

Combining Biocontrol Agents with Conventional Pesticides

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Compatibility Check

- Which pesticide/application method?
- Residues? How persistent?
- What stage of the crop? Propagation? Later?

- Which BCA's are you using?
- Established or establishing populations?
- What is the impact on the BCA system as a whole?



Compatible?
→



Questions to Ask Before You Load Up the Tank



- Is it **really** necessary to spray? Tipping point reached? How many BCA's are you finding?
- What other options are there? Increase BCA numbers? Different BCA's? Softer chemistries or bio-pesticides?

Questions to ask if you DO have to spray

- Do I need to apply everywhere or can I spot treat?
- **What impact will this have on my pest management program as a whole?**

Other Questions to Ask

- How did it get to this point?
- How can I avoid this situation in the future?



To Spray or Not to Spray?



To Spray or Not to Spray?



**No Spray
Required!**

**Tipping point
has been
reached**

**Control has
been achieved**





Some Reasons Why Biocontrol Fails

- **Starting too late!**
- Reactive vs proactive
- “Trying” biological control
- Not starting clean → pest and residues
- Scouting and monitoring!
- Not taking all pest and disease problem into consideration
- Poor planning → Supply of BCA’s (forecasting)



Some (more) Reasons Why Biocontrol Fails



- Poor management (application of BCA's)
- No technical support
- Not checking quality of BCA's
- **Fear of loss → bailing at tipping point → Trust**
- Expectations vs threshold
- Cost → Reducing input
- Compatibility with traditional crop protection products



Pest Management and Residues



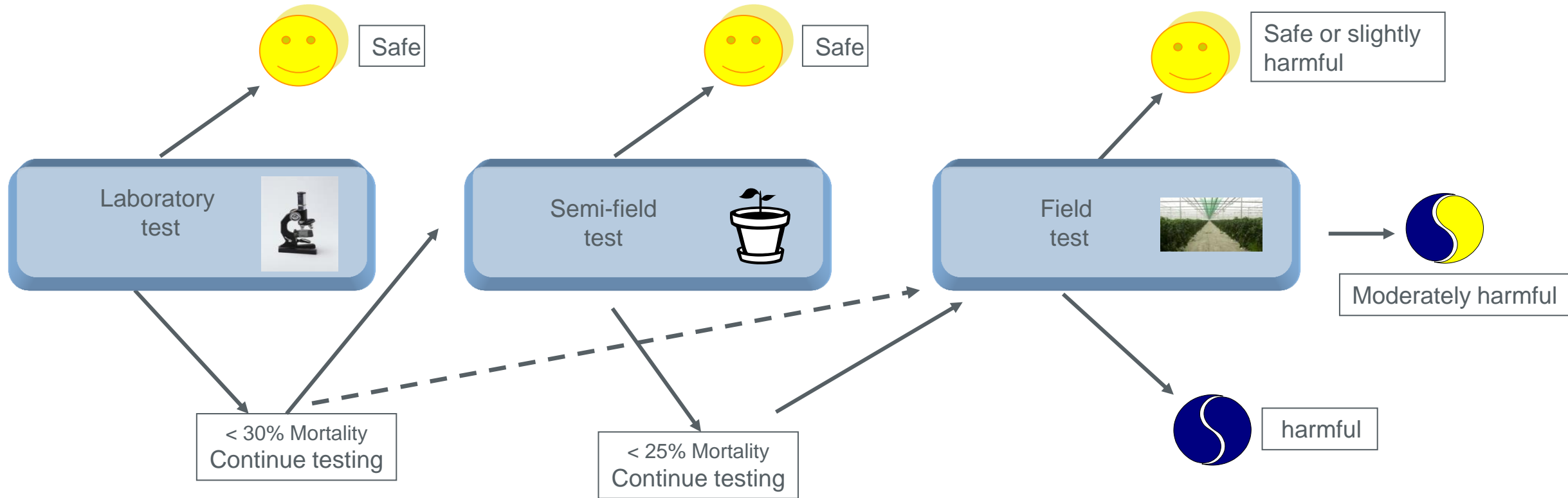
- 2011 – Canadian growers, poor results from biocontrol in poinsettias
- 2012 - 10 samples of unrooted cutting sent off for testing
- Found AI from 24 insecticides and 20 fungicides
- Half had Orthene (major contributor to failure of *Eretmocerus* – 16 wk residual)



- Abamectin (Avid®)
- Buprofezin (Talus®)
- Fenazaquin (miticide)
- Pyridaben (Sanmite®)
- Pyriproxifen (Distance®)
- Spinosad (Conserve®)
- Spiromesifen (Judo®)
- Thiacloprid (neonic)
- Thiamethoxam (Flagship®)
- Novaluron (Pedestal®)

- Acephate (Orthene®)
- Acetamiprid (Tristar®)
- Bifenthrin (Talstar®)
- Clothianidin
- Cyfluthrin (neonic)
- Imidacloprid (Marathon®)
- Lambda-cyhalothrin
- Methamidophos (Monitor®)
- Methomyl (Lannate®)
- Omethoate
- Oxamyl (Vydate®)

