

Integrated Pest Management
(IPM) options for stink bugs in
our macadamia orchards.

Thembeke Mkhize

10 – 11 September 2024

SAMAC

proudly presents

Mac Day'24

Together we move forward - fuelled by momentum



SAMAC
Macadamias South Africa NPC

Introduction



Feeding damage is causing significant loss

Leading to an increase in insecticide usage



Consequences of excessive insecticide usage



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Integrated Pest Management



Cultural practices



Physical and/or mechanical



Biological control



Chemical control



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| Focus of this study



Identify alternative plant hosts



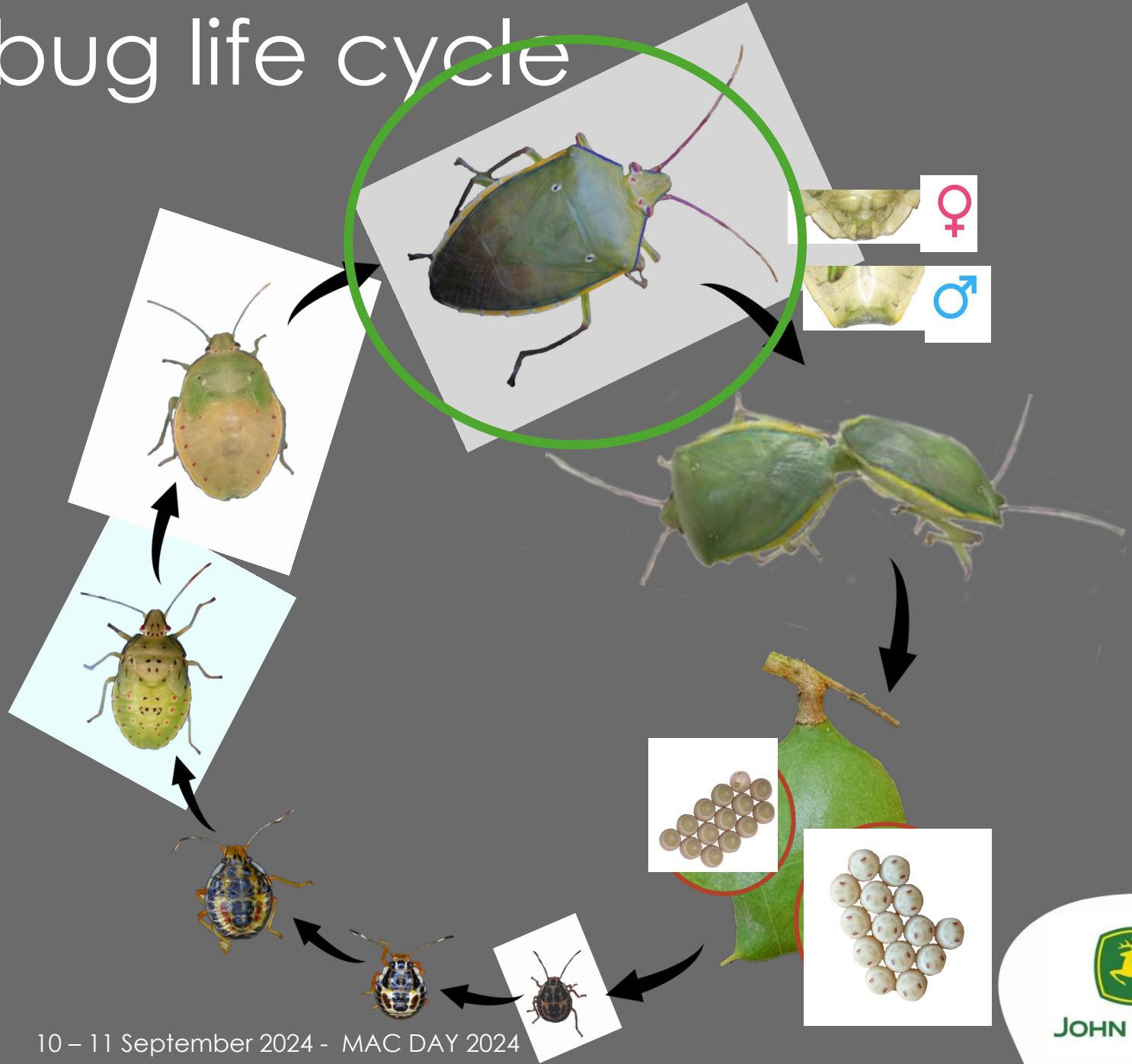
Bacterial symbiont removal



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Stink bug life cycle



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| Why look for alternative plant hosts?



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Why look for alternative plant hosts?

Alarm pheromone (Pal et al., 2022)



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| Why look for alternative plant hosts?



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| Why look for alternative plant hosts?

Gain a better understanding of the pest's movement

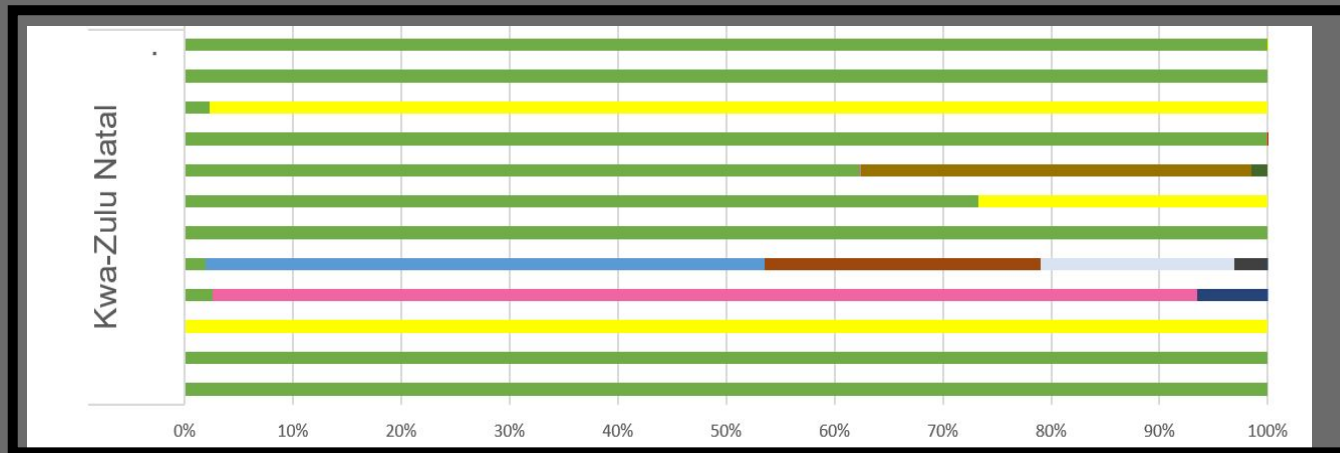
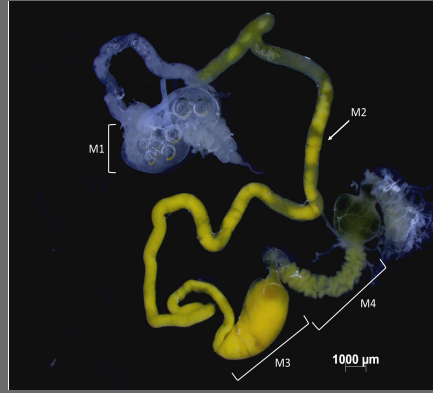
Identify plant hosts to target for early pest monitoring



