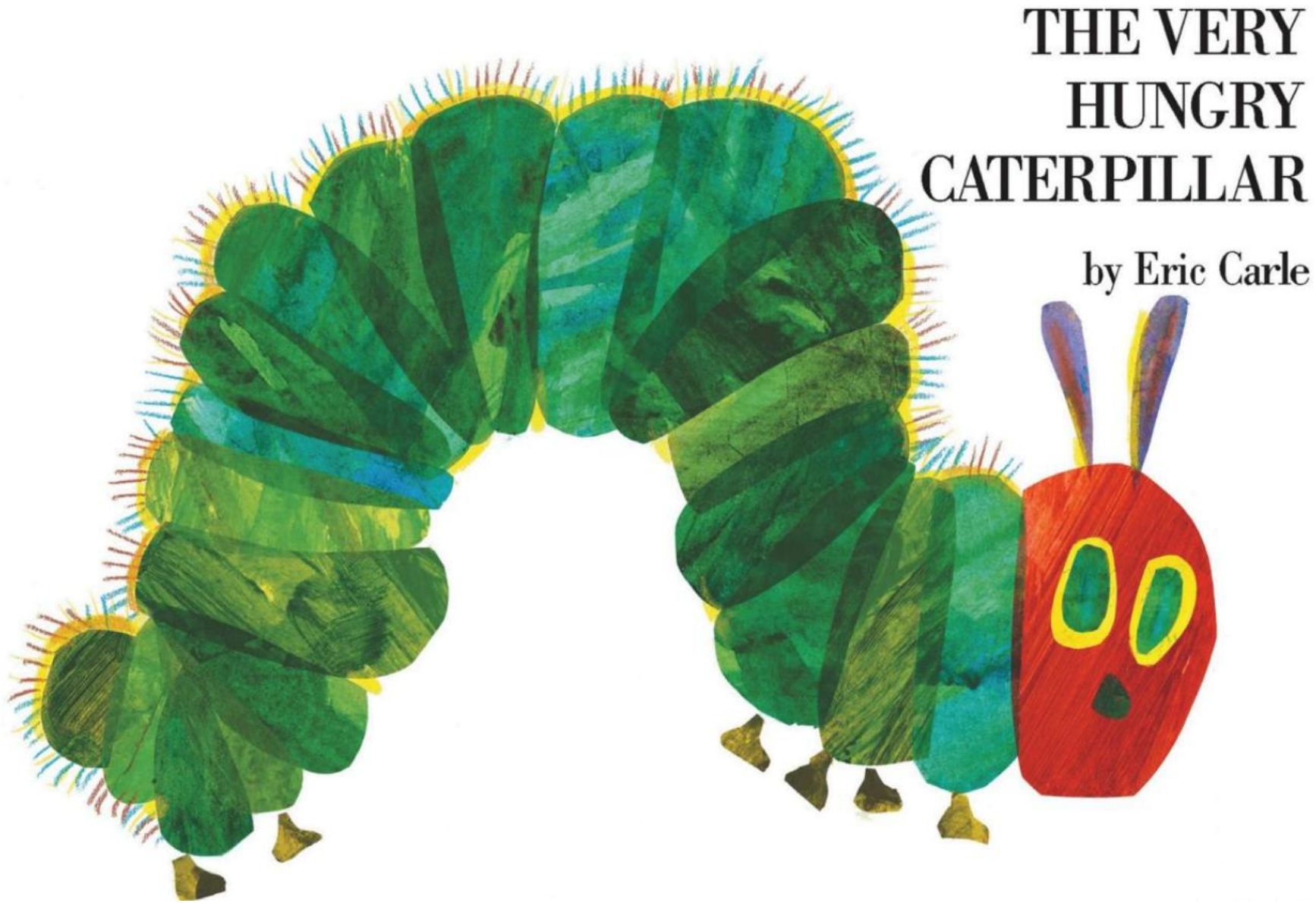

THE VERY
HUNGRY
CATERPILLAR
by Eric Carle

Overview

1. Biological Control Basics.
2. The Biological Control industry.
3. Biological Control in nut crops today / future opportunities.
4. Case study : Local Action – International Recognition.
5. Hazelnuts growers . Case study / Work in Progress.
6. Recommended next steps for the Hazelnut sector.

