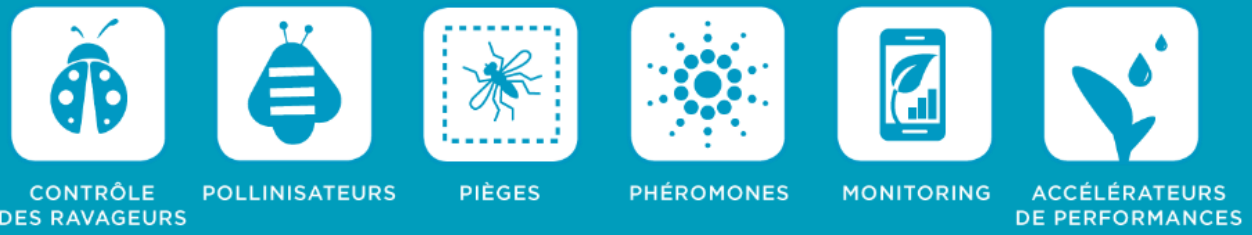
Biocontrol solutions for major crops on the Central Coast

Manuel Gómez

Senior Technical Support Lead at

Bioline AgroSciences



UC CE

4th AG INNOVATIONS CONFERENCE

AIC2020

COMPREHENSIVE CROP CARE

SESSION 1: Tuesday 15 September 2020

Entomology & Biologicals

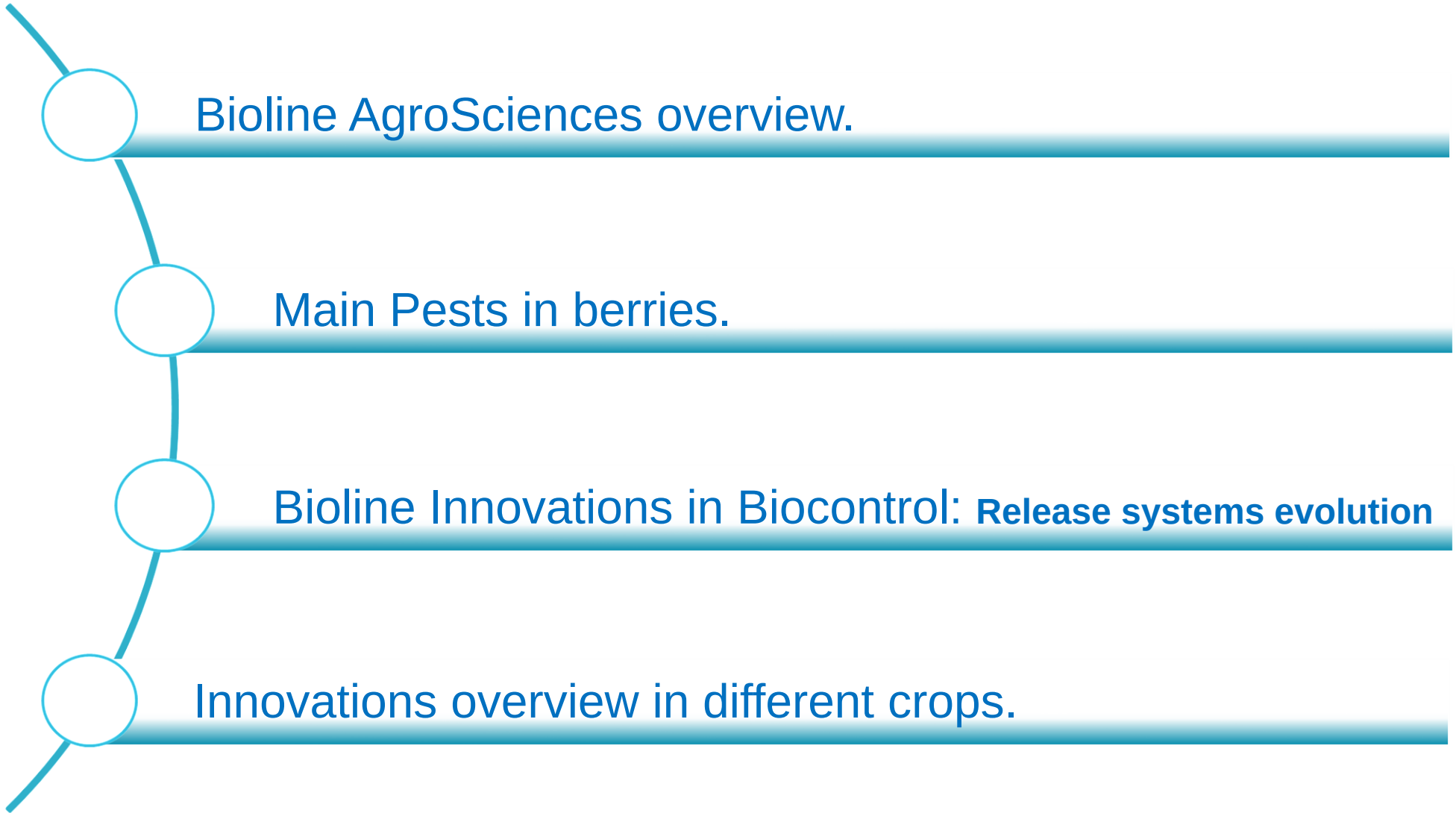
Virtual Conference on Comprehensive Crop Care

Organizer: Surendra Dara, University of California Cooperative Extension

Bioline AgroSciences

Cultivating Bioalliances

Biocontrol solutions for major crops on the Central Coast



Overview

Worldwide Biocontrol Leader

44+ Years

+180 employees

30+ Countries

8 Bio-factories 4 in CA

40+ Technical & sales team

> 8% TO invested in R&D

10 Patents

30+ R&D Team

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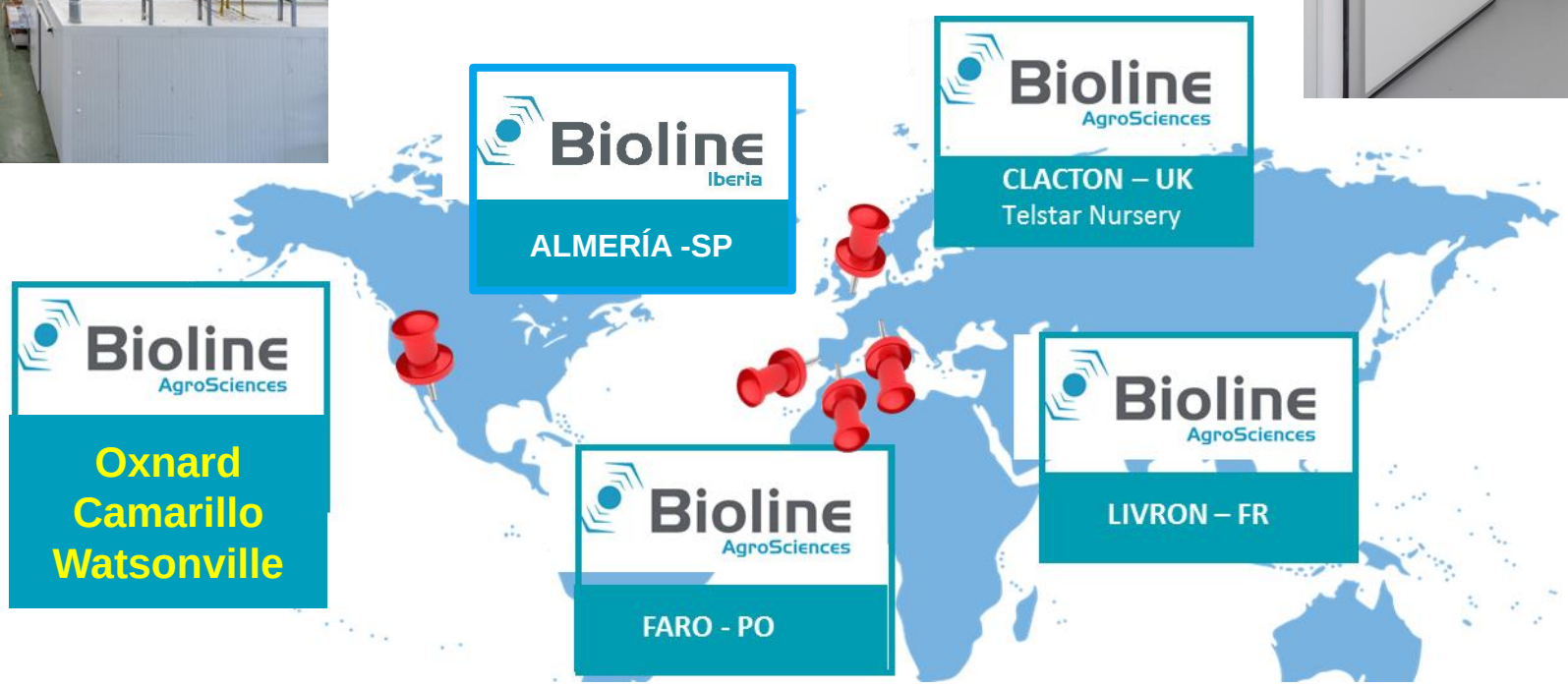
Cultivating Bioalliances