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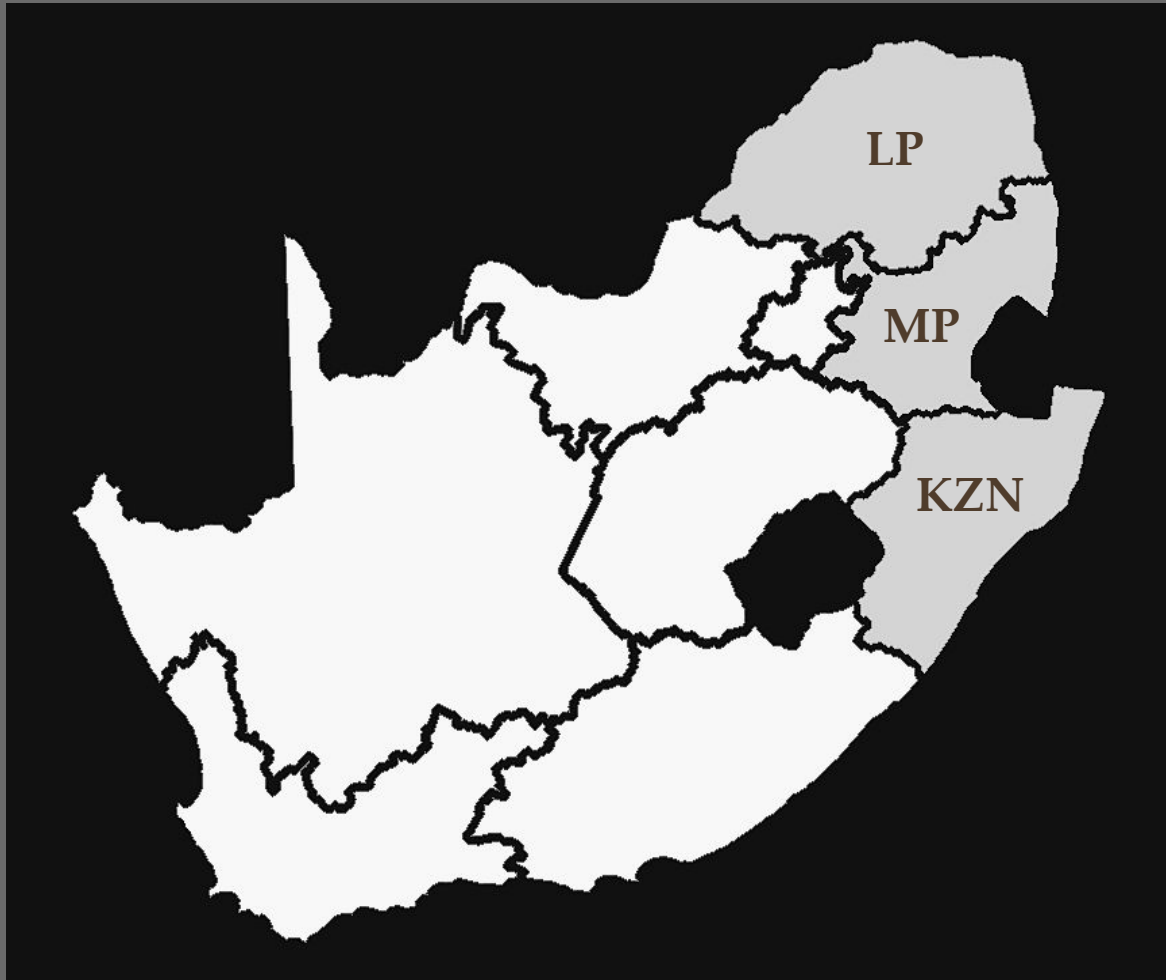
Methodology



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Plants in high abundance



Present in all growing regions:

- Macadamia
- Pine



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Plants in high abundance



Present in Mpumalanga:

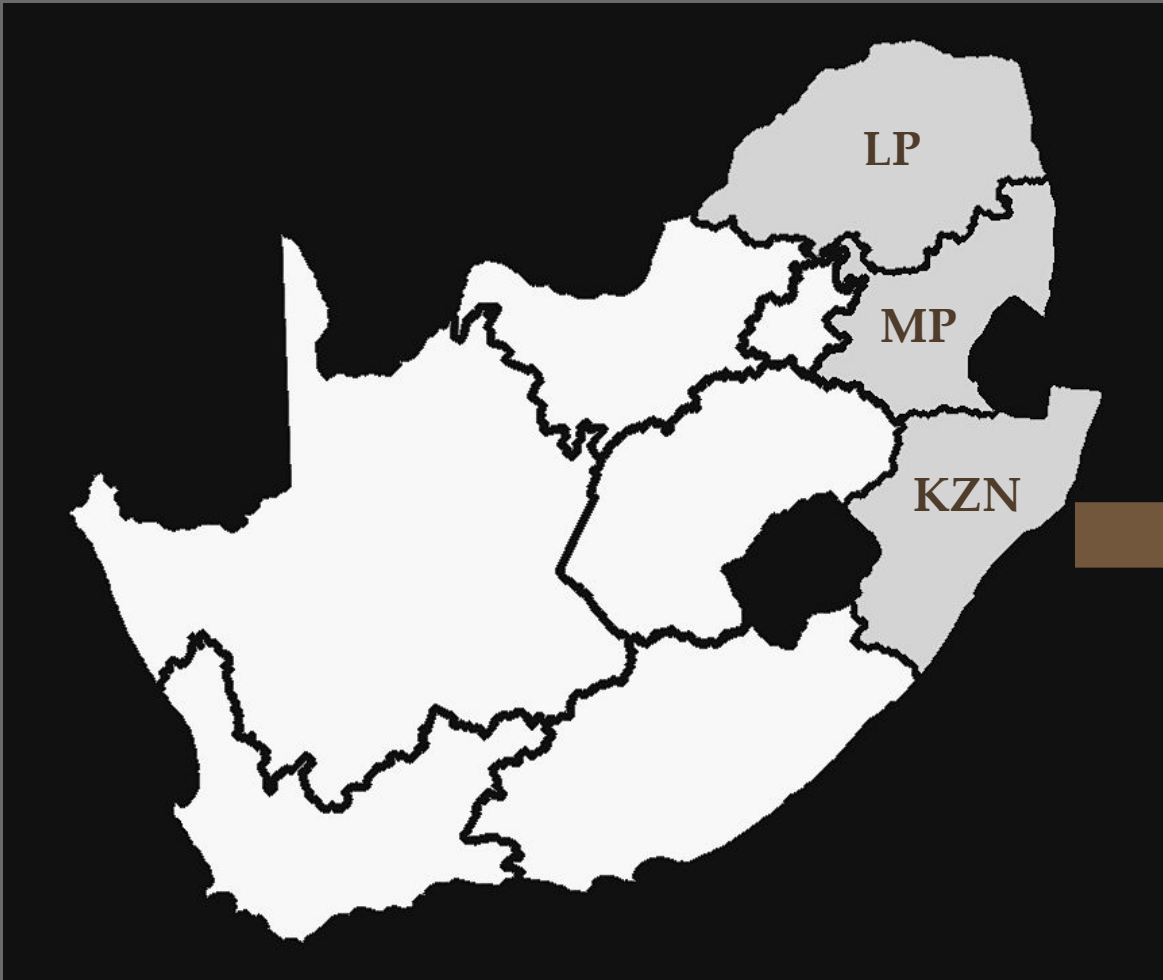
- Green tea
- Cannabis
- Avocado



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Plants in high abundance



Present in KZN:

- Banana
- Maize



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Results summary



35



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| Commercial crops



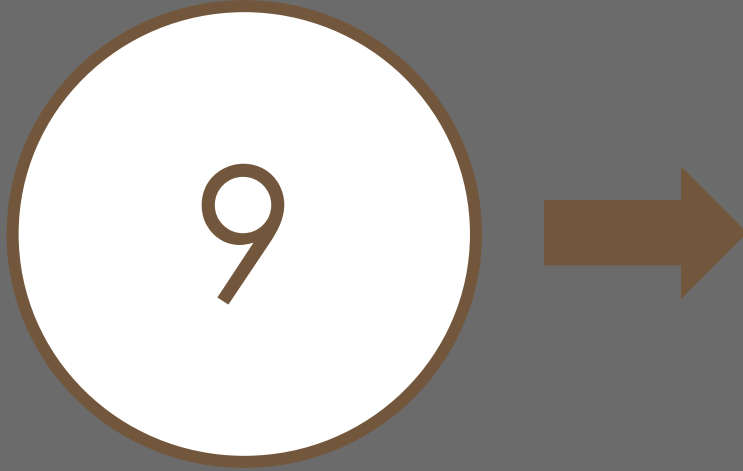
- Macadamia
- Pine
- Avocado
- Maize
- Cannabis
- Cabbage
- Papaya
- Green tea
- Almond
- Banana
- Cucumber
- Pineapple
- Sweet orange
- Cumin



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Native (Wild growing)



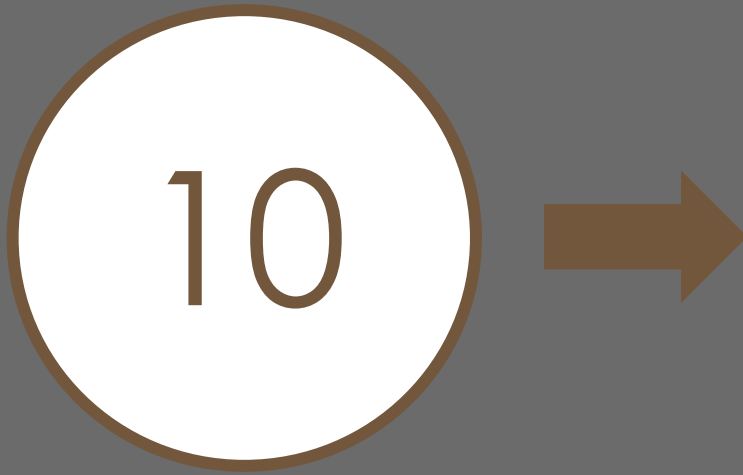
- Boom creeper
- *Lauraceae* family
- Common jujube
- Paper mulberry
- White stinkwood
- *Bridelia* sp.
- *Flindersia* sp.
- Molasses grass
- Natal grass



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Non-Native (Wild growing)



- Stinging nettle
- Oak sp.
- Oriental sycamore
- Velvet ash
- Grey alder
- Black alder
- *Xylopi*a sp.
- Colocynth
- Chia
- Green fox tail grass



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|Cover crop trial



2



- Sunflower
- Carrot



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2021

- Macadamia
- Pine
- *Lauraceae* family
- Sunflower
- White stinkwood
- *Xylopi*a sp.
- *Bridelia* sp.
- Green tea
- Almond
- Carrot
- *Flindersia* sp.

2022

- Macadamia
- Pine
- *Lauraceae* family
- Stinging nettle
- Tomato
- Avocado
- Oak sp.
- Oriental sycamore
- Cabbage
- Velvet ash
- Paper mulberry
- Broom creeper
- Papaya
- Common Jujube

2023

- Macadamia
- Pine
- Cannabis
- Banana
- Maize
- Cumin
- Molasses grass
- Black alder
- Natal grass
- Pineapple
- Colocynth
- Chia
- Sweet orange
- Green fox tail grass





2021

- Macadamia
- Pine
- *Lauraceae* family
- Sunflower
- White stinkwood
- *Xylopi*a sp.
- *Bridelia* sp.
- Green tea
- Almond
- Carrot
- *Flindersia* sp.

2022

- Macadamia
- Pine
- *Lauraceae* family
- Stinging nettle
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2023

- Macadamia
- Pine
- Cannabis
- Banana
- Maize
- Cumin
- Molasses grass
- Black alder
- Natal grass
- Pineapple
- Colocynth
- Chia
- Sweet orange
- Green fox tail grass



2021

- Macadamia
- Pine
- *Lauraceae* family
- Sunflower
- White stinkwood
- *Xylopi*a sp.
- *Bridelia* sp.
- Green tea
- Almond
- Carrot
- *Flindersia* sp.

2022

- Macadamia
- Pine
- *Lauraceae* family
- Stinging nettle
- Tomato
- Avocado
- Oak sp.
- Oriental sycamore
- Cabbage
- Velvet ash
- Paper mulberry
- Broom creeper
- Papaya
- Common Jujube

2023

- Macadamia
- Pine
- Cannabis
- Banana
- Maize
- Cumin
- Molasses grass
- Black alder
- Natal grass
- Pineapple
- Colocynth
- Chia
- Sweet orange
- Green fox tail grass



2021

- Macadamia
- Pine
- *Lauraceae* family
- Sunflower
- White stinkwood
- *Xylopi*a sp.
- *Bridelia* sp.
- Green tea
- Almond
- Carrot
- *Flindersia* sp.

2022

- Macadamia
- Pine
- *Lauraceae* family
- Stinging nettle
- Tomato
- Avocado
- Oak sp.
- Oriental sycamore
- Cabbage
- Velvet ash
- Paper mulberry
- Broom creeper
- Papaya
- Common Jujube

2023

- Macadamia
- Pine
- Cannabis
- Banana
- Maize
- Cumin
- Molasses grass
- Black alder
- Natal grass
- Pineapple
- Colocynth
- Chia
- Sweet orange
- Green fox tail grass



2021

- Macadamia
- Pine
- *Lauraceae* family
- Sunflower
- White stinkwood
- *Xylopi*a sp.
- *Bridelia* sp.
- Green tea
- Almond
- Carrot
- *Flindersia* sp.

