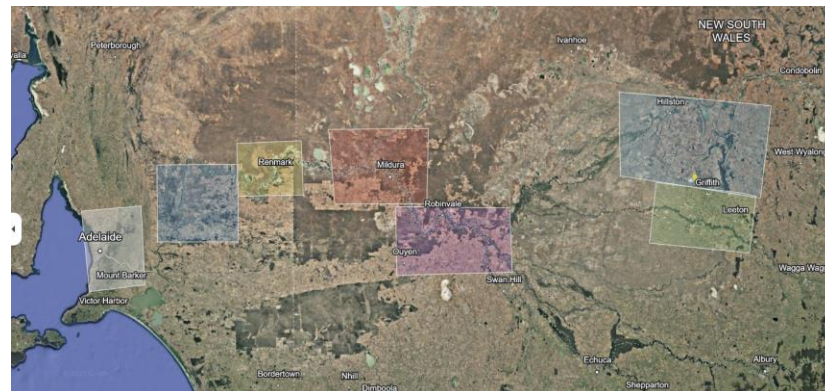
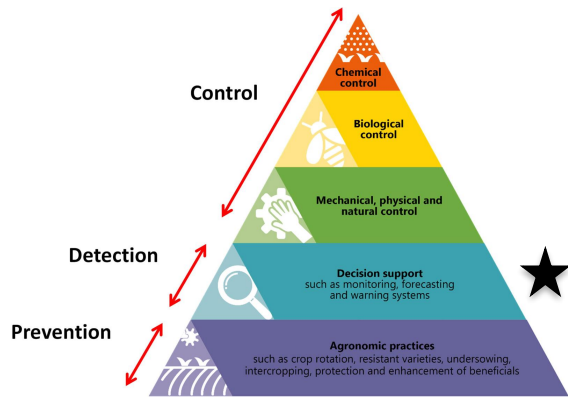
Detection: Monitoring

Regional rollout

- Assess trap performance (regions/time)
- Seasonal activity
- Species mix
- Sex ratio
- Catch vs crop damage levels
- Catch vs orchard characteristics



(ABA)