1.1 Biological Control Basics

"CLASSICAL"

- Native range to New Area
- Host specificity.
- Environmental adaption.
- Population permancy.
- Usually the preserve of governments / universities / scientific authorities / institutions to perform the foundation work

"CONSERVATION"

- Preserving or increasing the population of naturally occurring beneficial organisms already present in an environment
- Cultural practices.
- Trap crops
- Favourable host plants (nectar)

"AUGMENTATIVE" ABC

- Largest / Commercially active category.
- Innoculative / Innundative
- Right amount / right time
- Boosts "pre-existing"population.
- Supplementary.

2.1 The Biological Control Industry

IBMA
INTERNATIONAL BIOCONTROL MANUFACTURERS ASSOCIATION

IOBC-WPRS

BioFirst GROUP

Koppert

BIOBEE
Inspired by Nature

RINCON-VITOVA INSECTARIES, INC.

ASSOCIATES INSECTARY SINCE 1928

Embrapa

MULTINATIONAL PRIVATE ENTERPRISES – GROWER OWNED CO-OPERATIVES – STATE OWNED BUSINESSES

2.2 Growth Drivers of The Biological Control Industry.

SUSTAINABLE DEVELOPMENT GOALS

CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

LEADING HARVEST

Optus Wi-Fi Call 8:55 am

Berries Cancel

Consumer Protection

Banned chemical found by scientist in fresh berries sold at NSW supermarkets

02 Sep 2025 at 8:42am •
Agricultural Pest Control

Surge in berry consumption prompts potential dimethoate restriction

4.1 Case Study : Local Action – International Recognition

A local case study in successful biological control in Nuts (Pecans) - Stahmann Websters.
(Pests : *Maroga Melanostigma* & *Nezara Viridula* (GVB-Stink Bug).

Pecan Stem Girdler (Maroga Melanostigma) pressure in ~ 600 Ha 2 – 4 year-old trees.

- Delivery technologies used.

Aerial – Precision Placement – Biodegradable containment system

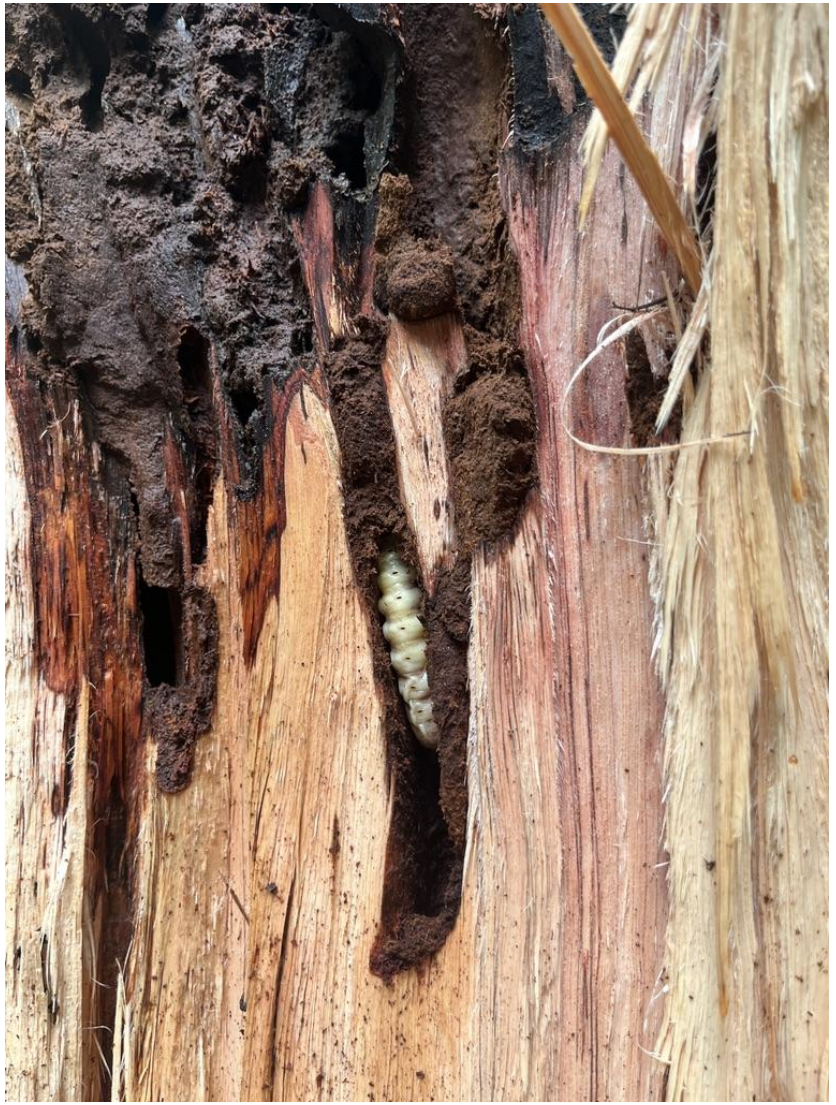
Beneficial insect species (Trichogramma spp / Tricopoda / Trissolchus spp) - predators / parasitoids.