Testing Compatibility BCA's and Pesticides



Testing Compatibility BCA's and Pesticides



SCALE	CATEGORY	LABORATORY		SEMI-FIELD	FIELD (%)
		INITIAL (% effect Incl. Mortality & Fecundity reduction)		PERSISTENCE (days)	
1	SAFE	<30	<25	<5 Low persistence	<25
2	SLIGHTLY HARMFUL	30-79	25-50	5-15 Slightly persistent	25-50
3	MODERATE HARMFUL	80-99	51-75	16-30 Moderate persistent	51-75
4	HARMFUL	>99	>75	>30 High persistence	>75

PERSISTENCE

TOXICITY



Some Real Examples of BCA's and Compatibility



Different Scenarios

Caution: Slippery Slope



Timing is Everything



Calculated Low Risk



Real situation in cut gerbera production → Slippery Slope



BCA's used in cut gerbera:

- *Amblyseius cucumeris*
- *Amblyseius swirskii*
- *Phytoseiulus persimilis*
- *Aphidius colemani*
- *Aphidius ervi*
- *Diglyphus isae*
- *Orius insidiosus*
- *Delphastus spp*
- *Aphidoletes aphidimyza*
- *Encarsia formosa*
- *Eretmocerus eremicus*



Real situation cut gerbera production → Slippery Slope

- West coast grower using biocontrol successfully since 1996
- Registration of Floramite® insecticide → presented as compatible product
- Owner/grower makes decision to reduce introduction rate for *Phytoseiulus persimilis* → ‘safety net’ = Floramite
- New planting after Mothers Day → 2 year crop



Regular introduction rate
6 to 8 mites per m² for 3 to 4 weeks



Reduced introduction rate
2 to 3 mites per m² for 2 weeks



Real situation in cut gerbera production → Slippery Slope

TSSM control is not going well → Floramite is used to reduce population however.....

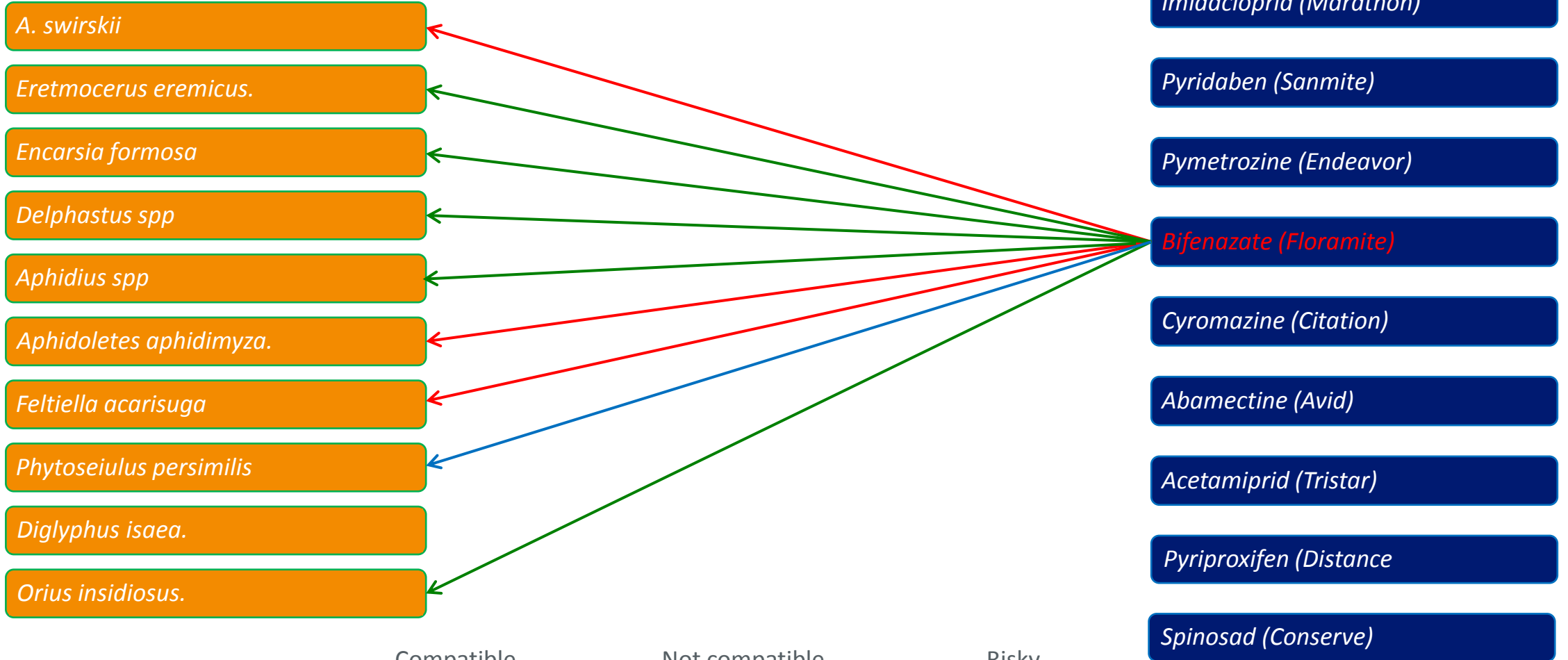
- *Amblyseius cucumeris*
- *Amblyseius swirskii* = Negatively affected by Floramite (60 – 70 % reduction)
- *Phytoseiulus persimilis*
- *Aphidius colemani*
- *Aphidius ervi*
- *Diglyphus isae*
- *Orius insidiosus*
- *Delphastus spp*
- *Aphidoletes aphidimyza*
- *Encarsia formosa*
- *Eretmocerus eremicus*





