TABLE TALK

GRAPE

CONVERSATIONS

PRACTICAL CONSIDERATIONS FOR BIOLOGICAL PEST CONTROL

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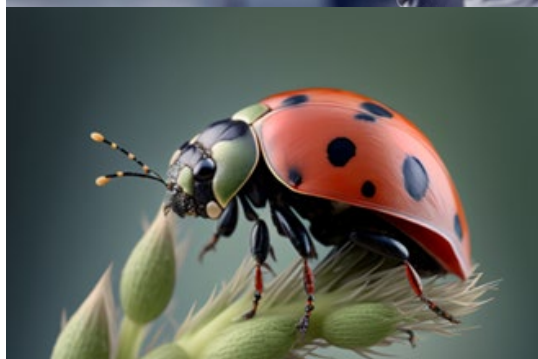
INTRODUCTION & BACKGROUND

BIOCONTROL IS THE USE OF NATURAL ENEMIES TO CONTROL PEST AND DISEASES IN CROPS AND THE ENVIRONMENT

- Predators (e.g. ladybugs eating aphids)
- Parasitoids (e.g. wasps laying eggs in caterpillars)
- Pathogens (e.g. fungi, bacteria, or viruses infecting insects or weeds)



BIOCONTROL: PRO'S & CON'S

Pro's

- Species-specific, low non target effect
- Pests cannot develop resistance
- **Environmentally friendly (?)**
- Sustainable long-term solution
- **Cost Effective (in the long term) (?)**
- Improves ecological balance

Con's

- Cannot eradicate pests, slower action
- Variable effectiveness
- Complex implementation
- Initial cost and time
- **Regulatory hurdles (?)**
- Quality control!

“Regulation is often seen as a barrier - but in IPM, it’s also the catalyst that ensures innovation is effective, safe, and scalable”

MARTIN WOHLFARTER
SENIOR GLABAL REGULATORY AFFAIRS SPECIALIST AT KOPPERT B.V.

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WHY SHOULD THERE BE REGISTRATION FOR PARISITOIDS & PREDATORS ALREADY OCCURING NATURALLY?

- **Quality Control** - Registration ensures mass-reared predators and parasitoids are safe, effective, and **contaminant-free.**
- **Science-Based Decision Making** - Scientific data submitted during registration **supports evidence-based pest control** and informed regulation.
- **Environmental Risk** - Even native species can **disrupt ecosystems** if misused—registration helps assess and manage ecological risks.

AVAILIBILITY OF BIOCONTROL OPTIONS
A Short Review

THE PROCESS
Consulted Agri-Intel Database (Filtered for Biologicals)
Consulted with insectaries, product producers & distributers
Filtered active ingredients according to **insect** targets & table grapes
Grouped target pests
Generated a list of registered & non-registered actives/agents

REGISTERED ACTIVE INGREDIENTS

active ingredient per target

Target	Bollworm	SA Carnation Tortrix	Mealybug	Whitefly	FCM	Mites	Weevils	Nematodes
Active Ingredients	*Bacillus thuringiensis*	*Bacillus thuringiensis*	*Beauveria bassiana*	*Beauveria bassiana*	*Beauveria bassiana*	*Metarhizium anisopliae*	*Metarhizium anisopliae*	*Paecilomyces lilacinus*
	Helicoverpa armigera Nucleopolyhedrovirus		*Metarhizium anisopliae*		*Thaumatotibia leucotreta Granulovirus*			
Number of Unique registrations	*4*	*1*	*2*	*1*	*3*	*1*	*1*	*1*

NON-REGISTERED ACTIVE INGREDIENTS

active ingredient per target

Target	Aphids	FCM	Flies	Mealybug	Mites	Scale	Thrips	Weevils
Active Ingriedients	***Chrysoperla carnae***	*Beauveria bassiana*	*Chrysoperla zastrowi zastrowi*	*Anagyrus vladimiri*	*Neoseiulus californicus*	*Cryptolaemus montrouzieri*	*Beauveria bassiana*	*Heterhorhabditis bacteriophora*
	Neuroptera	*Trichogrammatoidea cryptophlebiae*		***Chrysoperla carnae***	*Chrysoperla zastrowi zastrowi*	*Aphytis melinus*	*Heterhorhabditis bacteriophora*	
	Chrysoperla zastrowi zastrowi	*Heterhorhabditis bacteriophora*		*Beauveria bassiana*	*Phytoseiulus persimilis*			
				Chrysoperla zastrowi zastrowi	*Beauveria bassiana*			
				Coccidoxenoides perminutus	*Neoseiulus californicus*			
				Cryptolaemus montrouzieri	*Phytoseiulus persimilis*			
				Leptomastix dactylopii				
				Nephus bipunctatus				
				Nephus kamburovi				
				Nephus sp.				
				Neuroptera				
Number of Unique actives	*3*	*3*	*1*	*11*	*6*	*2*	*2*	*1*