Bernard Blum Award "Best New Invention for the uptake of biological control for a business" "Crop Capsules" Finalist 2023 – Winner 2024

4.1 Case study Local Action – International Recognition

4.1 Case study Local Action – International Recognition

Photos used with permission : Mark Banning-Taylor – The Kootingal Pecan Company



Multiple inundative releases of the egg parasitoid Trichogramma to
stop a high % of Maroga Melanostigma larva developing into damaging borers

Numbers of Maroga melanostigma adult moths caught per light trap at "Trawalla" pecan orchard Moree 1991

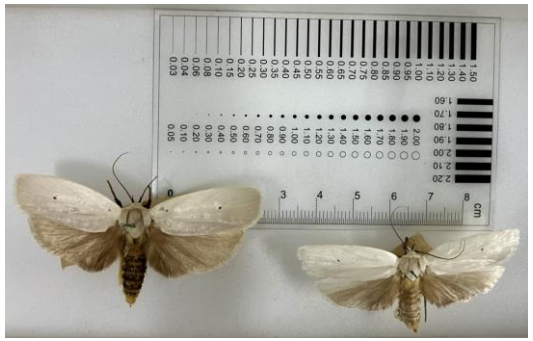
Number of moths per trap

Cumulative moth count

0 10 20 30 40

0 100 200 300 400

26/09/1991 30/09 4/10 8/10 12/10 16/10 20/10 24/10 28/10 1/11 5/11 9/11 13/11 17/11 21/11 25/11 29/11 3/12 7/12 13/12

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4.2 The StahmannWebster's Experience

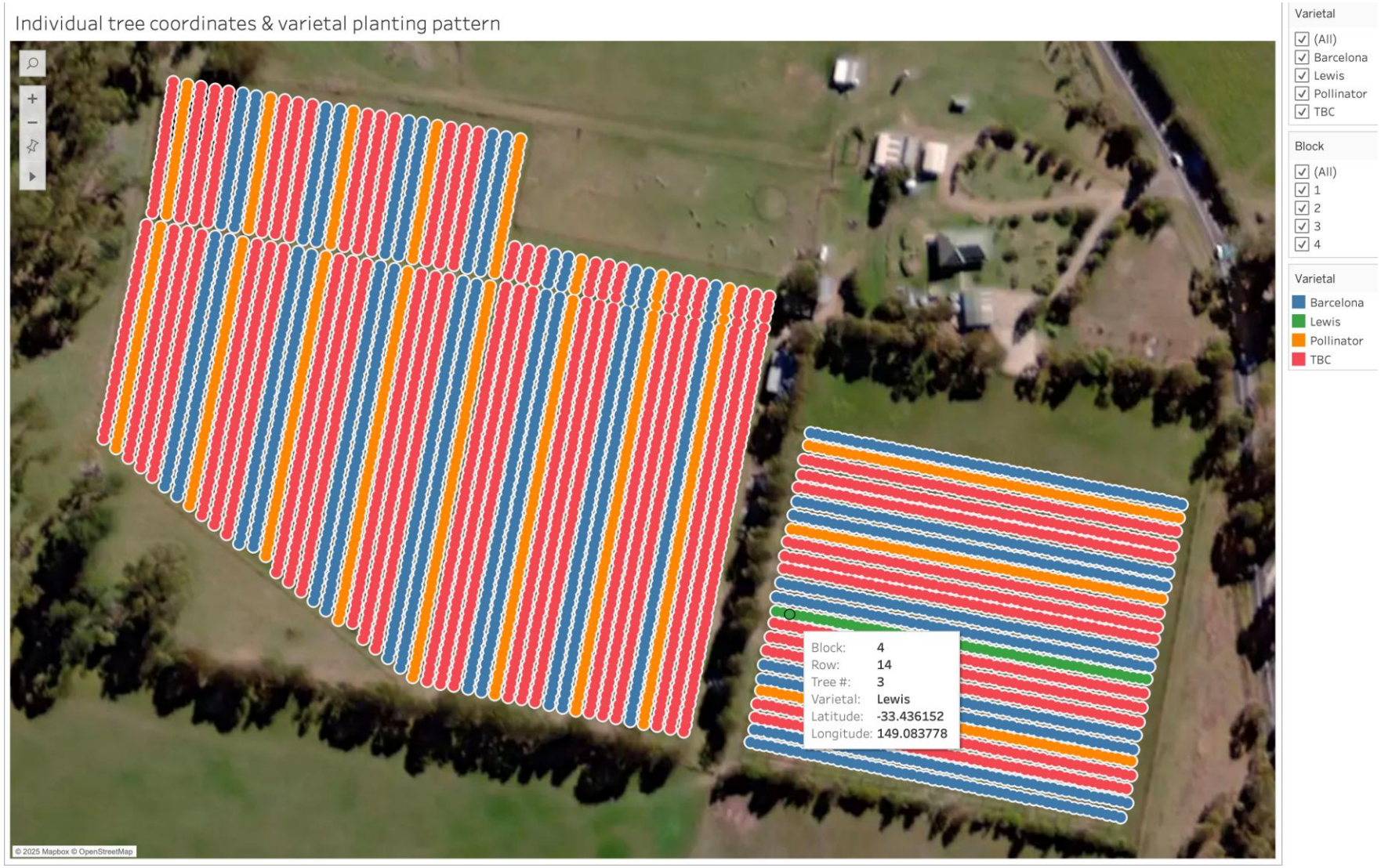
"The release over two consecutive seasons of *Trichogramma* wasps have helped us get on top of a very significant problem with pecan stem girdlers [Maroga melanostigma] without having to use systemic insecticides or significant amounts of manual labour…"