OWN PRODUCTION SITES



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INNOVATION

BLISTER

SACHETS

Tricholine

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OUR PRODUCTS RANGE

Different species are used to build a complete and custom IPM program adapted to each situation

+ **50** Beneficials
+ **200** Solutions for growers
+ **10** Patents
+ **40** Crops protected

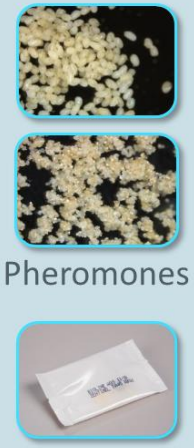
Predatory Mites

Parasitoids

Predatory Insects

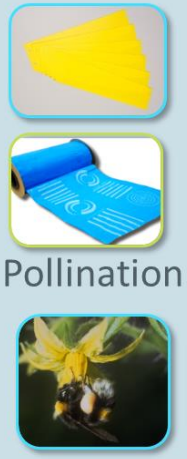
Nematodes

Insect Feed



Pheromones

Sticky Traps



Pollination

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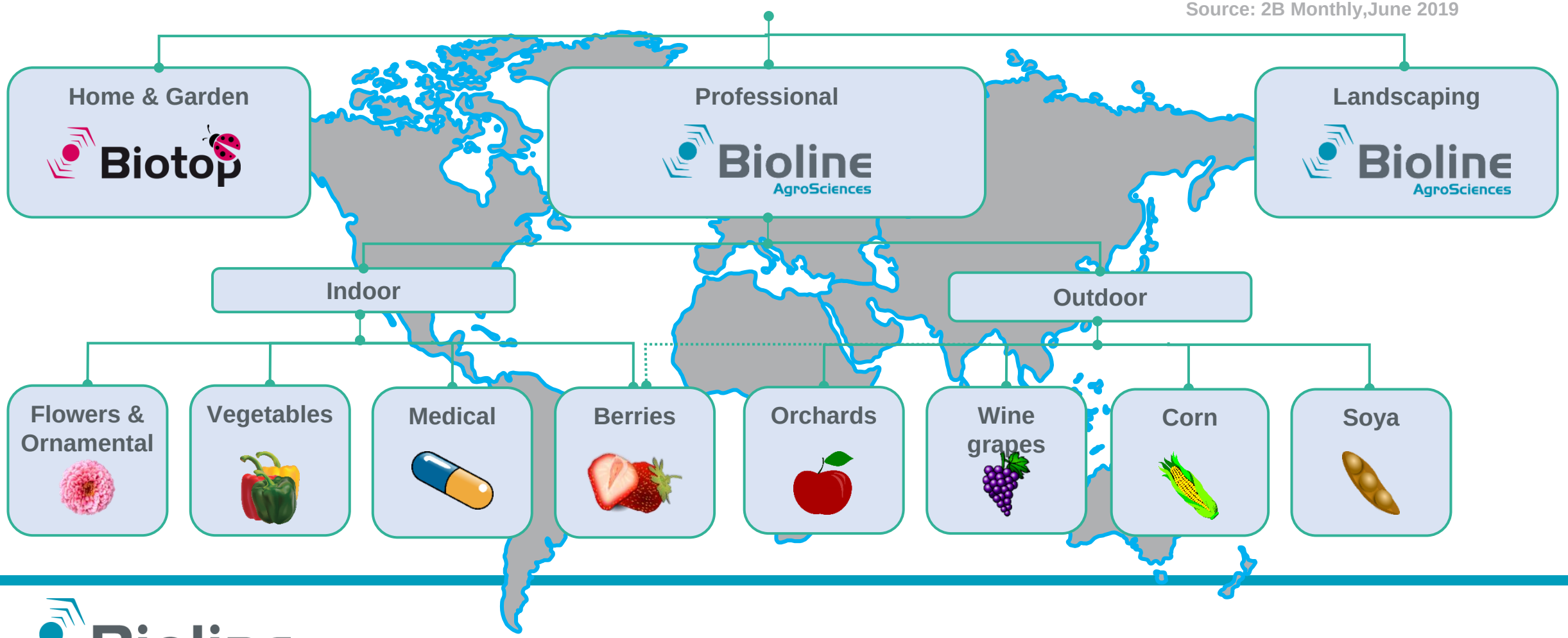
Presence in the most important Biocontrol markets

Europe & Nord America represents , 2/3 of worldwide Biocontrol

Source: 2B Monthly,June 2019



HIGH QUALITY TECHNICAL IMPUTS

As leading Biocontrol company Bioline key drivers are:

Product innovation

Sustainable Technology

Sharing knowledge

Academy Bioline

Technical support

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MAIN PEST IN BERRIES

Bioline AgroSciences Biocontrol solutions

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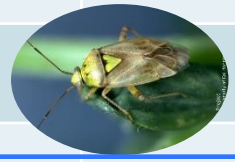
Main pests in berries

PEST MITES	**TWO SPOTTED SPIDER MITE** *(Tetranychus urticae)*
	LEWIS MITE *(Eotetranychus lewisi)*
	CYCLAMEN MITE *(Phytonemus pallidus)*
	RED BERRY MITES *(Acalitus essigi)*
PLANT BUG	**Lygus** (Tarsnished plant bug)
FRUIT FLIES	**SWD** (Spotted wing Drosophila)
THRIPS	**WFT** (Frankliniella occidentalis)
WHITEFLY	**Greenhouses whitelly** (Trialeurodes vaporariorum) irish whiteflies (Aleyrodes spiroeoides) strawberry whitefly (Trialeurodes packardi)
APHIDS	Myzus persicae, Aphis gossypii, Macrosiphun euphorbiae, Chaetosiphon fragaefolii
CATERPILLARS	Spodoptera spp., Helicoverpa





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Biocontrol solutions

PEST MITES

TWO SPOTTED SPIDER MITE
(*Tetranychus urticae*)

LEWIS MITE
(*Eotetranychus lewisi*)

CYCLAMEN MITE
(*Phytonemus pallidus*)

RED BERRY MITE
(Acalitus essigi)