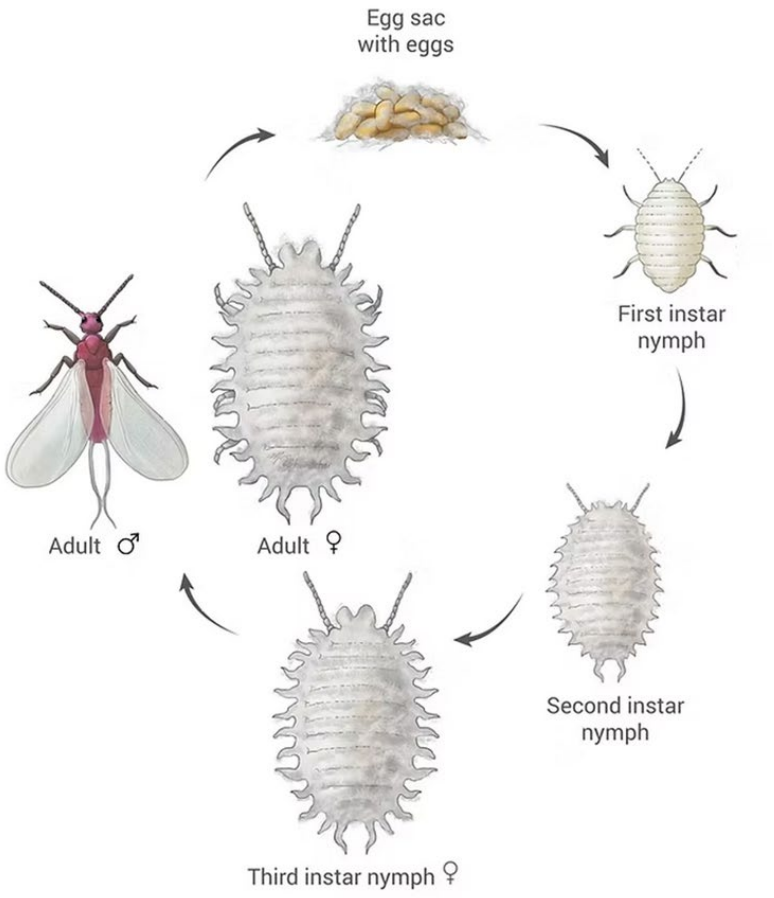
Chrysoperla carnea – does not occur in South Africa – wrong identification?

Identifications of biocontrol agents?

WHAT QUESTIONS SHOULD BE CONSIDERED BEFORE USING BIOCONTROL?

HOW DO WE CHOOSE A BIOCONTROL AGENT?

THE PEST: MEALYBUGS (PSEUDOCOCCIDAE)



Dispersal

- Nymps & adult females crawl on branches, leaves and fruit
- Adult males have wings and can fly

Damage

- Wilting leaves
- Desiccation of bunches
- Pre-mature leaf drop
- Production of honeydew-sooty mould
- Transmission of leafroll virus

Other Information

- Multiple generations in a season
- Honeydew attracts ants, which "farm" the mealybugs
- Males do not feed

https://scalenet.info

SCALENET

Search Catalogue...

Use: Enter a scientific name (genus or binomial) to retrieve a catalogue entry. You'll get a summary of the nomenclatural history, a complete bibliography, information about geographic distribution and ecological associations, as well as comments about systematics, economics, and other topics. Does not accept any symbols.

For other types of queries, use the search links at the top of the page. Alternatively, you can search for catalogue entries by drilling down through the classification.

Citing ScaleNet

García Morales M, Denno BD, Miller DR, Miller GL, Ben-Dov Y, Hardy NB. 2016. *ScaleNet: A literature-based model of scale insect biology and systematics*. Database. doi: 10.1093/database/bav118. http://scalenet.info [Date accessed].