M.V-K : Chief Scientist StahmannWebster T: +61 0428 838 806
K.Mc: Pecan Business Unit Manager "Trawalla" Orchard Moree NSW. T: +61 428 422 583

stahmann webster

5.1 Central West NSW Hazelnut Orchards Borer Audit

5.2 HTB audits



Lucknow Gold Hazelnuts Orchard

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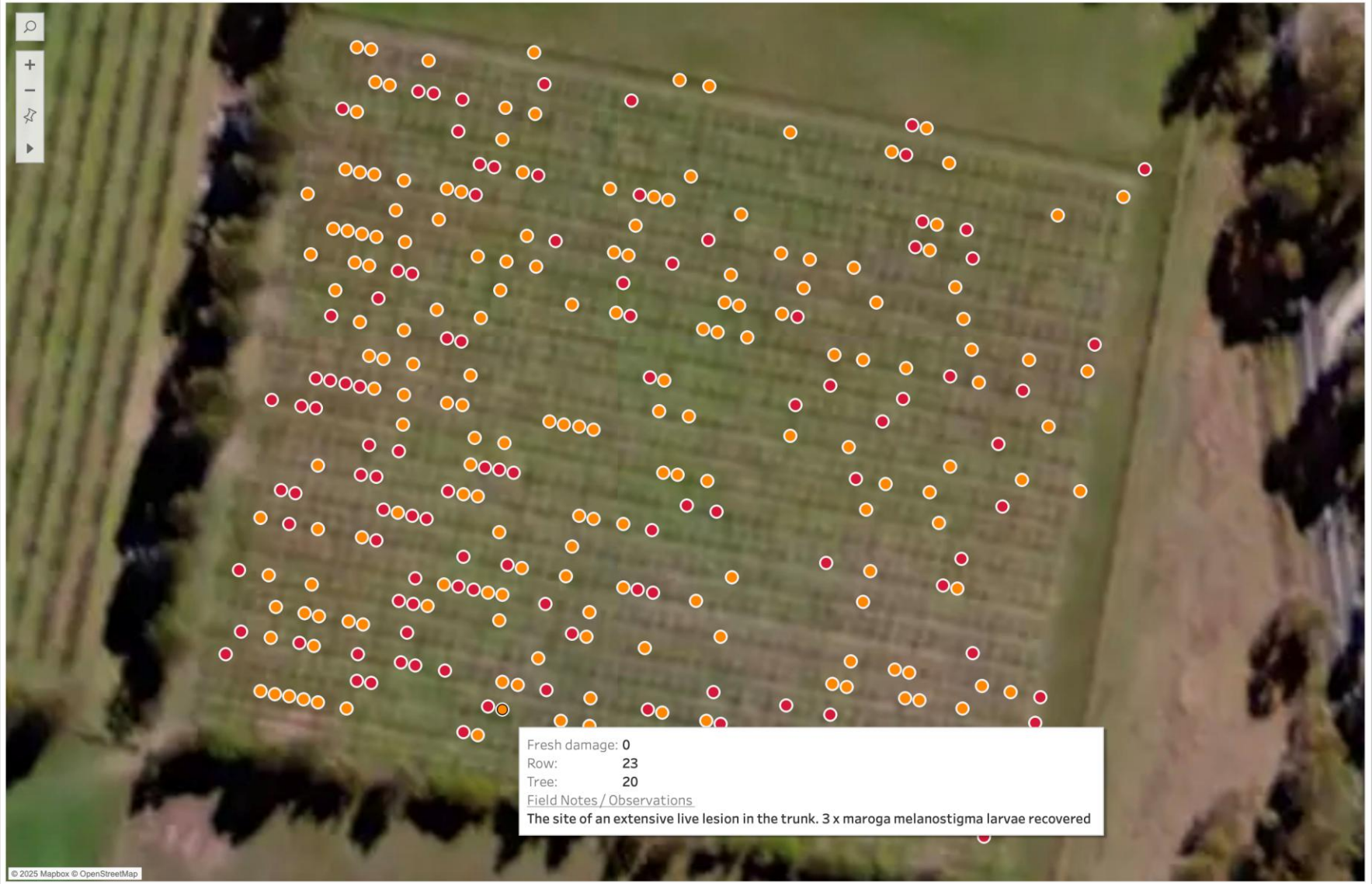
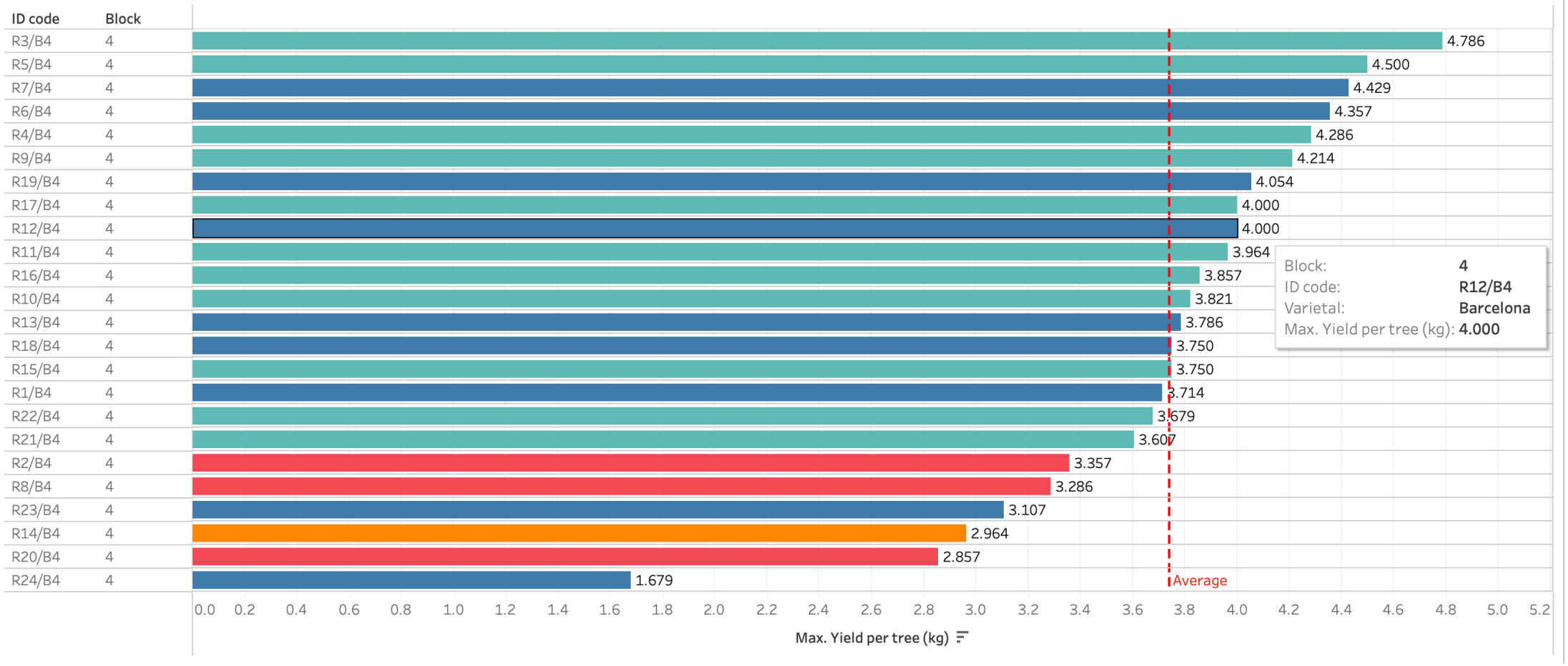
Spatial Distribution of Borers (Old & Fresh Damage Sites)