2022

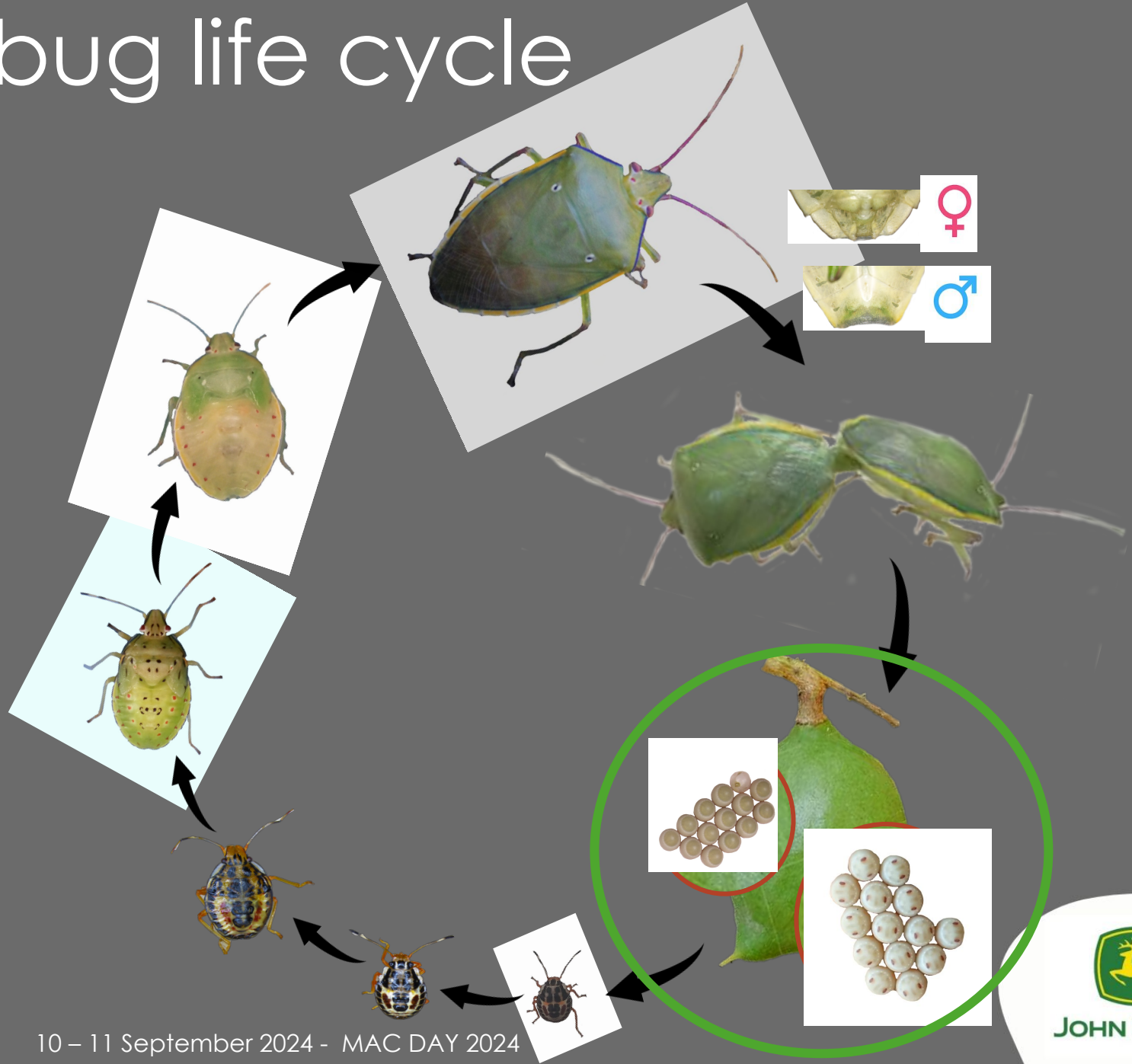
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2023

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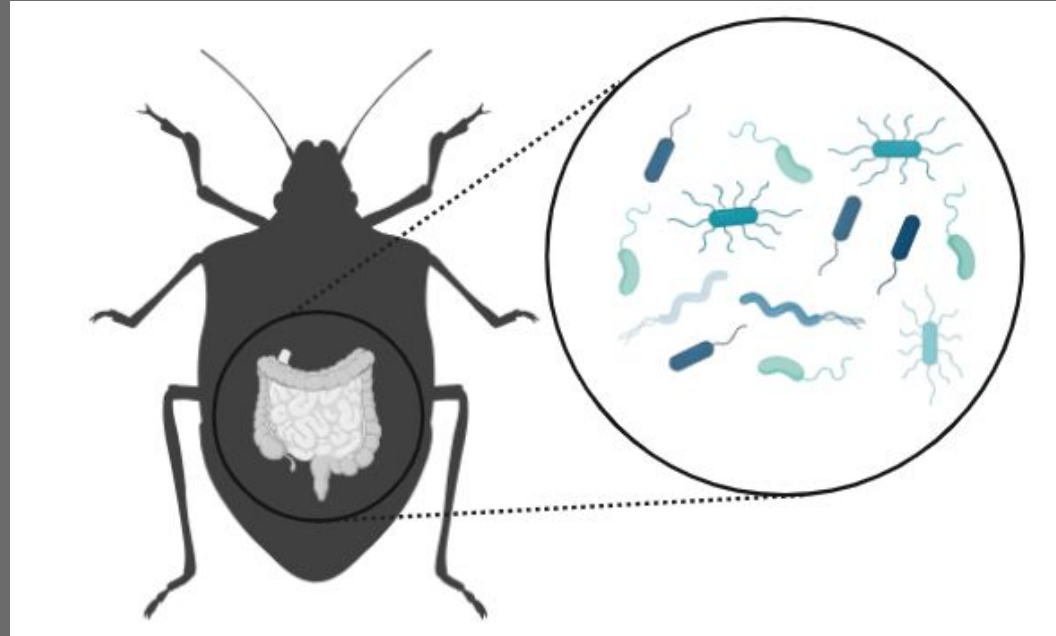
Stink bug life cycle



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Why remove bacterial symbionts?

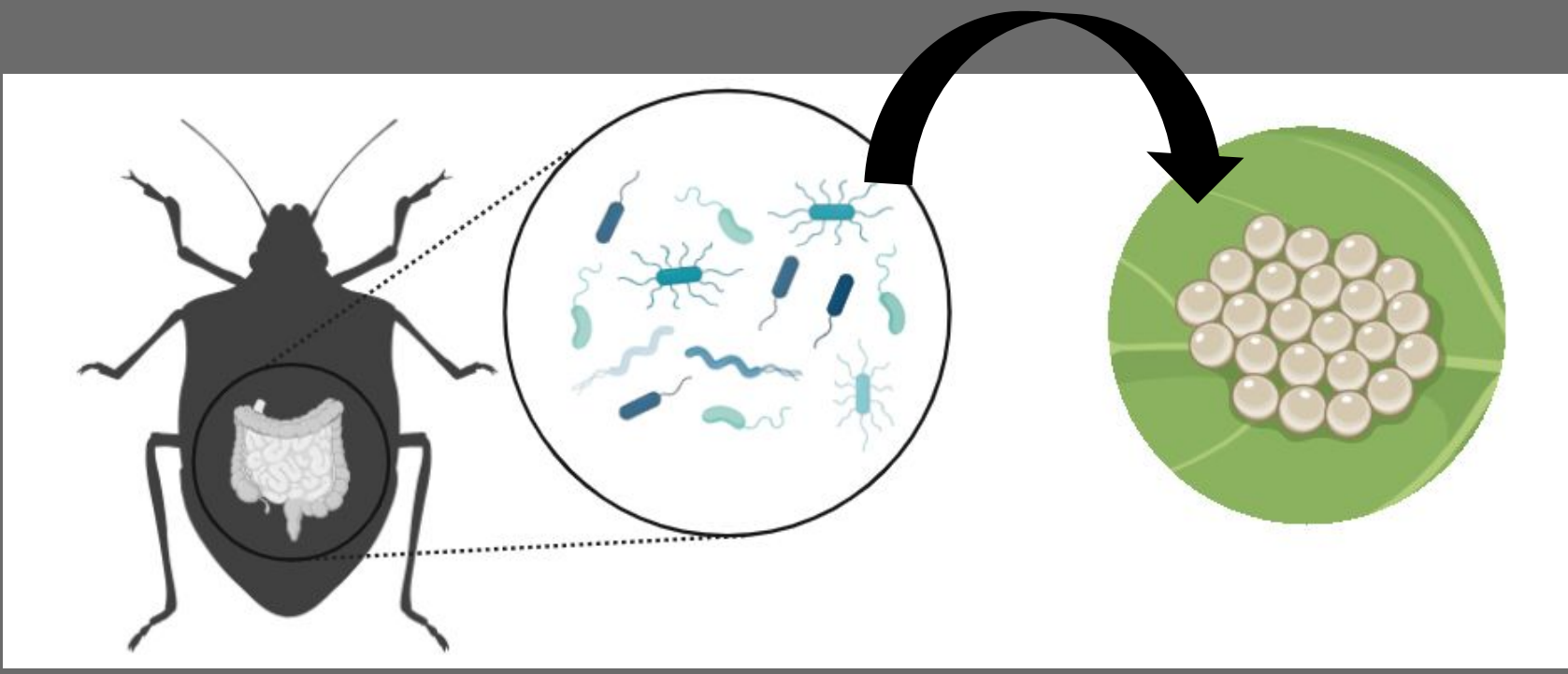


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Fourie et al., 2023



Why remove bacterial symbionts?