Phytoline
Phytoseiulus persimilis

Californiline
Amblyseius californicus

Amblyline
Amblyseius cucumeris

Anderline
Amblyseius andersoni

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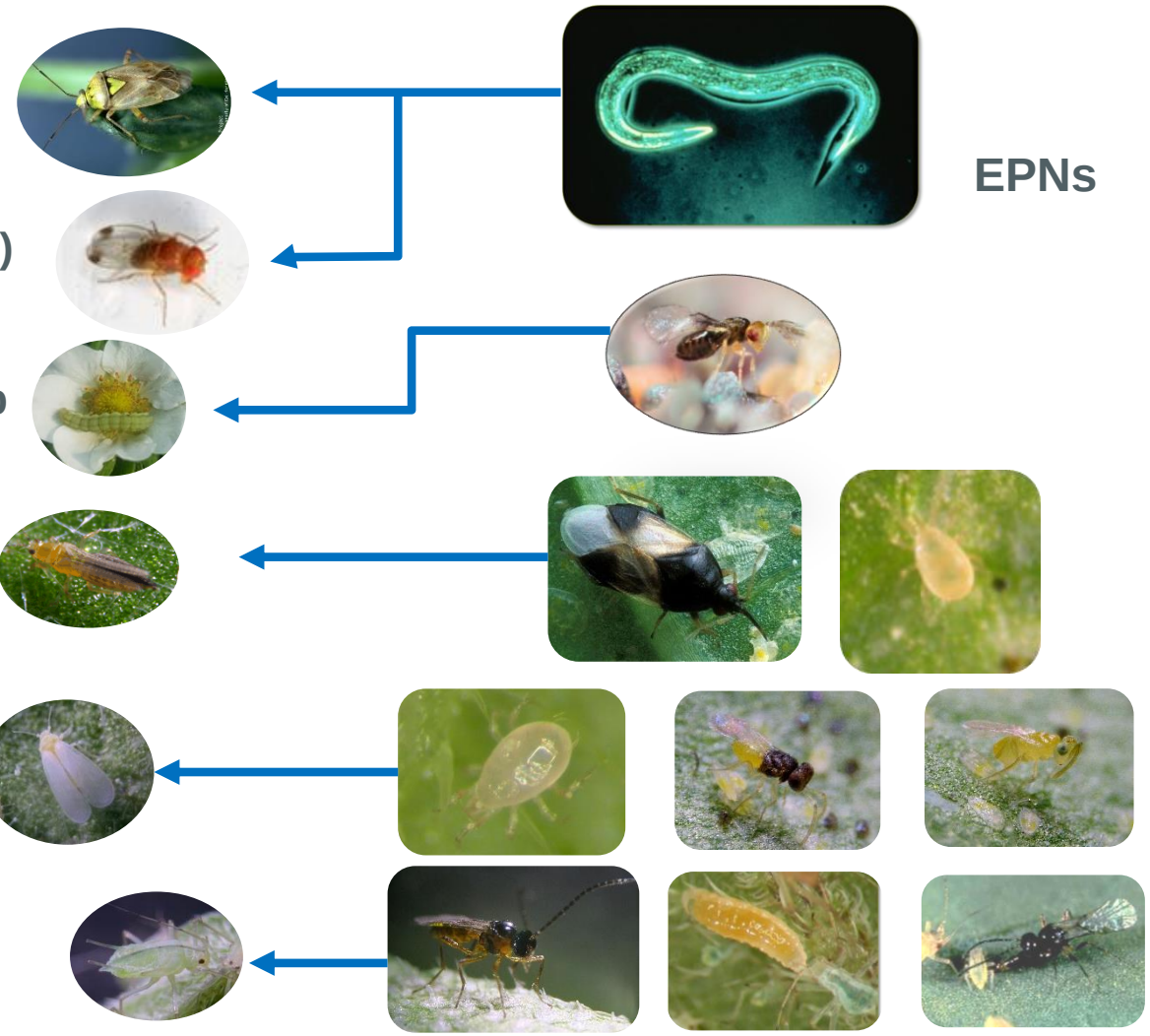
Main pest in berries

- **PLANT BUG** — Lygus (Tarnished plant bug)
- **FRUIT FLIES** — SWD (Spotted Wind Drosophilla)
- **CATERPILLARS** — Spodoptera spp, Hlicoverpa spp
- **THRIPS** — WFT (Frankliniella *occidentalis*)
- **WHITEFLY** — WF (*Greenhouse, Irish and strawberry whitefly*)
- **APHIDS** — Aphids (several species)



EPNs




PEST MITES IN BERRIES

Bioline AgroSciences Biocontrol solutions

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Biocontrol solutions

PEST MITES

TWO SPOTTED SPIDER MITE
(*Tetranychus urticae*)

LEWIS MITE
(*Eotetranychus lewisi*)

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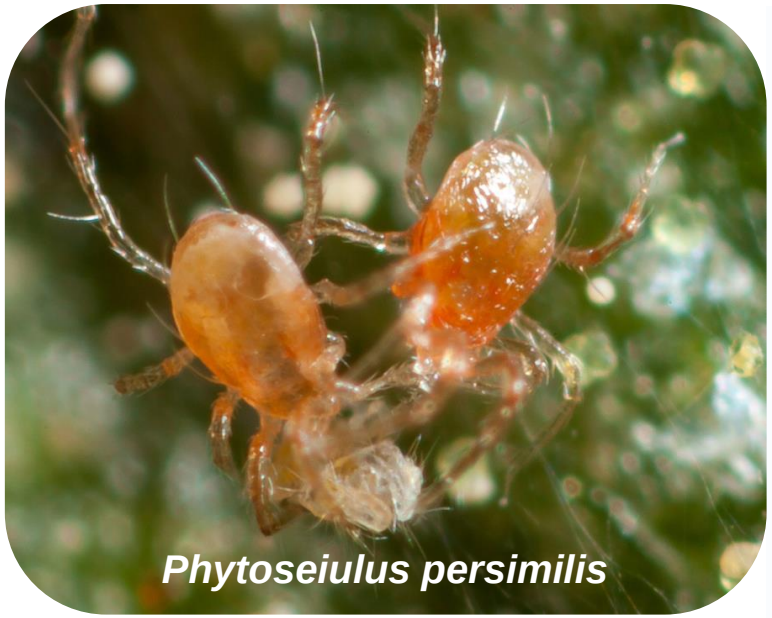
(*Phytonemus pallidus*)

RED BERRY MITE
(Acalitus essigi)

Phytoline

Phytoseiulus persimilis

TSSM control: Phytoline (*Phytoseiulus persimilis*)



- Predatory mite specific to spider mites (mainly TSSM)
- It is produced locally in California
- Very mobile and good searching behaviour
- Can be used in a wide range of crops (protected and open field)
- Active from 15°C
- Complete its life cycle in 7 days at 25ºC (much quicker than TSSM)
- Humidity >60-70%, otherwise eggs dry out

Phytoline

- Apply 15-20 Phytoseiulus per m2 split in 4-8 introductions, starting as soon as first spider mites are seen.
- Most of the release (60-70%) will be located in and around hot spots and risk areas at high rate and the rest will be evenly spread onto the crop

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Biocontrol solutions

PEST MITES

TWO SPOTTED SPIDER MITE
(*Tetranychus urticae*)

LEWIS MITE
(*Eotetranychus lewisi*)

CYCLAMEN MITE
(*Phytonemus pallidus*)

RED BERRY MITE
(Acalitus essigi)

Californiline
Amblyseius californicus

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TSSM control: Californiline (*Amblyseius californicus)*

- Wide range of preys:
  - Eats all stages of spider mites (mainly TSSM and ***P.citri***).
  - Also feeds on **Lewis mite**, tarsonemids (Broadmite and Cyclamen mite) and pollen
- Can be used in wide range of crops (protected and open field)
- Complete its life cycle in 6 days at 25ºC (much quicker than TSSM)
- Active at high temperature (from 12-15°C)
- Survives dry circumstances and less food

Californiline

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Cultivating Bioalliances

Recommended dose rates for Californiline

Crop	Loose product	Gemini Sachet	Mini Sachet
Berries	• 25-50 mites per m^2 • Combined with curative introductions of Phytoline	• 1 Gemini sachet per 2-3 linear meters	• 1 mini sachet per 1-1.5 linear meters
Californiline			

Phytoline

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Biocontrol solutions

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RED BERRY MITE
(Acalitus essigi)

Amblyline
Amblyseius cucumeris

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Cultivating Bioalliances

TSSM control: Amblyline (*Amblyseius cacucumeris)*

- Predation kills 5 thrips larvae per day
- Especially eggs and small larvae stage (L1)
- **Also broadmites (Cyclamen mites)**
- Optimum temperature 20 – 27.2°
- No diapause → active at low light levels and temperatures
- **Does not like >30°C**
- Humidity >60-70%, otherwise eggs dry out

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Cultivating Bioalliances

Anderline

THE MOST VERSATILE PREDATORY MITE FOR PEST MITES CONTROL

Amblyseius andersoni

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Cultivating Bioalliances

Biocontrol solutions

PEST MITES

TWO SPOTTED SPIDER MITE
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LEWIS MITE
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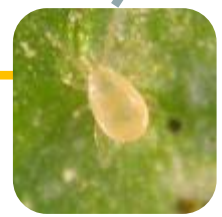

Anderline
Amblyseius andersoni

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Cultivating Bioalliances

Amblyseius andersoni

Anderline

- *A. andersoni* is the most versatile predatory mite.
- Broad range of mites: Tetranychus sp., Panonychus sp., tarsonemid mites, Eriophyidae (e.g Aculops)
- Can be used in wide range of crops (protected and open field).
- Active at wider range of temperatures (from 6ºC)
- Survives dry circumstances and lack of food
- Also feeds on thrips and pollen

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Available products Anderline

Mini CRS* sachet with hook

Gemini sachet

1 ltr tube loose material

5 ltr bag loose material

Bugline

*** CRS = Controlled Release System**

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Cultivating Bioalliances

Evolution breeding sachets ➔ Solution / strategy driven.