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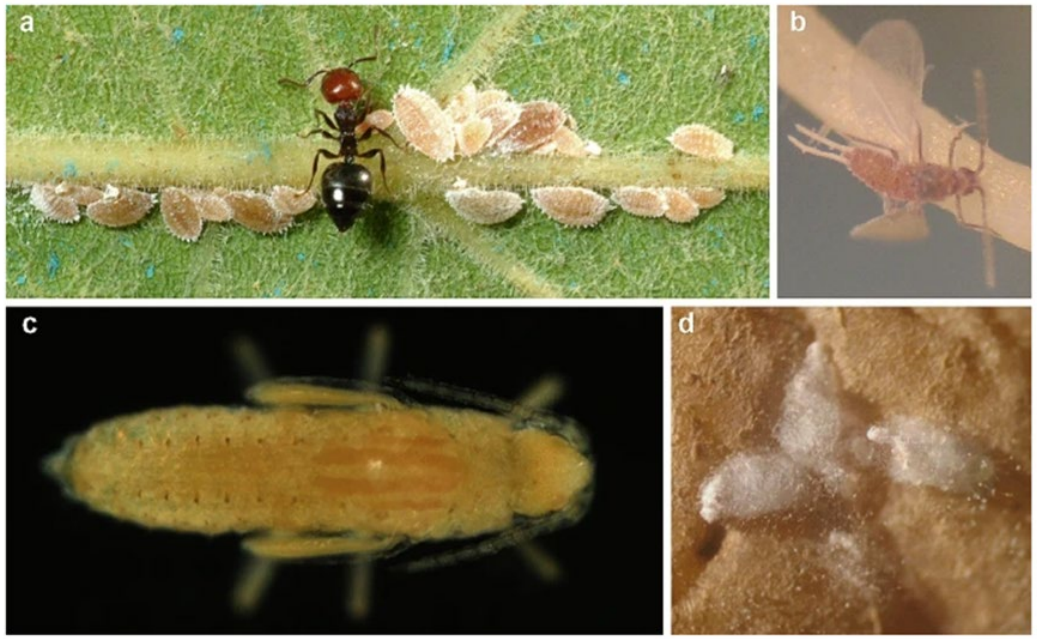
MEALYBUGS ON GRAPE VINES

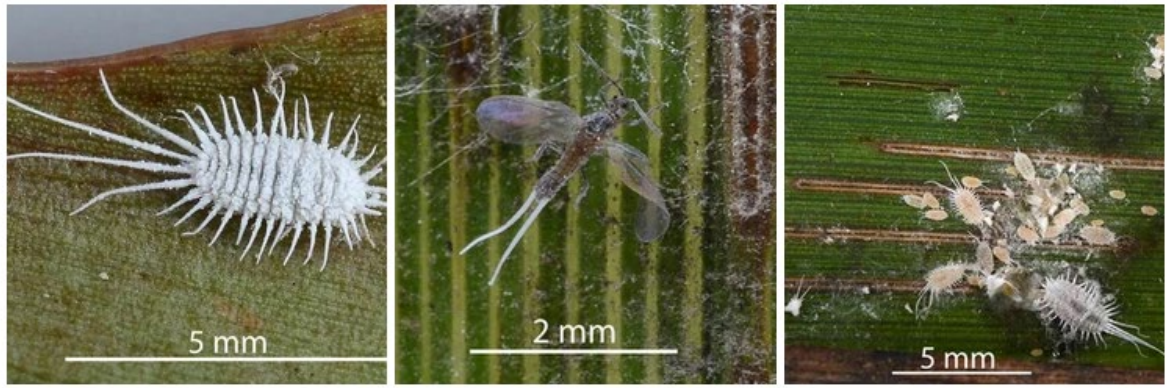
- *Planococcus ficus* - ***Grapevine mealybug*** *(above & below ground)*
- *Pseudococcus longispinus* - ***Longtail mealybug*** *(above ground)*
- *Nipaecoccus viridis* - ***Karoo thorn mealyug*** *(above & below ground)*
- *Ferrisia malvastra (above ground)*
- *Pseudococcus viburni* - ***Obscure mealybug*** *(only on weeds)*



The vine mealybug, *Planococcus ficus:* **a** colony of young females (note the attending ant *Crematogaster scutellaris* promoting *P. ficus* infestation through a trophobiotic relationship), **b** adult male, **c** male pupa and **d** male pupal cocoons (photograph credit **a**: A. Lucchi, **b–d**: P. Giannotti)

Cocco, A., Pacheco da Silva, V.C., Benelli, G., Botton, M., Lucchi, A. and Lentini, A., 2021. Sustainable management of the vine mealybug in organic vineyards. Journal of Pest Science, 94(2), pp.153-185.

Long-tailed mealybug (Pseudococcus longispinus). From left to right; adult female, adult male, larvae.



Walton, V.M. and Pringle, K.L., 2004. A survey of mealybugs and associated natural enemies in vineyards in the Western Cape Province, South Africa. South African Journal of Enology and Viticulture, 25(1), pp.23-25.

MEALYBUG PARASITOIDS

Planococcus ficus - Grapevine mealybug

- *Anagyrus sp.*
- *Leptomastixs dactylopii*
- *Coccidoxenoides perminutes*
- *Chrysoplatecyrus splendens*

Walton, V.M. and Pringle, K.L., 2004. A survey of mealybugs and associated natural enemies in vineyards in the Western Cape Province, South Africa. South African Journal of Enology and Viticulture, 25(1), pp.23-25.