Primary symbiont: *Pantoea bathycoelia*



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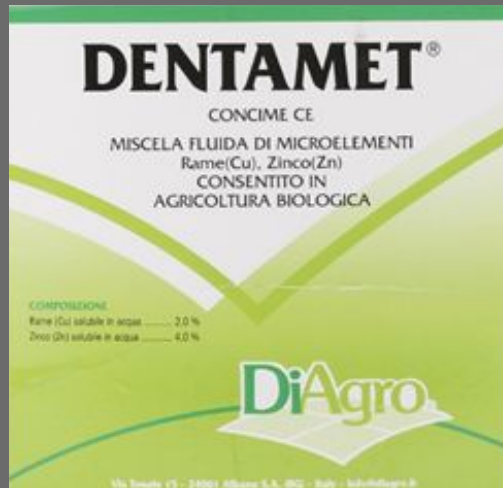
Fourie et al., 2023



A collection of logos in the bottom right corner, including the John Deere logo, the MACDAY 2024 logo, and the SAMAC (Macadamias South Africa NPC) logo.

What products have been tested?

MACADAMIA
protection programme



Dentament, copper and zinc complex with citric acid



Bio-D, Manganese and zinc complex with citric acid



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Gonella et al., 2019



JOHN DEERE



SAMAC
Macadamias South Africa NPC

| What products are we testing?

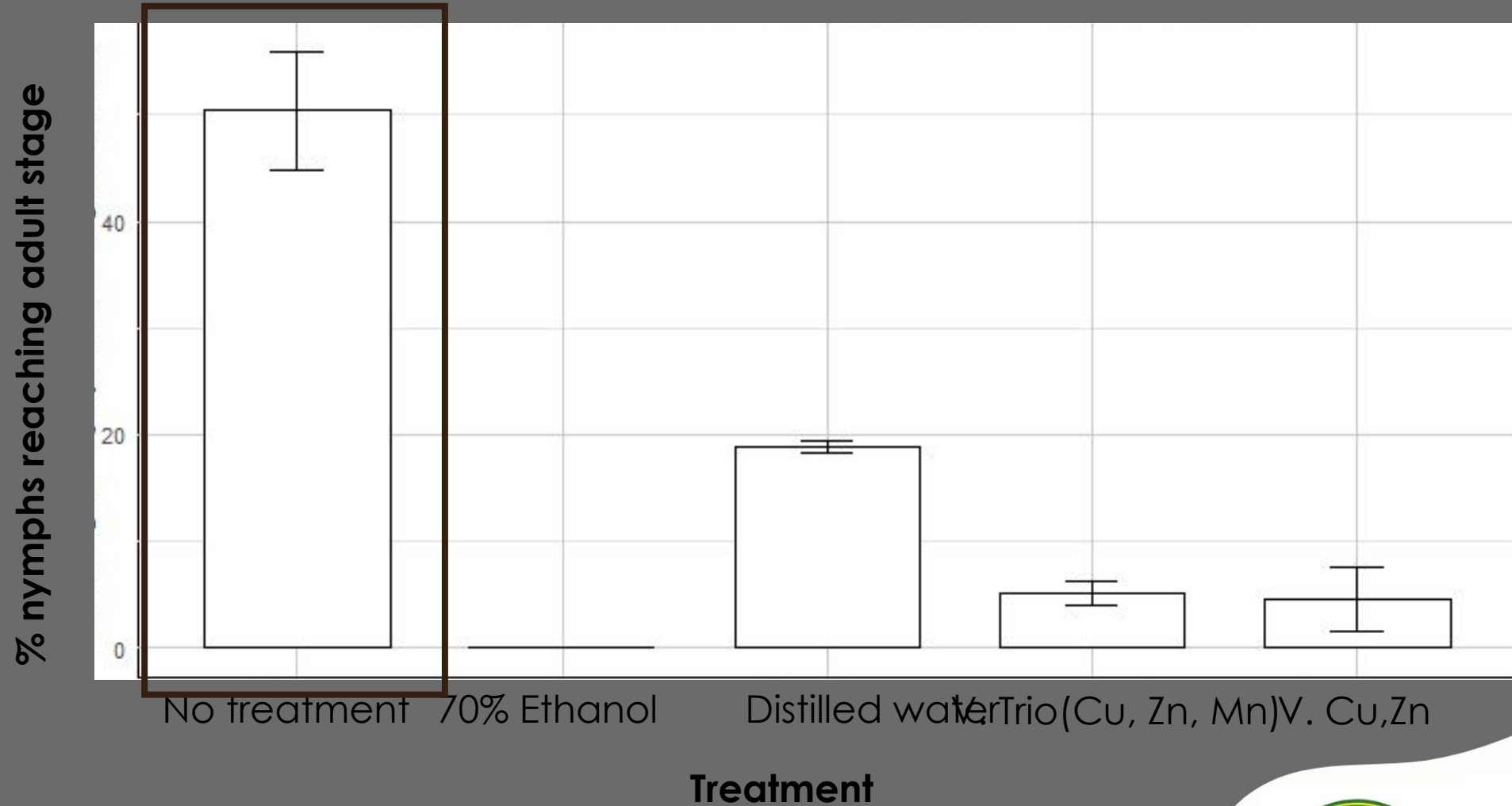


verno™ Micronutrients

	Copper as Cuprous Oxide	Zinc as Zinc Oxide	Manganese as Manganese Carbonate
Verno Copper+ Zinc	300g/kg	300g/kg	-
Verno Trio	150g/kg	150g/kg	160g/kg