- Finding solutions for pest problems
- Different crops, different strategies (formulations)
- **PREVENTIVE APPROACH**

1989
Loose bran in tube

1991
1st Controlled Release System

2004
Gemini water proof breeding sachet

2007
Bugline for use in flower beds

2017
Stickline

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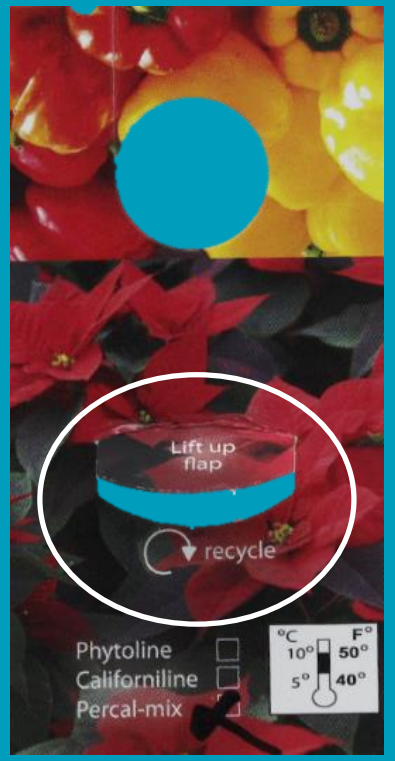
CONTROLLED RELEASE SYSTEM

preventive approach

Loose material

FAST RELEASE SYSTEM



curative approach

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BLISTSERS PACKS ARE A HIGH QUALITY PRODUCT, **UNIQUE TO BIOLINE**

AVAILABLE IN:

- Aphiline
- Aphidoline
- Encarline Mix
- Eretline

BLISTERS

THE NEW FAST RELEASE SYSTEM FOR A CURATIVE APPROACH

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Blisters: Bioline innovation

- **Effective:** blister packs get “one of the best” TSSM predators in close contact to pest. Leads to faster control.
- **Quick emergence** of predators out of blister. Much faster than sachets.
- **Even dosing**; the same number of predators in each blister.
- **Time-saving**; no need to divide carrier between RB’s. Easy to open and apply.
- **Protection** against rain, spray,…

Product	Specie
Phytoline	*Phytoseilus persimilis*
Californiline	*Ambluseius californicus*
Phytoline&Californiline mix	*P.Persimilis & A. californicus*
Anderline*	*Amblyseius andersoni*
Amblylin^	*Amblyseius cucumeris*
Swirskiline*	*Amsblyseius swirskiii*

Field strawberry:
1 Blister covers 1.000-500 ft2 or 100-50 m sq = 15.000 mites / acre

BLISTSERS PACKS ARE A HIGH QUALITY PRODUCT, **UNIQUE TO BIOLINE**

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Main pest in berries

- **PLANT BUG** — **Lygus (Tarnished plant bug)**
- **FRUIT FLIES** — **SWD (Spotted Wind Drosophilla)**
- **THRIPS** — **WFT (Frankliniella *occidentalis*)**
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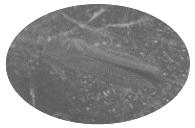
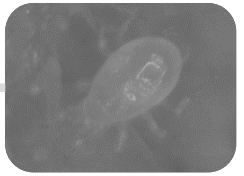
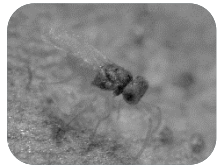
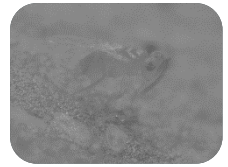
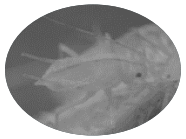
EPNs

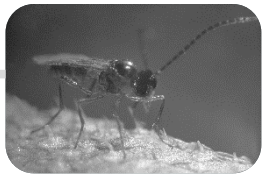


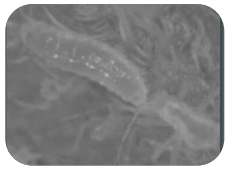












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Cultivating Bioalliances

PLANT BUGS
Lygus spp.

SWD
(Spotted wing Drosophilla)

Lygus spp. Background

- **Western tarnished plant bug** is commonly referred to as lygus bug.
- It is a serious pest in the Central Coast and Oxnard, but they rarely become a pest in Southern California and the Central Valley.
- Lygus bugs are one of the causes of irregularly shaped, cat-faced strawberries.
- Most of the insecticides that are effective against lygus bug disrupt natural enemies of spider mites and other pests.

Source: UC IPM

Lygus spp. Background

Source: UC IPM

CONTROL TIPS

- **Biological control: Parasitoides** *(Anaphes iole and Peristenus relictus) and* ***predators*** *(Geocoris, Nabis , Podisus and several species of spiders).*
- **Suction devices** (bug-vacs).
- **Monitoring.**
- **New approach: EPNs (entomopathogenic nematodes)**

SWD. Introduction

- Spotted-wing drosophila is found in many California counties infesting ripening cherry, raspberry, blackberry, blueberry, and strawberry fruit
- it has also been observed attacking other potential hosts such as grape, peach, boysenberry, varieties of Japanese plums, plumcots and other soft-fleshed fruits.
- Adults and maggots closely resemble the common vinegar fly, Drosophila melanogaster, and other Drosophila species that primarily attack rotting or fermenting fruit. **The spotted-wing drosophila, however, readily attacks undamaged fruit.**

Source: UC IPM

ENTOMOPATHOGENIC NEMATODES

EFFICIENT SOLUTION AGAINST LYGUS AND SWD

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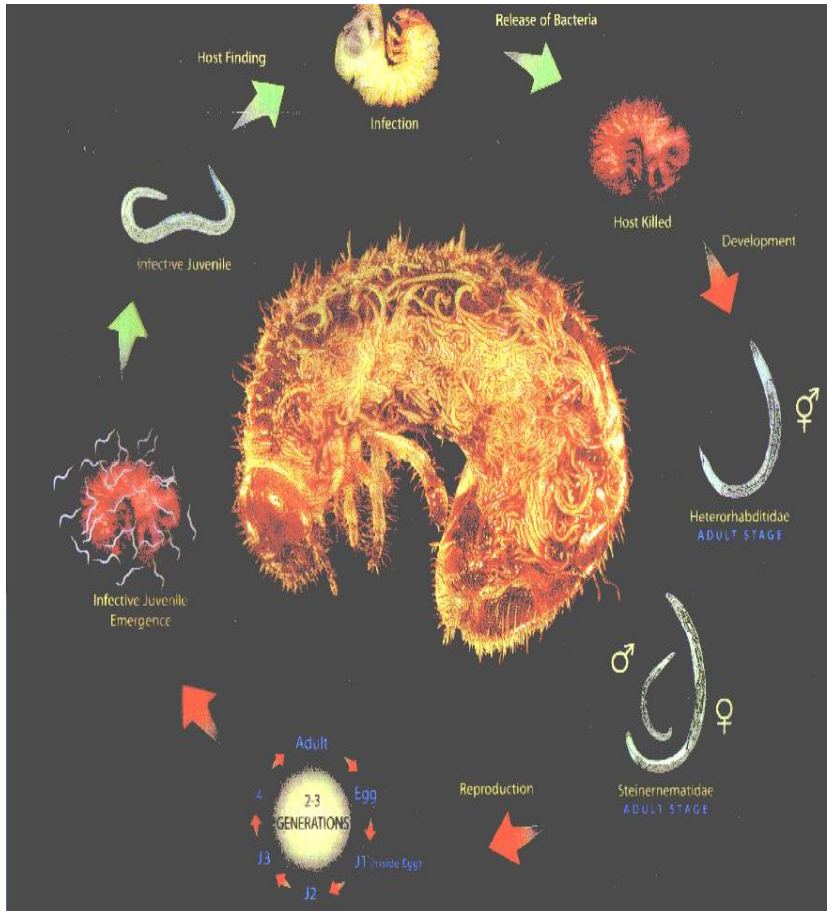
Entomopathogenic nematodes (EPNs)