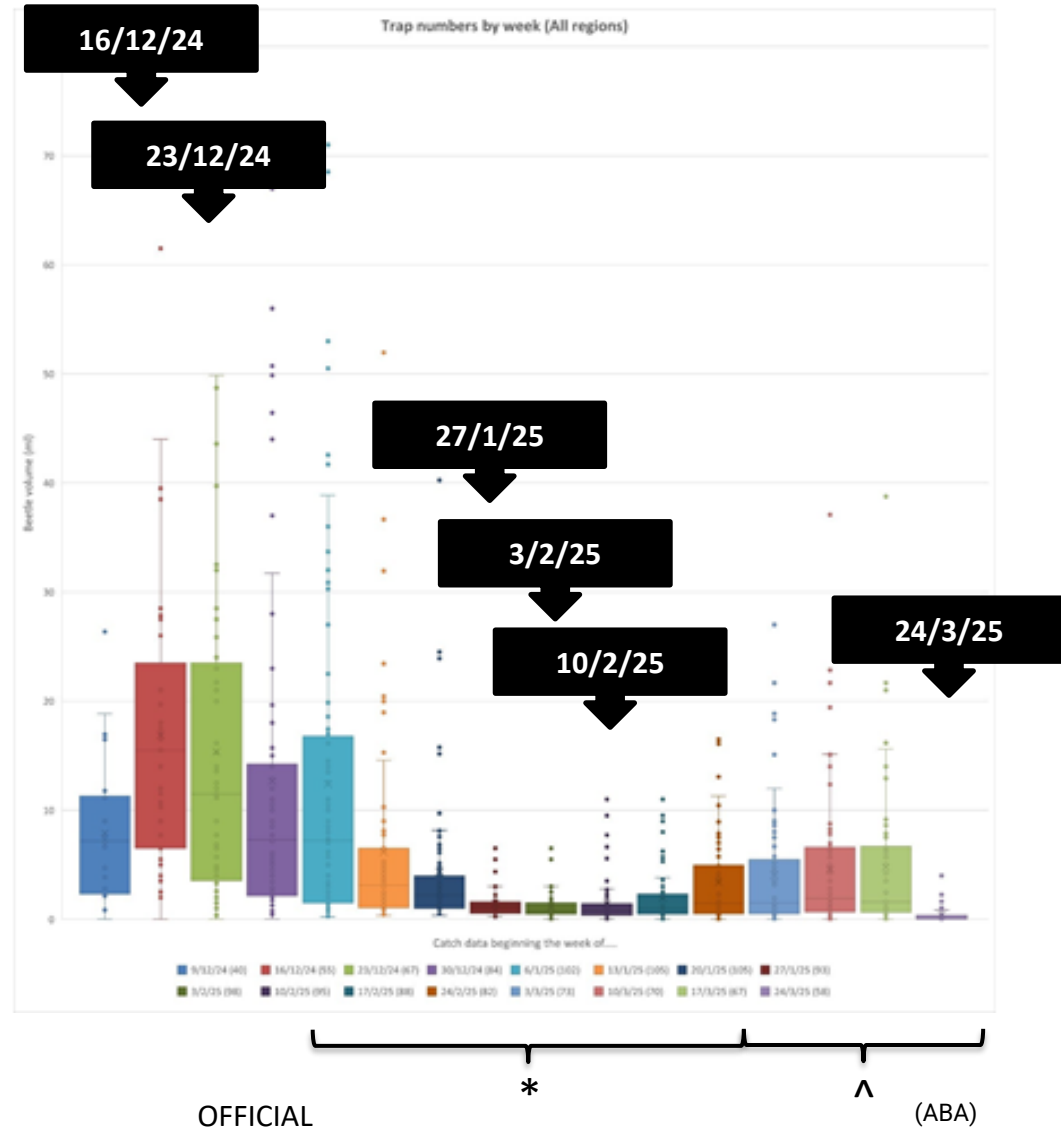
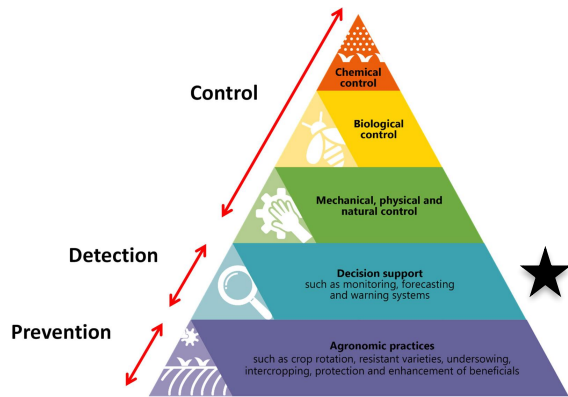


(ABA)

Detection: Monitoring

Regional rollout

- Hull split*
- Competing with nuts!
- Volatiles
- Harvest^
- Nuts dry
- Traps more attractive

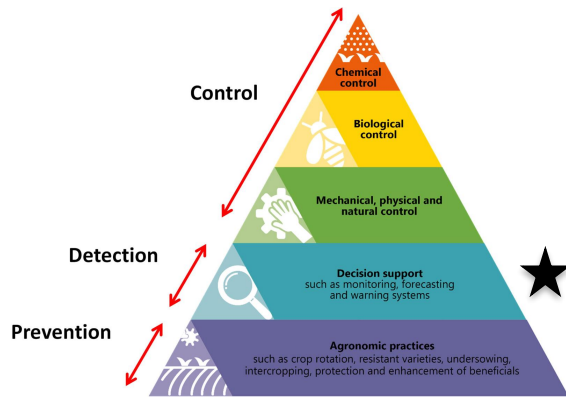


Detection: Monitoring

- Attract and kill (A&K)
- 16/Ha – proof of concept
 - Full season (20 weeks)
 - Not commercially viable
- Investigating lower densities
 - From Dec 24 (11 weeks)
- 16/Ha AND 8/Ha equivalent!
- ~50% damage reduction