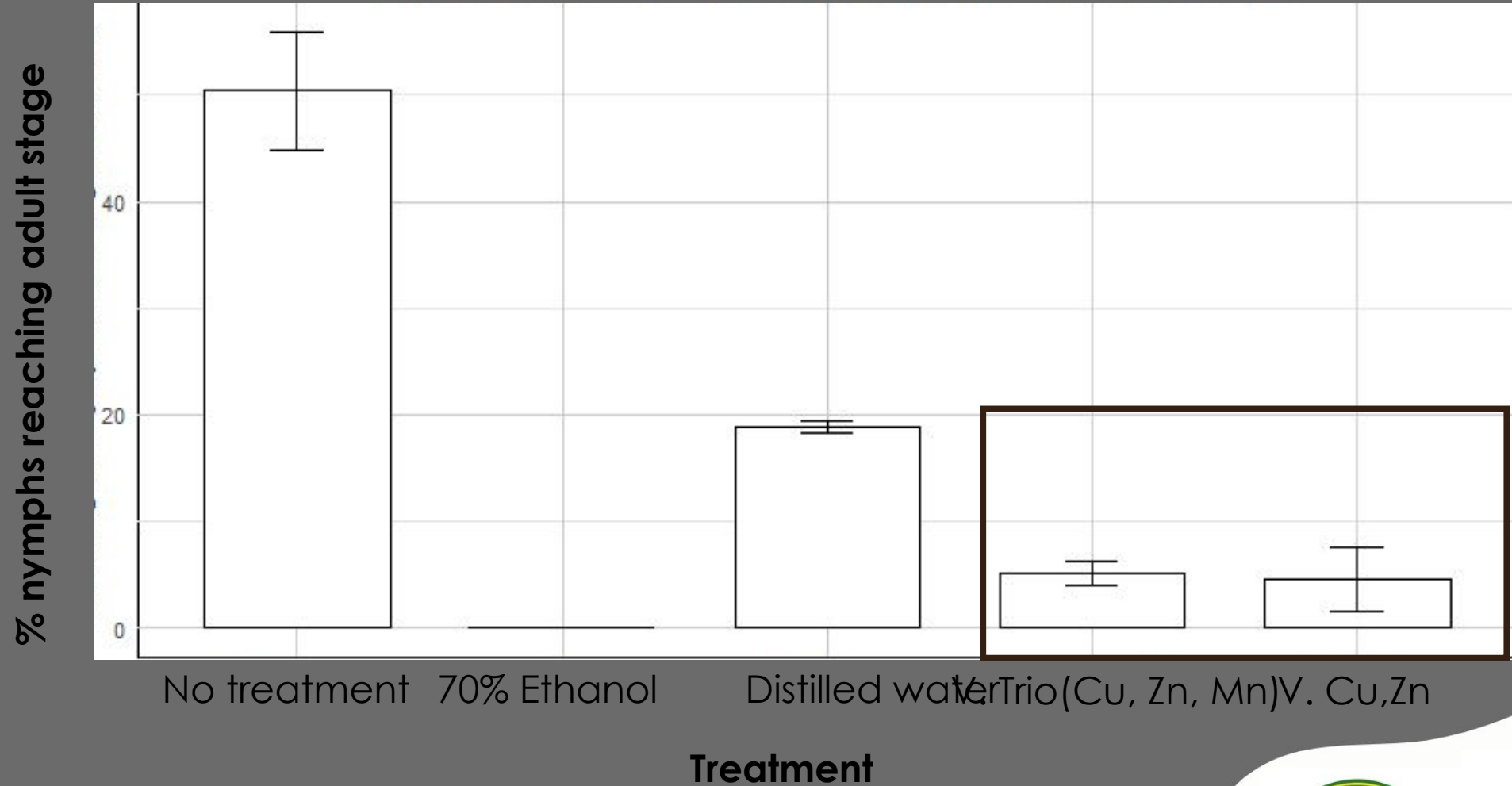
How did sterilization affect survival?



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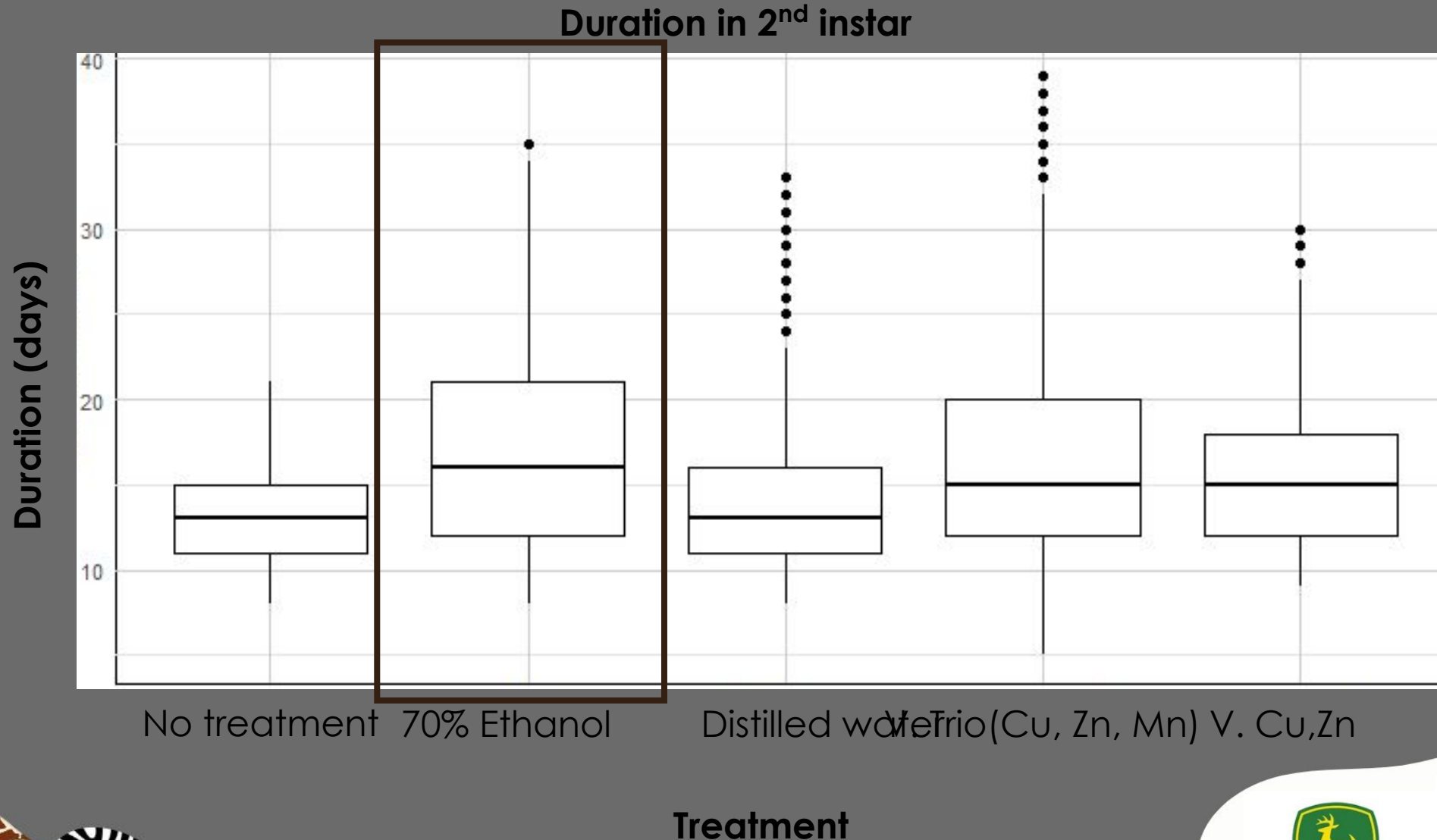
How did sterilization affect survival?