- Microscopic roundworms
- Distributed worldwide
- Entomopathogenic nematodes (EPNs) or Insect pathogenic nematodes live inside the body of their host → *endoparasitic*
- Contain bacteria which is responsible for killing host
- Reproduction in larvae and pupae of insects
- Survives in (wet) soil and looks for new hosts
- There are several available products based in different species with different targets depending of the associated bacteria and conditions (Tº)



Range of Entomopathogenic nematodes (EPNs)

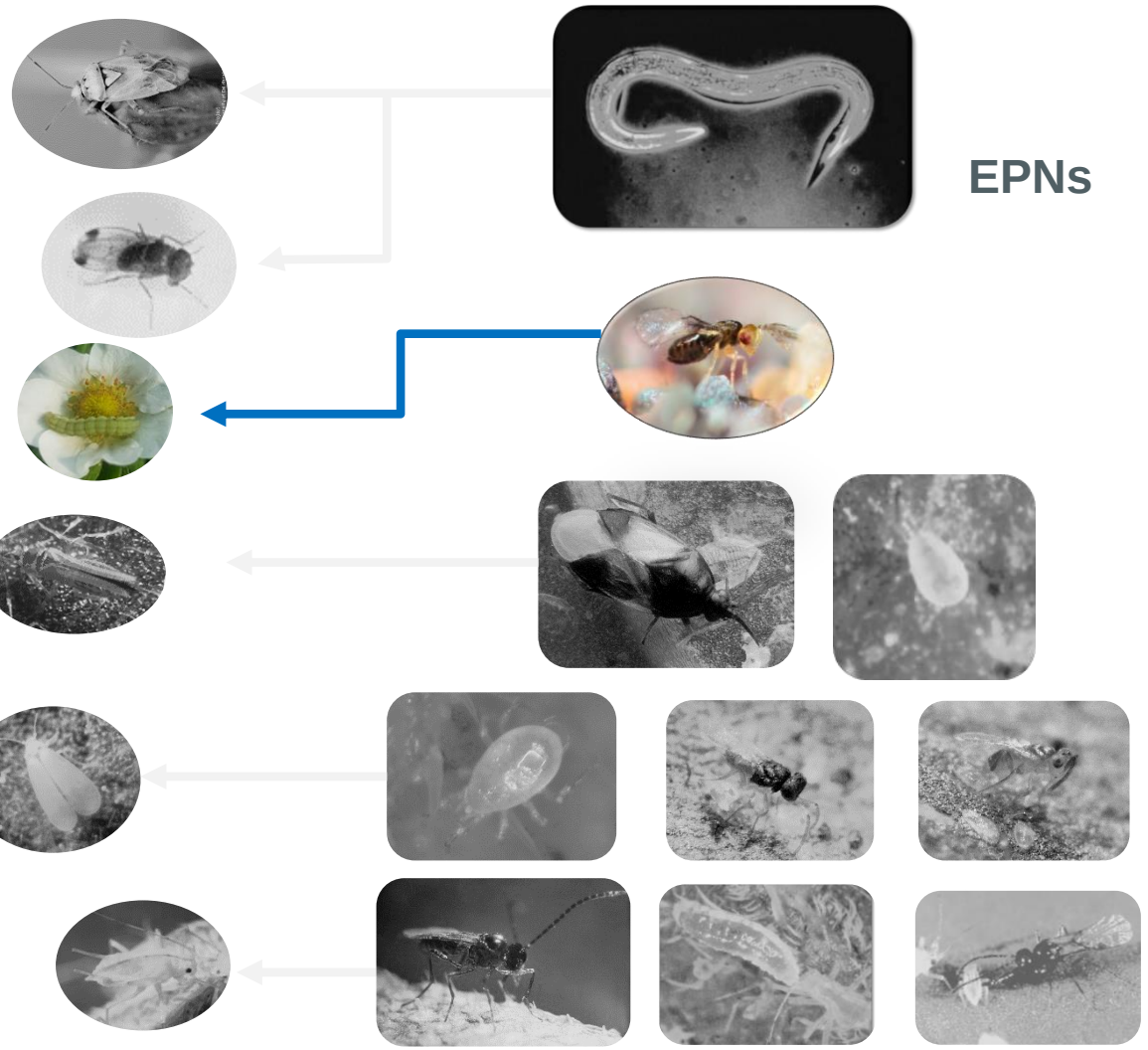
EPN species	Product	Target Pests
Heterohabditis bacteriophora	**Nemasys H** **Exhibitline Hb**	Vine Weevil * Strawberry Root Weevil Garden Chafer Western Corn Rootworm
Steinernema feltiae	**Nemasys** **Exhibitline Sf**	Sciarid flies Thrips Leafminer/ Tuta absoluta Leatherjackets Codling moth # Lygus spp SWD*
Steinername carpocapsae	**Nemasys C** **Exhibitline Sc**	Turf pests – Tipula, Gryllotalpa, Bradysia, Agrotis Cranberry Girdler Red Palm Weevil Flat Headed Root Borer Vine Weevil * Codling moth # SWD*
Steinernema kraussei	**Nemasys L**	Vine Weevil *
Phasmarhabditis hermaphrodita	**Nemaslug**	Slugs and Some snails

Product Range of *Steinernma spp*.

- Insect pathogenic nematodes *Steinernema feltiae* / *carpocapsae*
- Penetrates larvae of Sciarid fly/Shore fly and releases bacteria (*Xenorhabdus spp*.)
- Steinernema spp. also used for control of Western Flower Thrips, leafminer, vine-weevil, cutworms, etc
- Bacteria is responsible for killing host
- Nematodes need moist/wet soil
- Active between 14-25°C (soil temperature)
- Temperatures >30°C are harmful
- **Especific rate for SWD and Lygus by spraying: 250 mil/acre**

Main pest in berries

- PLANT BUG — Lygus (Tarnished plant bug)
- FRUIT FLIES — SWD (Spotted Wind Drosophilla)
- **CATERPILLARS — Spodoptera spp, Hlicoverpa spp**
- THRIPS — WFT (Frankliniella *occidentalis*)
- WHITEFLY — WF (*Greenhouse, Irish and strawberry whitefly*)
- APHIDS — Aphids (several species)