Fresh damage
(All)
0
1

Fresh damage
0
1

Block Number 4, Season 2025, Varietal All



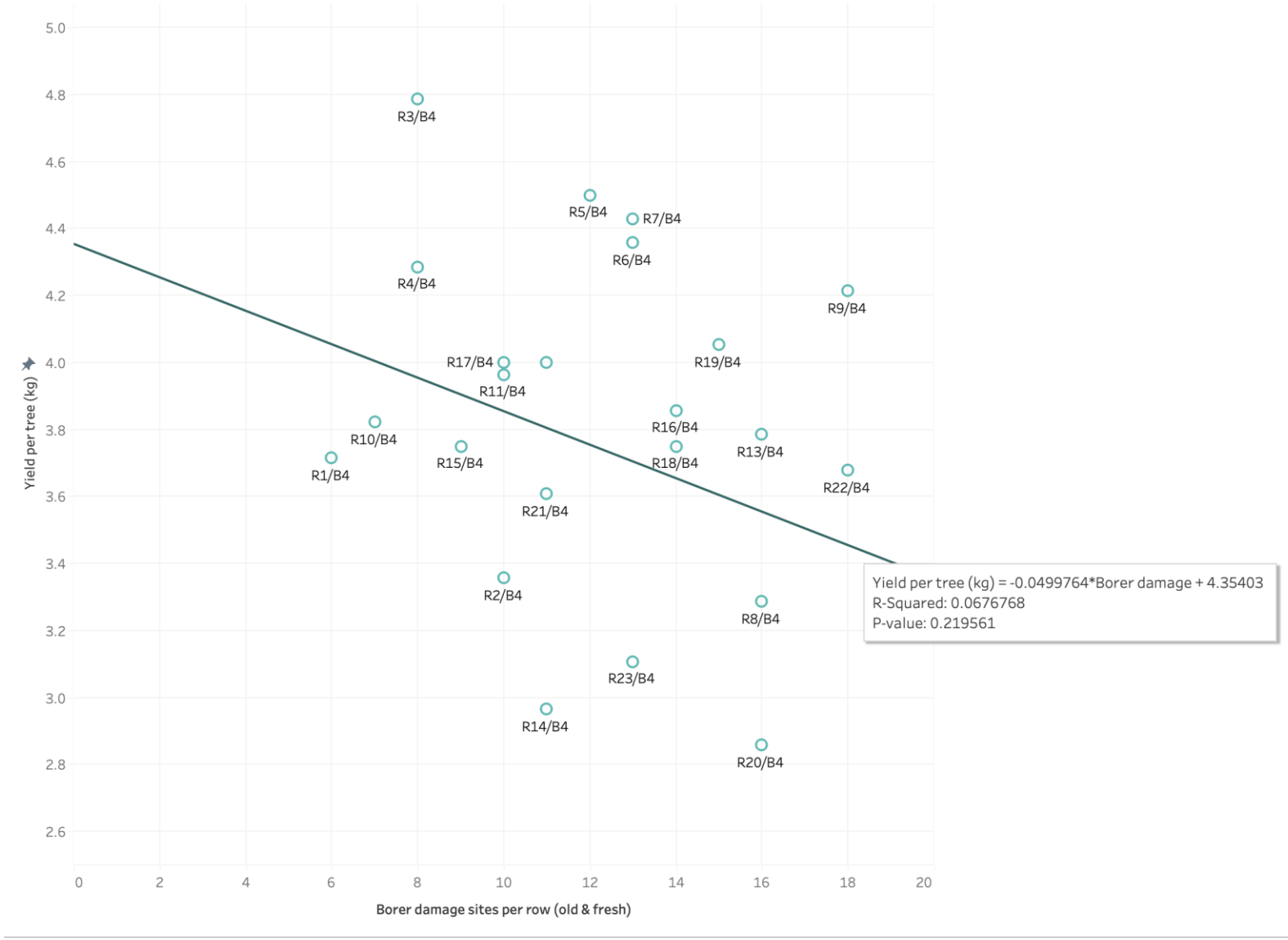
Varietal
- [x] (All)
- [x] Barcelona
- [x] Lewis
- [x] Pollinator
- [x] TBC