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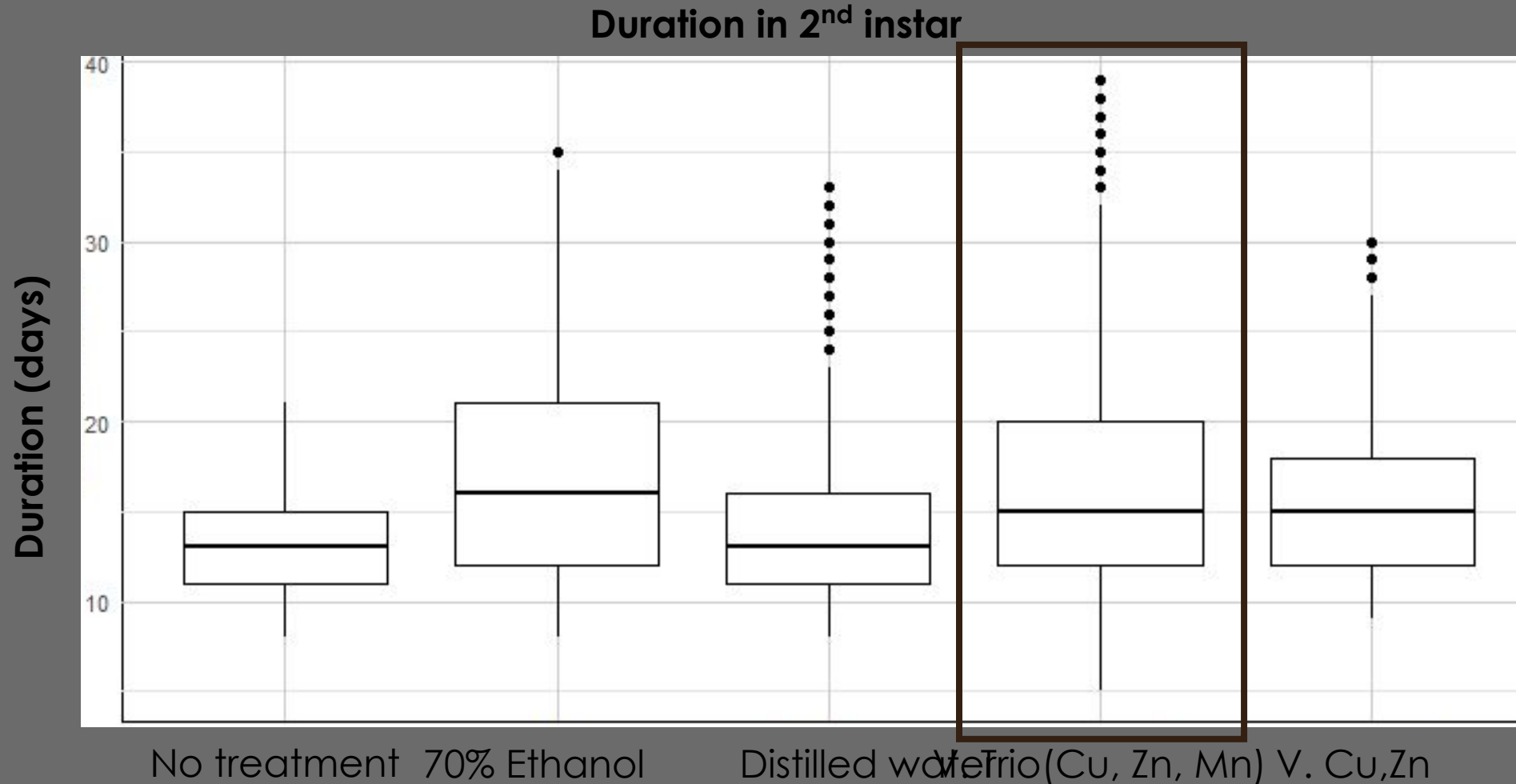
How did sterilization affect development?



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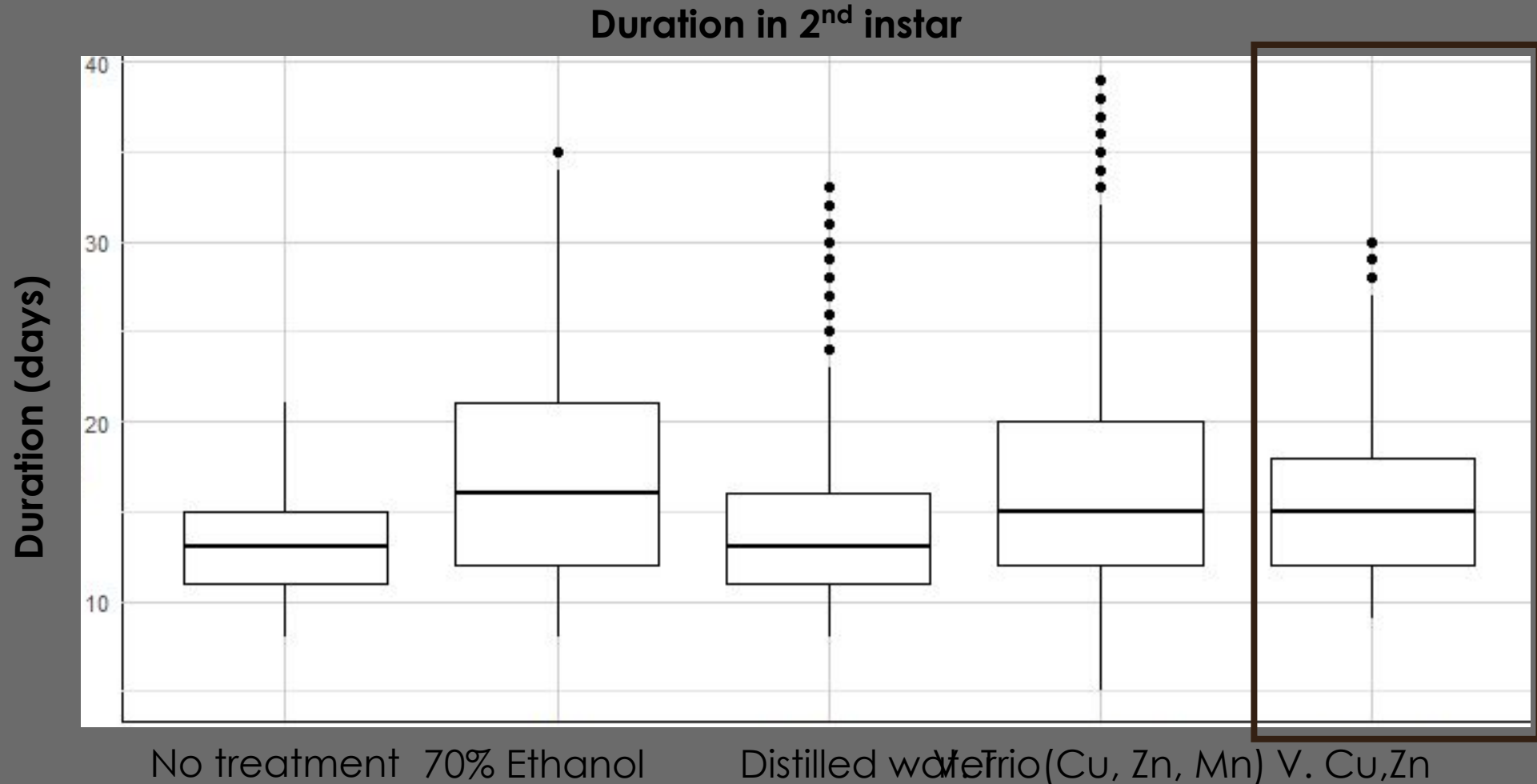
How did sterilization affect development?



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How did sterilization affect development?