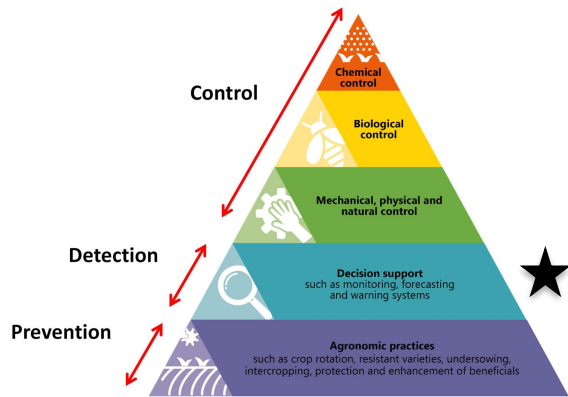
(Same as MD and sprays for NOW)
(Not a silver bullet!)



Detection: Monitoring

Commercialisation

- Finding partners
- Separately funded
- AVS
- In their hands
- Trap alterations
- Taken a long time!
- APVMA regs

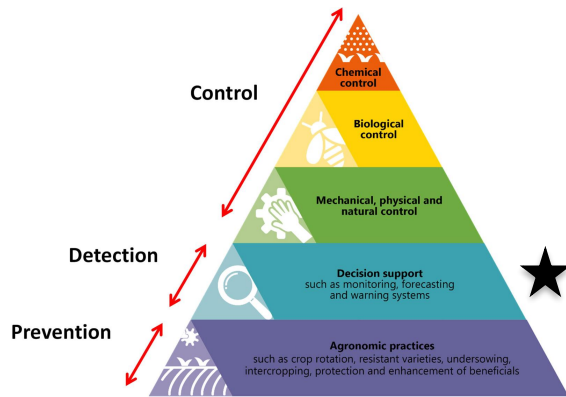


Detection: Monitoring

Other pests

- Carob moth
 - Chews through, entry for *C. truncatus*
- Light brown apple moth
 - Recent issue in almonds
- *Helicoverpa*
 - Previous issue in pistachios
- Florida pink scavenger moth, apple dimpling bug, Rutherglen bug etc

2017 Hort Innovation project

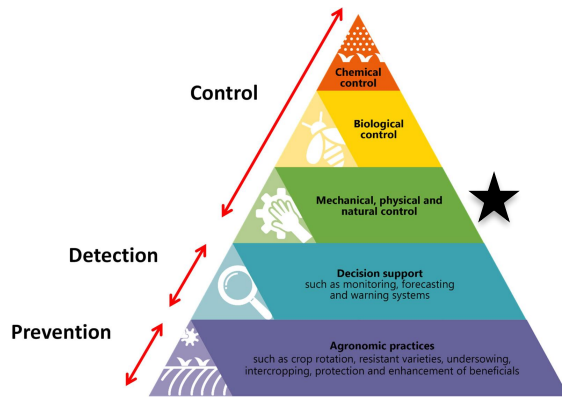


Control: Cultural control

Crop hygiene

18 beetles per nut!

- **Get crop off and out**
 - Minimise resources
- 2019 – burial trial
 - Depth vs emergence
 - Emerged from 90cm (maximum)
 - Breeding!
 - Inform of disposal techniques



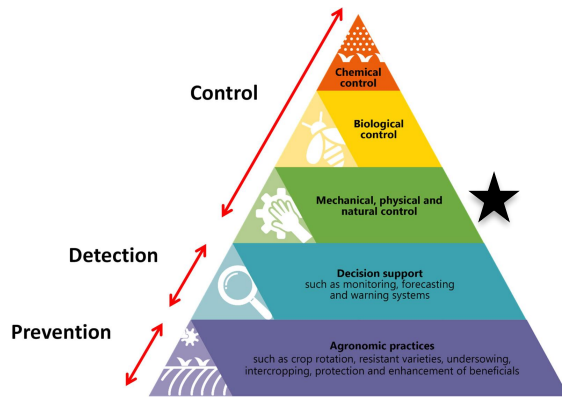
Control: Cultural control

Disposal

- Mulching – **pulverise**, do not spread!
- Almond industry – terminator
 - Cattle fodder, burning, some burial

Crop hygiene

- Smaller almond orchards = birds!
- Year-on-year effects



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(Delmade)