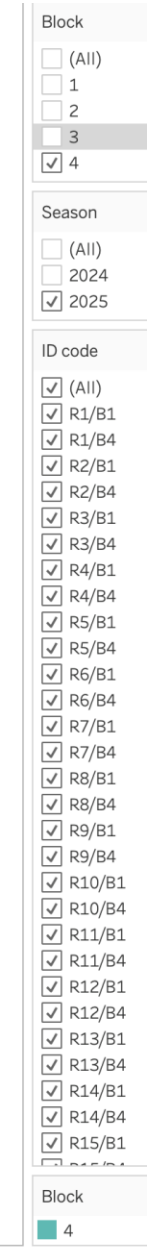
Season
- [ ] (All)
- [ ] 2024
- [x] 2025

Block
- [ ] (All)
- [ ] 1
- [ ] 2
- [ ] 3
- [x] 4

Varietal
- Barcelona
- Lewis
- Pollinator
- TBC

Block 4 Scatterplot: Is there a correlation between total borer damage and yield per tree (2025 harvest)?





Citizen science from the last century

"The larvae of this Moth destroy the trees by boring, first tunnelling for some distance under the bark, and then gnawing their way right into the very heart of the tree (see Plate XIII., Fig, 3). The sawdust-like excrescence on the trees being quite sufficient indication of the presence of borers in general, and this one in particular.

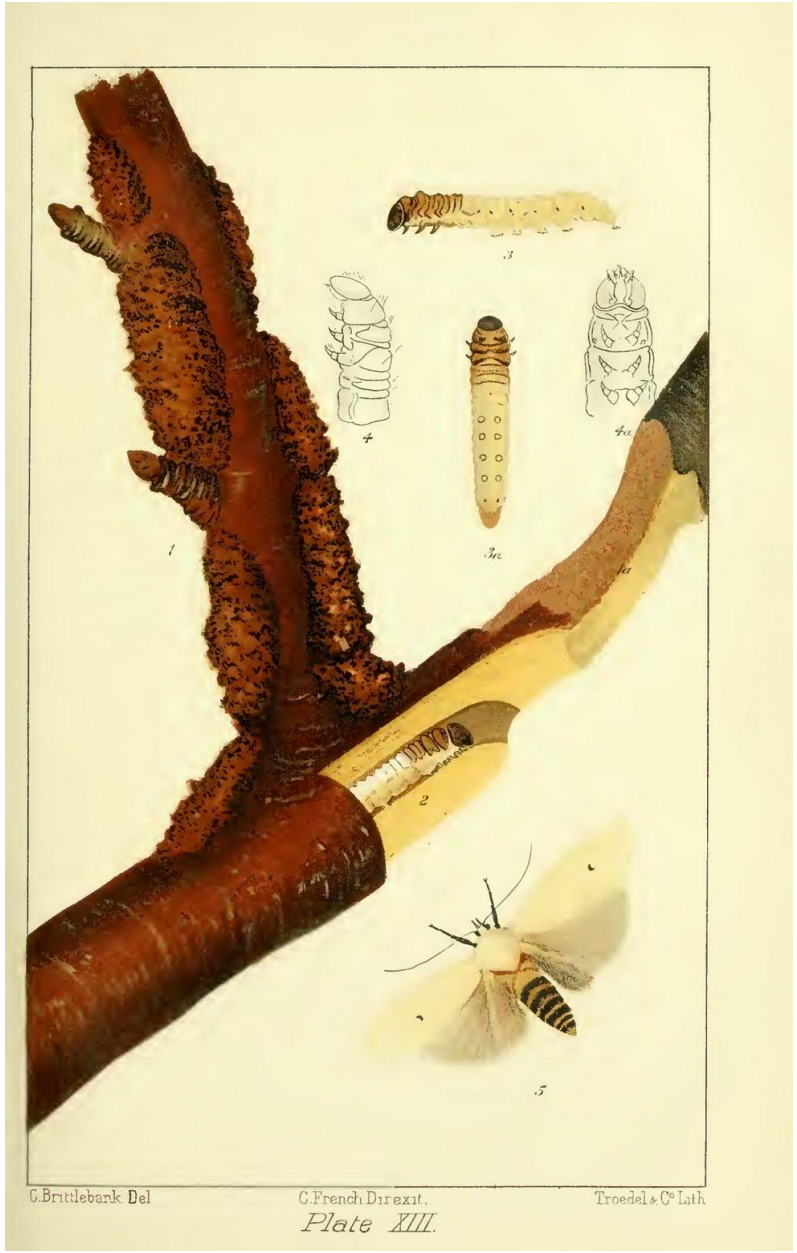
The jaws of the larvae are very strongly made, which enable them to gnaw with great rapidity, it being perfectly surprising to find what a large amount of damage they are capable of doing during a single night. As an instance of the boring power of some even small grubs, I may mention the fact of the larva of a moth (the former about an inch in length) in one night having bored through a box in which I had had the grub confined, and nearly through a thick table of old seasoned cedar, so that in green wood it is hardly to be wondered at when they do so much damage to trees.
The losses caused by the depredations of this insect are very serious, and if not at once attended to, the grower of both cherries, peaches, and even apricots may suffer more severely than they have hitherto done.