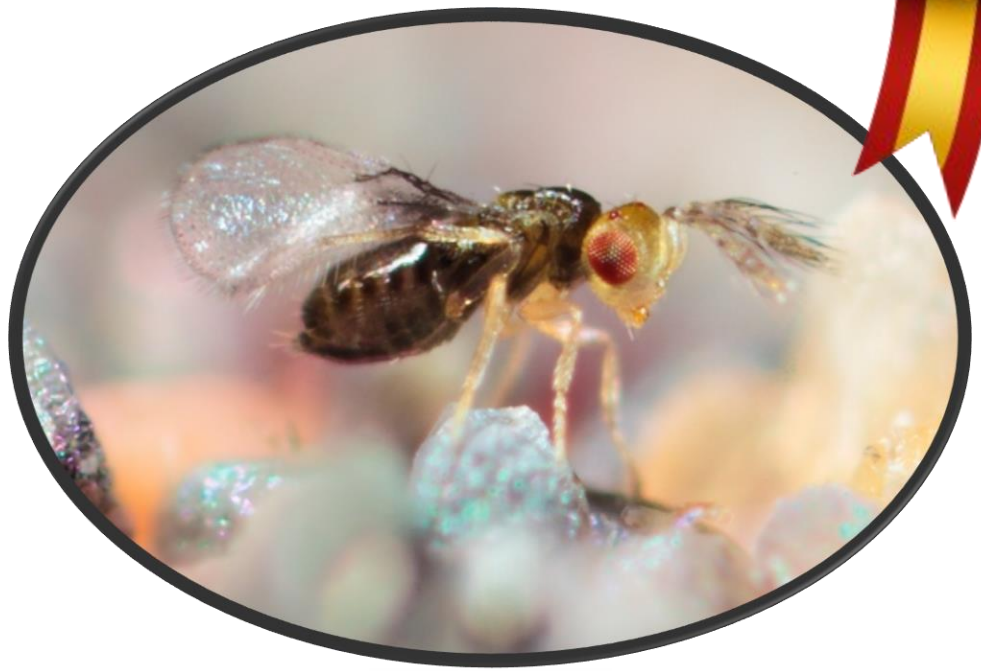


EPNs

Caterpillars control. Trichogramma spp.

SPECIALISTS IN TRICHOGRAMMA

Product	Crop	Target Pest
Tricholine TA	**Tomatoes**	***Tuta absoluta***
Trichotop Max	**Corn**	***Ostriana nubilalis***
Tricholine Buxus	**Boxwood**	***Cydalima perspectalis***
Tricholine Vitis	**Vineyard**	***Eupoecilia ambiguella*** ***Lobesia botrana***
Tricholine Splendana	Chestnut	*Cydia splendana*
Tricholine Food	Food industry	*Ephestia spp, Sitotroga spp, Plodia spp …* (moths)
Tricholine Sugar cane	Sugar cane	*Diatraea saccharalis*
Tricholine Maxi	Soybean	*Anticarsia gemmatalis* *Rachiplusia nu*



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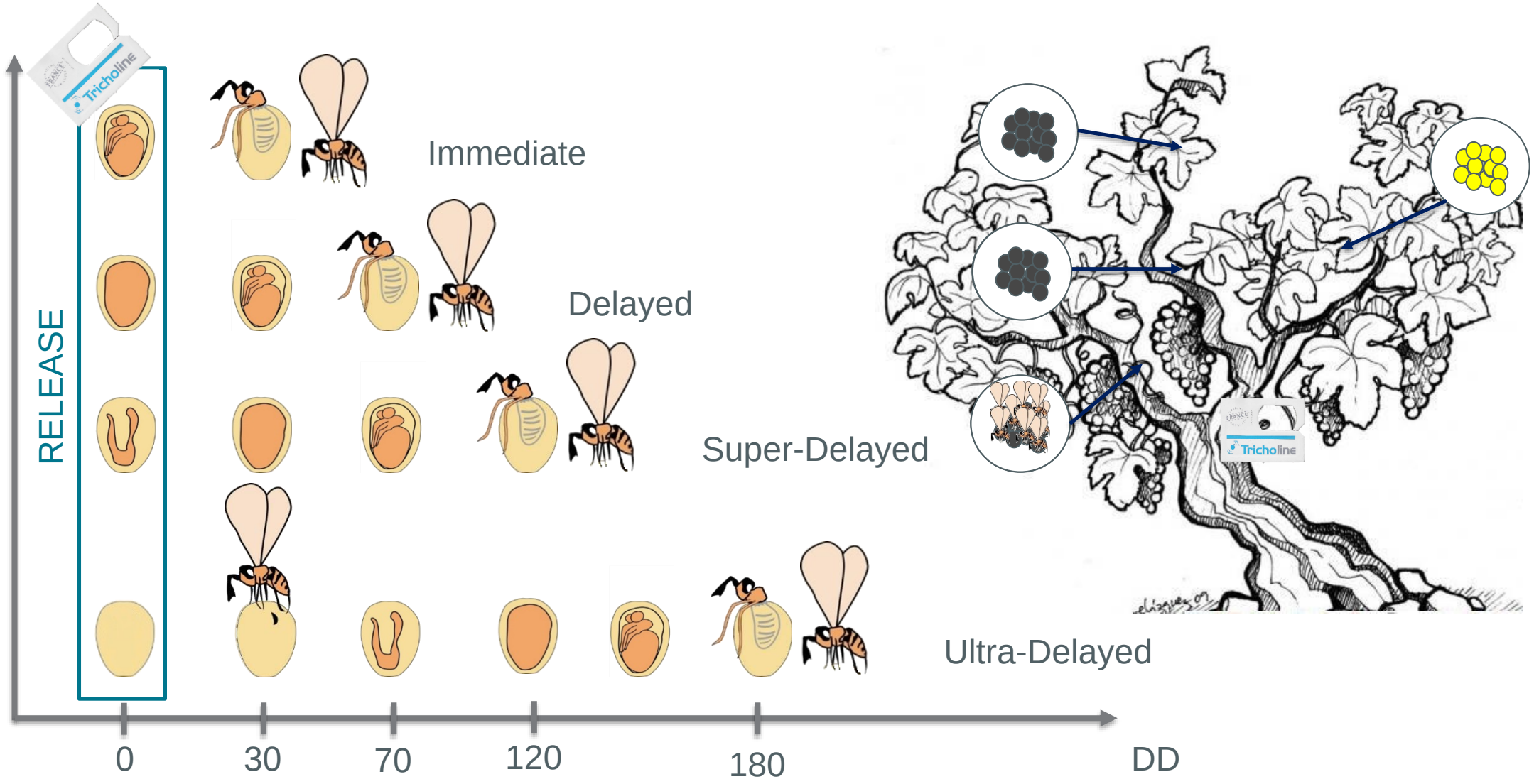
Cultivating Bioalliances

How Emergence waves work in Bioline products



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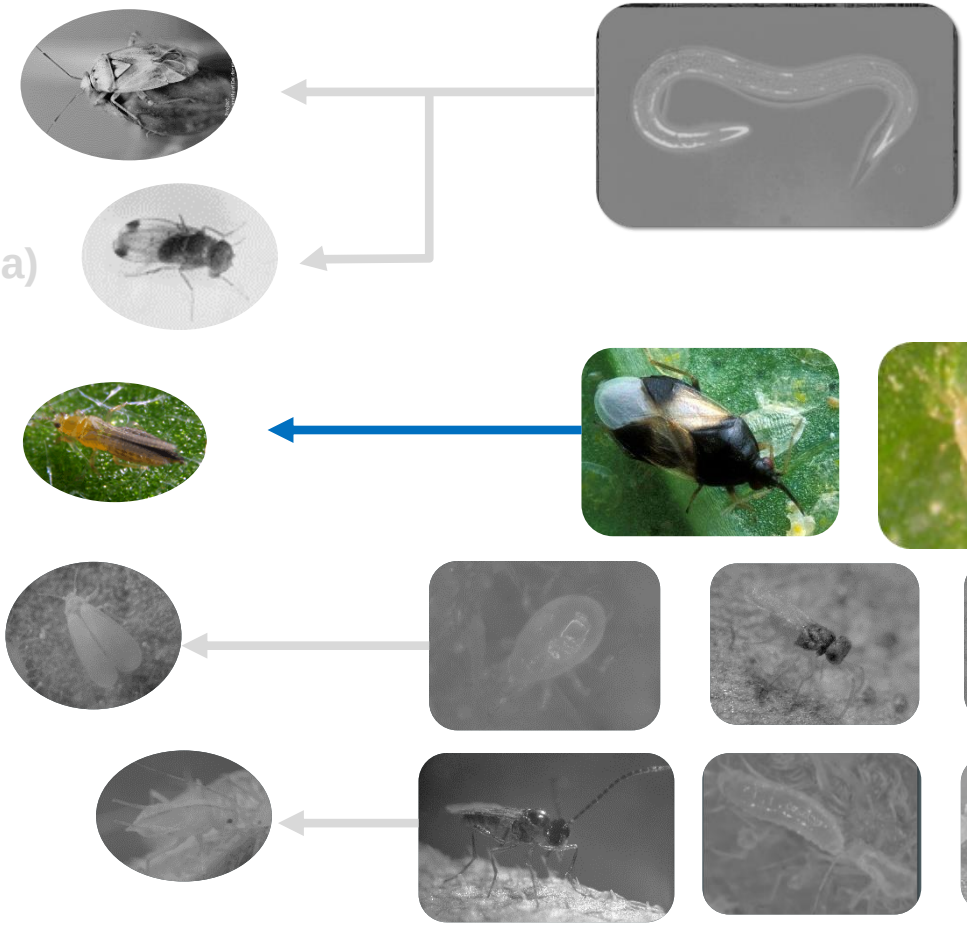