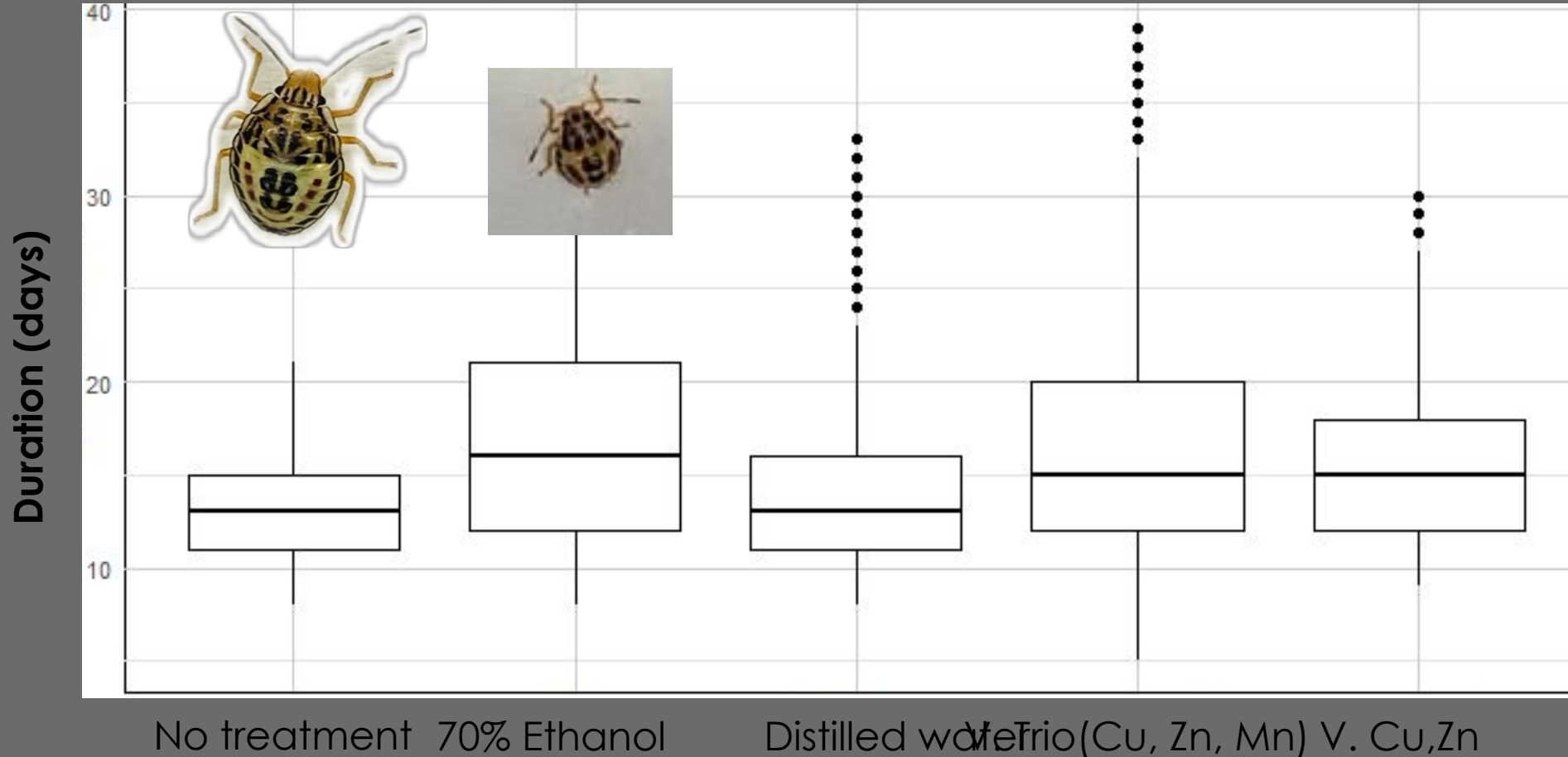
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Treatment



How did sterilization affect development?

Duration in 2nd instar

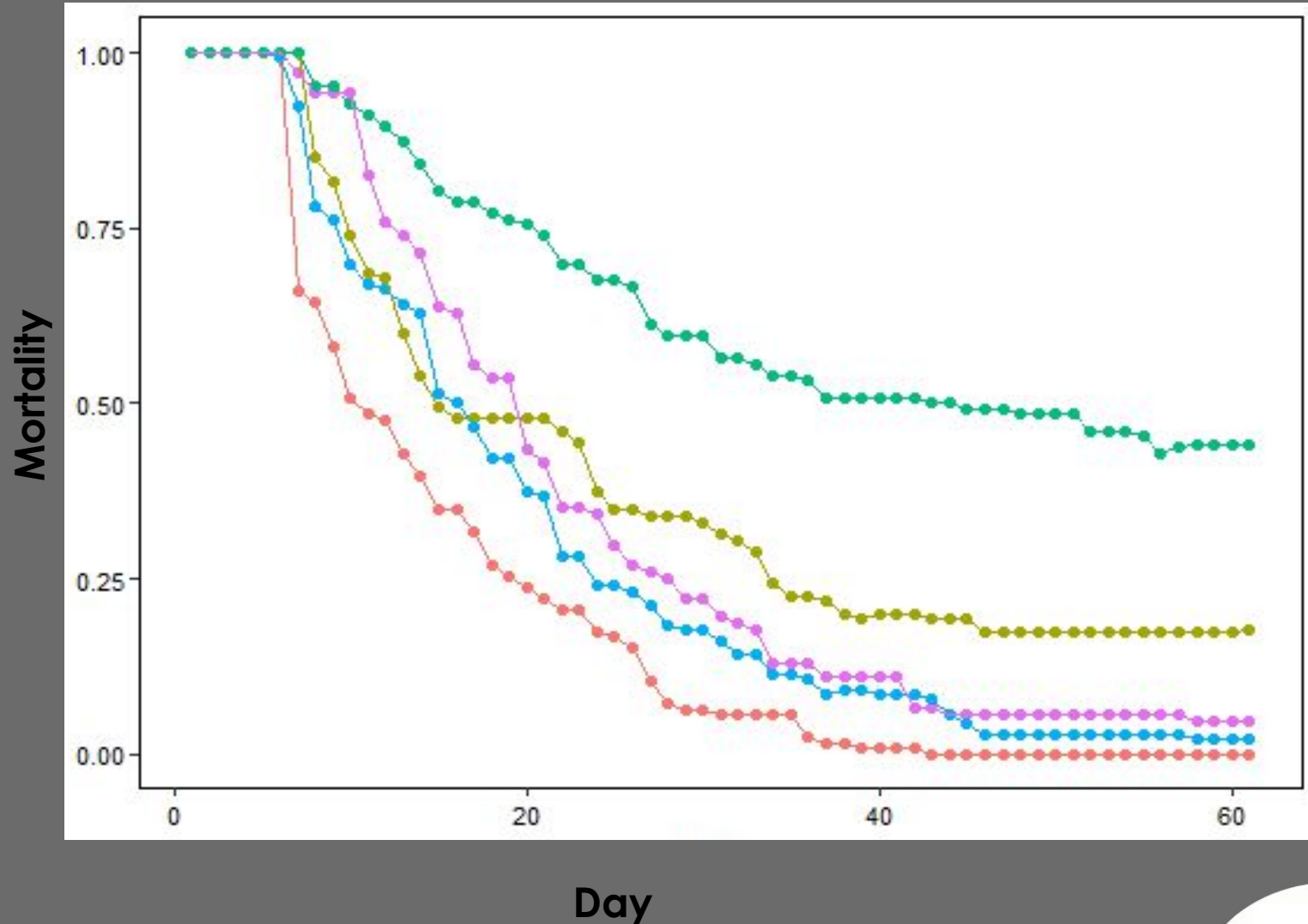


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Treatment



|How did sterilization affect mortality?



- No treatment
- 70% Ethanol
- Distilled water
- V. Trio (Cu, Zn, Mn)
- V. Copper Zinc



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Take-home message:

Understanding stink bug behaviour is important for management

Alternative plant hosts can be investigated as potential trap crops

Micro-nutrient fertilizers may offer a sustainable method to control stink bugs

Together we move forward - fuelled by momentum



Acknowledgements



Funding: SAMAC and NRF

Farms that kindly collected and stored stink bugs for us

Supervisors and collaborators

Macadamia protection programme team

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Thank you