On my return to the colonies, during the past summer, I was led to observe that many fruit trees in the garden of the Hon. George Coppin, at Richmond, near Melbourne, had been attacked by some pest, and were rapidly approaching destruction. Close investigation displayed the fact that some burrows had been made in the trees, somewhat similar to those of the *Cossidae,* the entrance to these burrows being artfully concealed by a small cap of fragments of wood and bark, so closely cemented together as to appear like a portion of the bark itself.

Upon cutting down one of the diseased branches, and splitting it open, I found that the burrow passed almost at right angles to the very heart of the branch, and thence downward for a space of 15 or 16 inches. At the bottom of this burrow I found a full-grown larva, which, when disturbed, wriggled itself about with very rapid movements, crawling up and down its burrow with surprising quickness. Below the home of the first insect noted was another burrow of 12 inches in depth, and in this I found a healthy pupa, equally with the larva disinclined to leave its resting place. Wherever throughout the garden a dead branch was to be seen, it was always found to contain one or more of these insects in either the larva or pupa state, and their number can be guessed at when I say that not less than thirty trees had been more or less attacked by this destructive species.

Notes on the Habits and Earlier Stages of *Cryptophasa unipunctata,* don. By Henry Edwards.*(Communicated by A. Sidney Olliff.)* 1891
Source : https://xyloryctinemothsofaustralia.blogspot.com/2010/07/maroga-melanostigma.html

Distance bored within a 12 month life cycle : (15 inches plus 12 inches) 27 inches or almost 70cm/year)



7.1 Hazelnut Grower Advice & Next Steps.

1. Release Trichogramma if you believe HTB (Maroga Melanostigma) damage is compromising your yields or increasing the risk of damage to your orchard assets.

2. Do your own research into Biological Control
- Biologicalservices.com.au
- Bugsforbugs.com.au
- https://www.iobc-global.org
- "Biological Control with Trichogramma – Advances, Successes and Potential of their use" Sandy Smith 1996 University of Toronto
- "Biological Control with Trichogramma in China : History, Present Status and Perspectives" Annual Reviews in Entomology 2021.

3. Open Mic to close. Questions (2 – 3 mins)
- Future extension and uptake opportunities for BC esp Trichogramma.
- Field days / demonstrations / Exemplar sites.
- Deeper entomological understanding of Maroga Melanostigma's life cycle. (1 – 2+ years why ??) Agrifutures $$
- Borer incidence survey – industry wide- Assoc led : Agrifutures $$
- Existing pest prioritisation. (Hazelnut Aphid : Myzocallis coryli (commercial solutions) , BBM Phytoptus avellanae.
- Development of policies / best practices on BC so HGA is well positioned for the future wrt crop protection / reduced use of insecticides, stewardship of important chemistry / insect resistance management etc. ERM document.

THANKS FOR LISTENING