MEALYBUG PARASITOIDS

Planococcus ficus - Grapevine mealybug

- *Cryptolaemus montrouzieri*
- *Nephus angustus*
- *Nephus quadrivittatus*
- *Nephus bineavatus*
- *Hyperaspis felixi*
- *Scymnus nubilis*
- *Cydonia lunata*
- *Rhizobiellus sp.*
- *Hyppodamia sp*

Nephus quadrimaculatus

Graham Finch

Walton, V.M. and Pringle, K.L., 2004. A survey of mealybugs and associated natural enemies in vineyards in the Western Cape Province, South Africa. South African Journal of Enology and Viticulture, 25(1), pp.23-25.

QUESTIONS TO ASK BEFORE STARTING BIOCONTROL

1. What is the value of the crop?	***High value**, fresh fruit for export **vs.** Fruit for juice – **Not as high***
2. How much damage can be tolerated?	*Leaves – **A lot**, starts getting problematic if interferes with leaf function **vs.** Fruit – **Very little***
3. Is the crop annual or perennial?	*Perennial*
4. Is the pest local or exotic?	Cosmopolitan – Local & exotic
5. Do suitable natural enemies exist?	**Yes** – many are available
6. Reproductive & dispersal ability of the pest?	**Reproduction** – high; multiple generations in a season **Dispersal** – low; mealybugs only move as far as they can crawl **Exception =** they are very good at "hitching a ride" on farm equipment (e.g. tractors, pruning shears etc.) and people
7. Are there biocontrol-friendly pesticides?	**Yes** – many available
8. Have there been previous successes?	**Yes** – worldwide
9. Other specific considerations?	Although unsightly, mealybugs do not cause much physical damage unless the population is extremely high . **Phytosanitary pests** – which means that on exported fruit there cannot be even a single mealybug (zero pest tolerance on exported fruit). Ants farm & protect mealybugs.

THE IDEAL NATURAL ENEMY

1. Good colonizer	Able to multiply quickly to keep up with the mealybug generations If augmentative release is considered, must be able to breed easily in the lab.
2. Good ability to locate prey	Able to locate and kill prey. Mealybugs are covered in a waxy layer (some species more than others). The predator must be able to handle this. Must also be able to deal with the ants.
3. (Usually) Host-specific	A host-specific natural enemy should target the vine mealybug mealybug, since that is the most common one.
4. Well synchronised with prey	As above, needs to control multiple generations
5. Adaptable to different climatic conditions	Some areas are hot and dry – natural enemy must be adapted to this.
6. Other specific considerations	Numerous pesticides are used in Table Grapes, therefore, the natural enemy must be able to tolerate at least some pesticides.

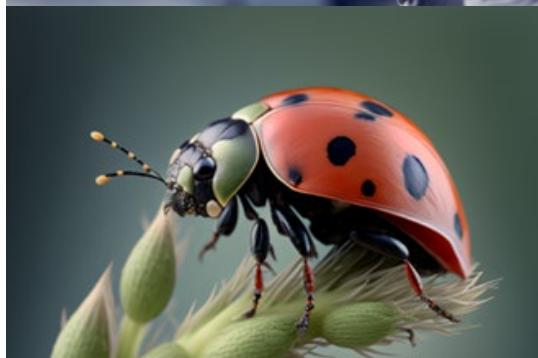
BIOCONTROL OPTIONS

Biocontrol types	***In this case:***
Conservation	**Yes** – can conserve natural enemies already in the system. But first make sure they are still there; pesticides sprays may have caused local extinctions.
Augmentation • *Inoculative release (low numbers – establish population)* • *Inundative release (large numbers – immediate knockdown)*	Could release **predators or parasitoids** during peak season. But be careful that predators do not switch prey to non-target species after the mealybug population is controlled.
Classical	Not a good option because: **1. Multiple species** – likely to be far too expensive to implement for all of them. **2. Some of them are local** – unlikely to find a good exotic natural enemy.
Possible biocontrol agents (general type):	**Why?**
Parasitoid wasps	**Yes** – several local species already present.
Predators	**Yes – local ladybug beetles** already present and can be conserved. There are also commercial species that can be released during peak season.
Microbes (e.g. Entomopathogenic fungi (EPFs))	**Yes**, but good coverage is difficult to achieve and the waxy layer on mealybugs is water-repellent.
Entomopathogenic nematodes (EPNs)	**Yes**, but under specific climatic conditions, adjuvants and time of day (below ground stages)

TAKE HOME MESSAGE

- **Big gap in registrations** i.e. generation of efficacy data lacking
- **Ask questions** to suppliers
- Understand that biocontrol is **knowledge intensive**
- Consult with relevant **independent experts** in the field (continue funding applicable research)
- **Positive outlook** for the future of biocontrol in the table grape industry - its time to **navigate & innovate**



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