EPNs

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Thrips control

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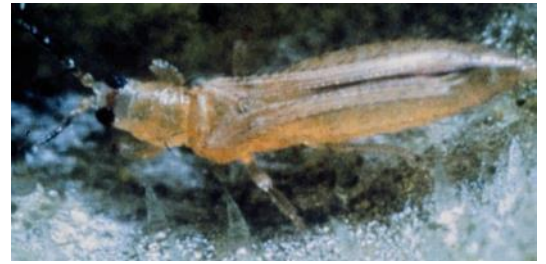
Thrips

Thysanoptera – Fringed wings (mainly Thripidae)

Several varieties (app. 5000 species):

- ***Frankliniella occidentalis - Western flower thrips***
- *Heliothrips haemorrhoidalis* - Greenhouse thrips
- *Thrips tabaci* - Onion Thrips,
- *Thrips setosus – Japanese thrips*
- *Echinothrips americanus*
- *Parthenothrips dracaenae* - Zebra Palm thrips
- *Thrips palmi – Palm thrips*



Bioline AgroSciences

Cultivating Bioalliances

Solutions for all life stages

ORILINE *Orius insidiosus*

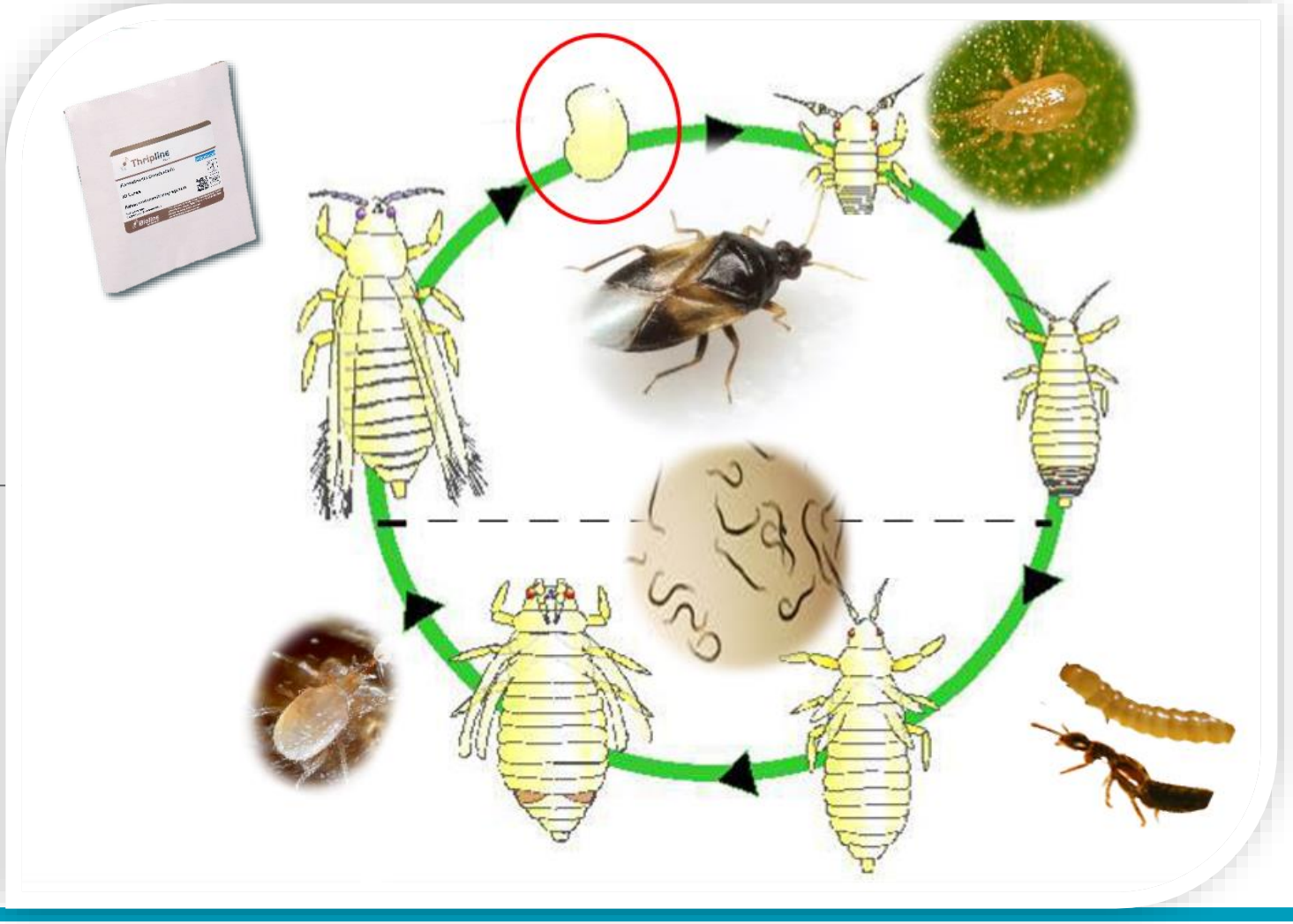
AMBLYLINE *Amblyseius cucumeris*

SWIRISKILINE *Amblyseius swirskii*

EXHIBITLINE SF *Steinernema feltiae*

HYPOLINE *Hypoaspis miles*

STAPHYLINE *Atheta coriara*



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Thrips control: Oriline (*Orius insidiosus*)

- Orius insidiosus is specifically used in North America because it is native to this part of the world.
- Eats larvae and adults of thrips
- It takes around 4-8 weeks to establish a population. Particularly well on pollen-rich crops.
- Curative treatment in hotspots (nymphs)
- Active from 12-15°C
- Diapause sensitive → less active at low light levels
- Also feeds on other small pest, e.g. aphids
- Available as loose material.

Oriline l

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AMBLYLINE: *A.cucumeris*

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SWIRSKILINE: *A. swirskii*

THRIPLINE-increasing number on Traps by using pheromone lures – active for 6-7 weeks

Thrips

Trapline t+

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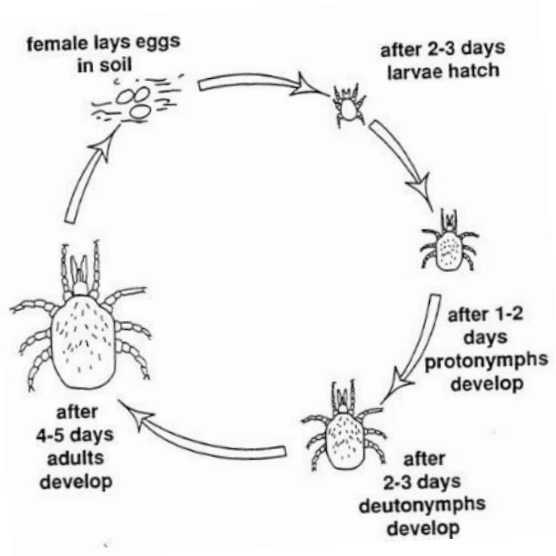
HYPOLINE - *Hypoaspis miles*

Temperature	Development time (egg – egg)	Adult (days)
15°C	40	± 120
20°C	21	± 80
24°C	14	
28°C	11	± 45