Control: Biological control

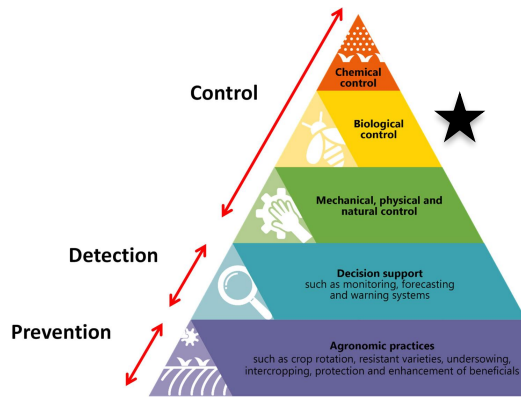
- Little known about *C. truncatus*
- Literature on nitidulids & *C. hemipterus*

Predators

- Rove beetles
- Assassin bugs (& other predatory bugs?)
- Spiders
- Lacewings
- Red and blue beetles? Earwigs? Birds!



Udo Schmidt



Control: Biological control

Parasitoids

- Larval parasitoids
- Overseas
- *Anisopteromalus calandrae*

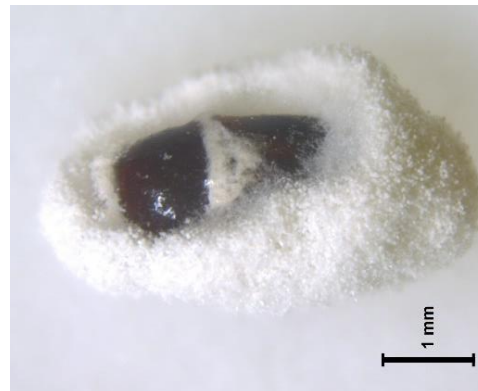
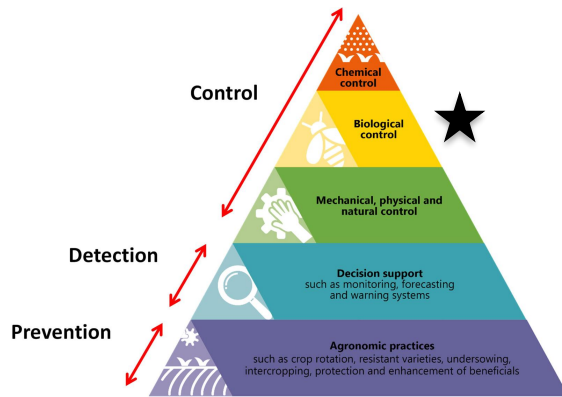


GMBUE1767-14
Lateral



Entomopathogens

- Fungi, nematodes, bacteria, viruses
- 2025 trial – pupation depth; inform inoculation techniques



Control: Biological control

PhD

- Explore the natural enemy diversity in Australian almonds,
- Understand the effects of orchard practices on natural enemies,
- Identify potential species for biological control of key almond pests.

PhD research opportunity

Seeking a student to support the almond industry through innovative research

Apply today



The successful candidate will receive:

- A \$37,000 p.a (tax-free) scholarship up to three and a half years
- Training in Australia's first integrated agricultural systems biology research centre, AgriBio
- Professional development programs
- Travel opportunities

Based at the Agriculture Victoria's Mildura SmartFarm, Irymple, Victoria, Australia

Successful applicants must meet the La Trobe University entry requirements for a Doctor of Philosophy degree.

Check your eligibility here: <https://www.latrobe.edu.au/study/apply/research/doctor>

For enquiries and to apply, please forward a covering letter, your curriculum vitae (please include evidence of research writing) and academic transcripts to:

Kendra Whiteman
Higher Education Manager
Agriculture Victoria Research
kendra.whiteman@agriculture.vic.gov.au

Closing date for applications: **until filled**

Investigating the use of biological control in almond IPM

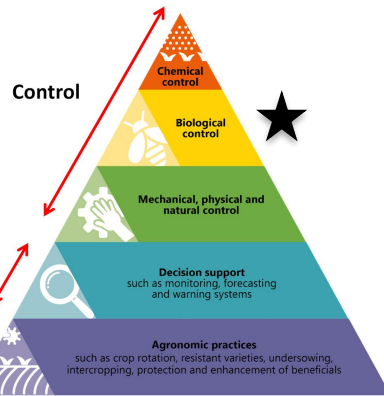
Australia's almond crops suffer significant economic damage from two pests, carob-moth (*Ectomyelois ceratoniae*) and almond carpophilus beetle (*Carpophilus truncatus*). The almond industry is eager to adopt sustainable approaches to effectively manage these two pests and is currently developing integrated pest management (IPM) strategies that reduce or avoid the reliance on chemical pesticides. Central to this approach is an understanding of the diversity and ecology of natural enemies that feed on these two major pests, and the development of biological control strategies that can be used in almond IPM.

Agriculture Victoria and Hort Innovation are funding an exciting PhD project to:

- Explore the natural enemy diversity in Australian almonds,
- Understand the effects of orchard practices on natural enemies,
- Identify potential species for biological control of key almond pests.

The successful candidate will be supervised by A/Prof Paul Cunningham and Dr Francesco Martoni from the School of Applied Systems Biology, La Trobe University. External co-supervision through Agriculture Victoria project Lead, Dr Samantha Edley and Dr Greg Lefoe.

This project will help shape the future of integrated pest management in the Australian almond industry. Through collaboration with a diverse team of researchers, entomologists, taxonomists, bioinformaticians, and industry partners, the student will receive comprehensive training, and access to cutting-edge techniques and skills that are in high demand within academia and industry.



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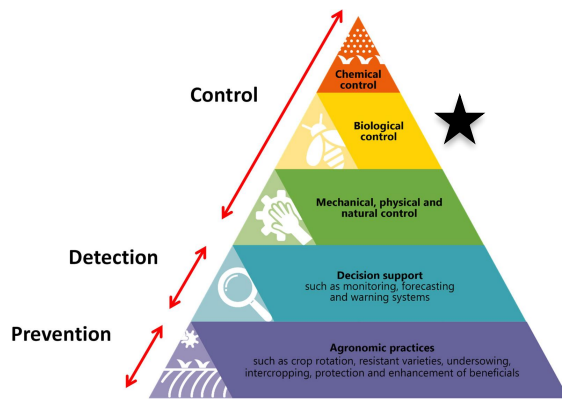
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Control: Biological control

Beneficial insects in pistachios

- Ladybirds
- Lacewings
- Syrphids
- Spiders
- Predatory mites
- Spined predatory shield bug
- Parasitoids

2017 Hort Innovation project

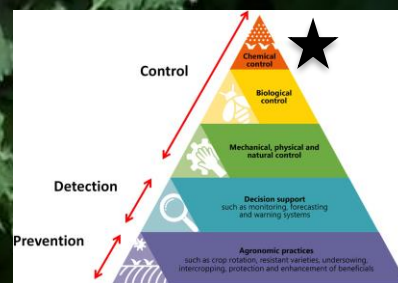


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Control: Chemical control



- Last resort, to be used only if risk of commercial damage is high. More data needed before harvest!
- Beetles in nuts or soil – protected!
- Spray coverage big issue in almonds
- Broad spectrums affect beneficials



Postharvest research



Carpophilus truncatus
Almond carpophilus beetle



Carpophilus hemipterus



Apomyelois ceratoniae
Carob moth



Tribolium castaneum
Rust red flour beetle



Oryzaephilus spp
Sawtoothed/
Merchant grain
beetles



Cryptolestes spp
Flat grain beetle



Plodia interpunctella
Indian meal moth

Postharvest research

- Phosphine resistance in grains
- Work by NSW DPI RD
 - Stockpiles, not processing
 - Shortcomings in bulk fumigation
 - *C. truncatus* susceptible to phosphine (Particularly adults)
- Fumigation must be effective, or resistance builds up
- Efficacy of sulfuryl fluoride unknown



Summary

- Issue since 2013/4
- Possibly due to previous year's rainfall
- Other host plants (nuts, little in bushland)
- Unharvested nuts provide year-round food source
- Monitor through in-field nut assessments
 - Keep eye out for other pests!
 - Don't rely on processing plant data
- Crop hygiene is imperative
- No silver bullet



Any questions?