- Predates on mainly sciarids , thrips pupae, Duponchelia
- Feed also on Collembola, gall midges….
- Soil dwelling mite in top layer of soil
- Prefers dark and wet circumstances
- Active from 15°C, development stops <10°C
- Survival without food 45-65 days
- Cannibalistic if there is lack of food



Hypoline preventively

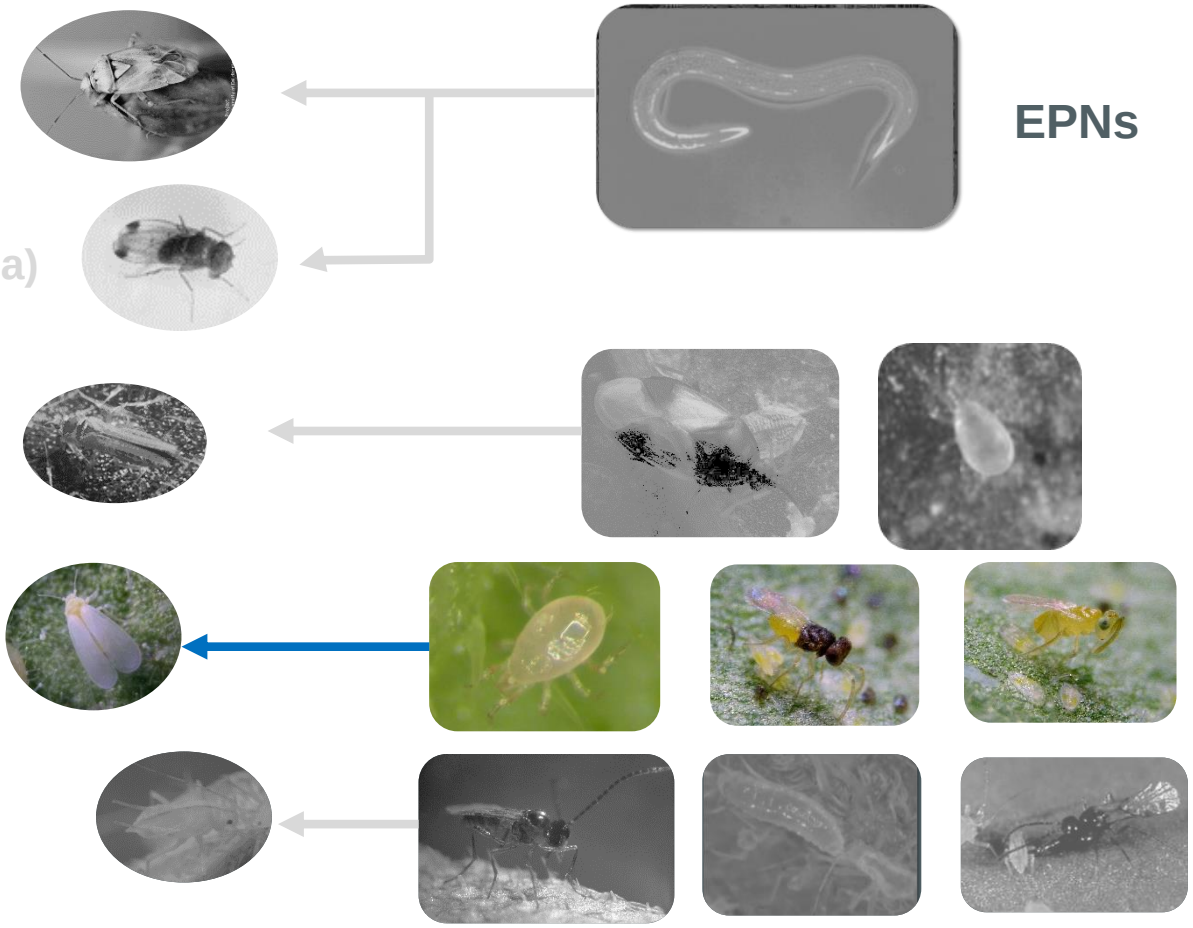
Apply Hypoline to the soil or on pots. Hypoaspis prefers humid surroundings (leaves on soil, algae,….), so eggs won't dry out

Avoid application in bright sunlight

Gently shake and rotate the bottle during releasing or use a cup in case of 5 litre bag and mix the product very well

Main pest in berries

- PLANT BUG — Lygus (Tarnished plant bug)
- FRUIT FLIES — SWD (Spotted Wind Drosophilla)
- THRIPS — WFT (*Frankliniella occidentalis*)
- **WHITEFLY** — **WF (*Greenhouse, Irish and strawberry whitefly*)**
- APHIDS — Aphids (several species)



EPNs

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Whitefly

Bemisia tabaci –Trialeurodes vaporariorum

Suborder of Homoptera, Family Aleyrodidae

Bemisia tabaci

- Smaller than Trialeurodes vaporariorum
- View from top: elongated
- More yellow due to less wax excrement

Trialeurodes vaporariorum

- Bigger than *Bemisia tabaci*
- View from top: more triangle shape
- Colour is whiter due to more wax excrement

ENCARLINE *Encarsia formosa*

ERETLINE *Eretmocerus eremicus*

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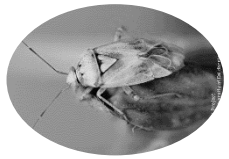
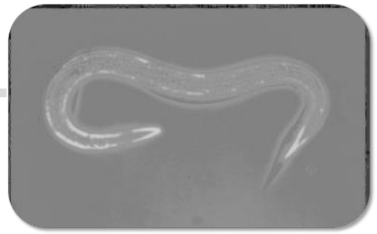
SWIRSKILINE: *A. swirskii*

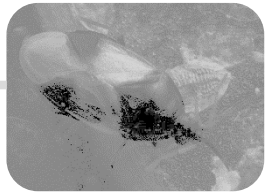
Main pest in berries

- PLANT BUG — Lygus (Tarnished plant bug)
- FRUIT FLIES — SWD (Spotted Wind Drosophilla)
- THRIPS — WFT (*Frankliniella occidentalis*)
- WHITEFLY — WF (*Greenhouse, Irish and strawberry whitefly*)
- **APHIDS** — **Aphids (several species)**

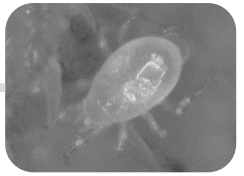




EPNs





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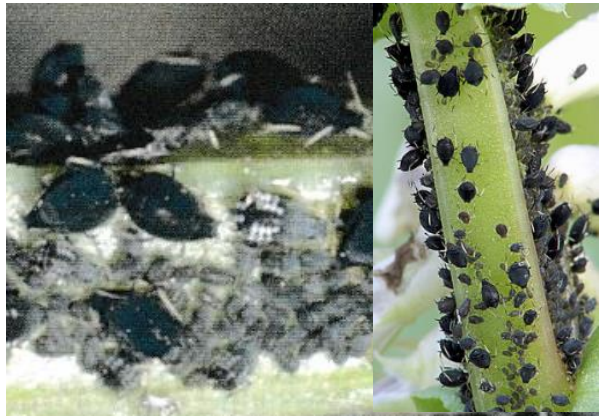
Aphids









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Parasitoids of Aphids

Aphids / parasitoids	Aphidius colemani	A. ervi	A. matricariae	Ephedrus cerasicola	Paron volucre	Aphelinus abdominalis
Myzus persicae						
Aphis gossypii		-				-
Macrosiphum euphorbiae	-		-	-		
Chaetosiphon fragaefolii	-	-	-			
Aphis forbesi		-		-	-	-
Acirthosyphon rogersii	-		-	-		-

Very high efficacy

High efficacy

Good effciccay

Efiiccacy lab /semi-field

_ No efficacy

Erviline

Aphiline Berry

Aphiline Mix

Apheline

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Predators of Aphids

Aphidoline

Aphidoletes aphidimyza

Chrysoline

Chrysoperla carnea

Adaline

Adalia bipunctata

PARASITIC WASPS & PREDATORS ON CARDS IN BLISTERS, VIALS AND BOTTLES IN A RANGE OF FORMATS AND SIZES

Blisters

Cards

Vials & Bottles

Sampling plots.

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Thanks for your attention