Compatible with BCA's?

Compatible with **MOST/SOME** biological control agents!!!????





Real situation in cut gerbera production → Slippery Slope

Whitefly control in cut gerbera:

- *Amblyseius swirskii*
- *Encarsia formosa*
- *Eretmocerus eremicus*

What happened next:

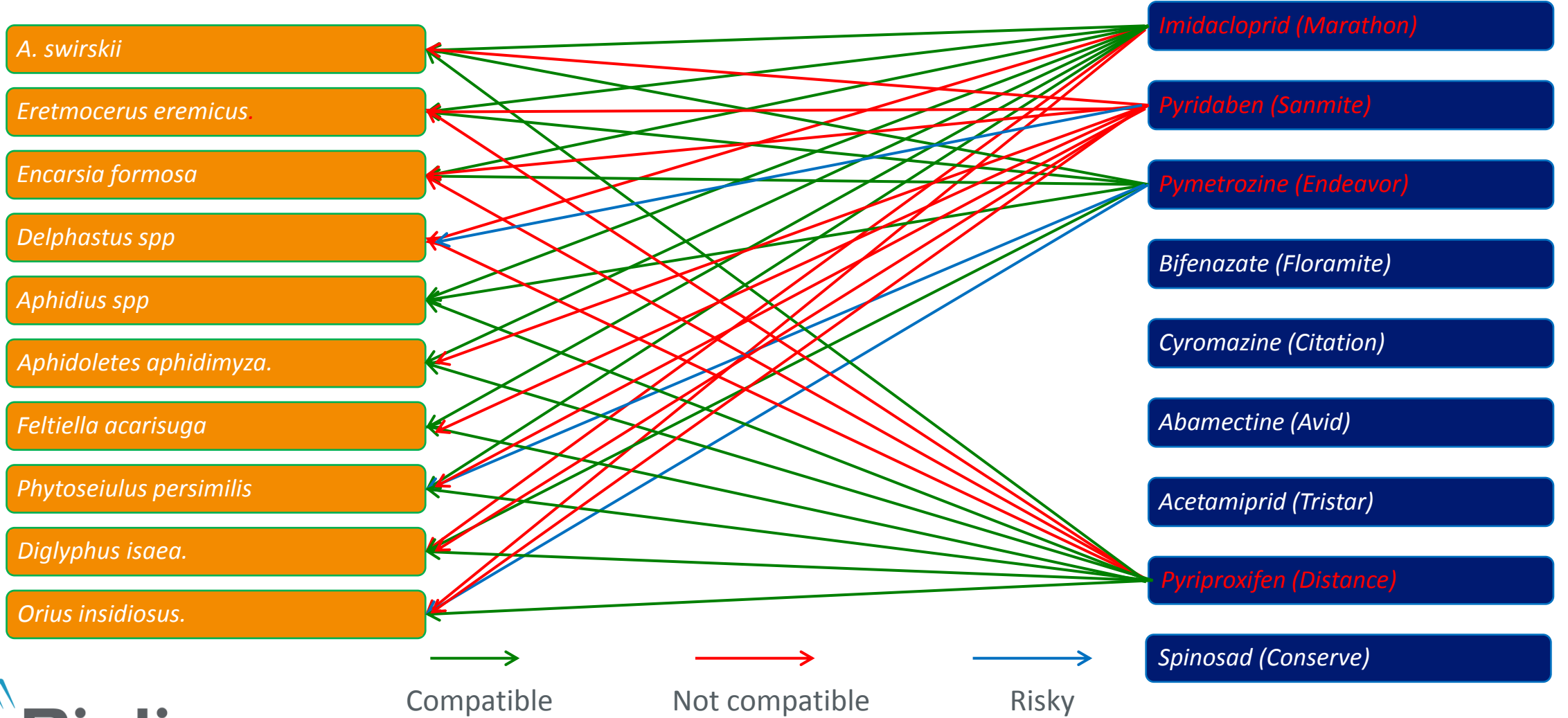
- Whitefly control is relying heavily on *A. swirskii* during summer months
- 3 weeks after Floramite application whitefly population explodes (life cycle)
- Not able to repair with BCA
- Next decision????





Real situation in cut gerbera production → Slippery Slope

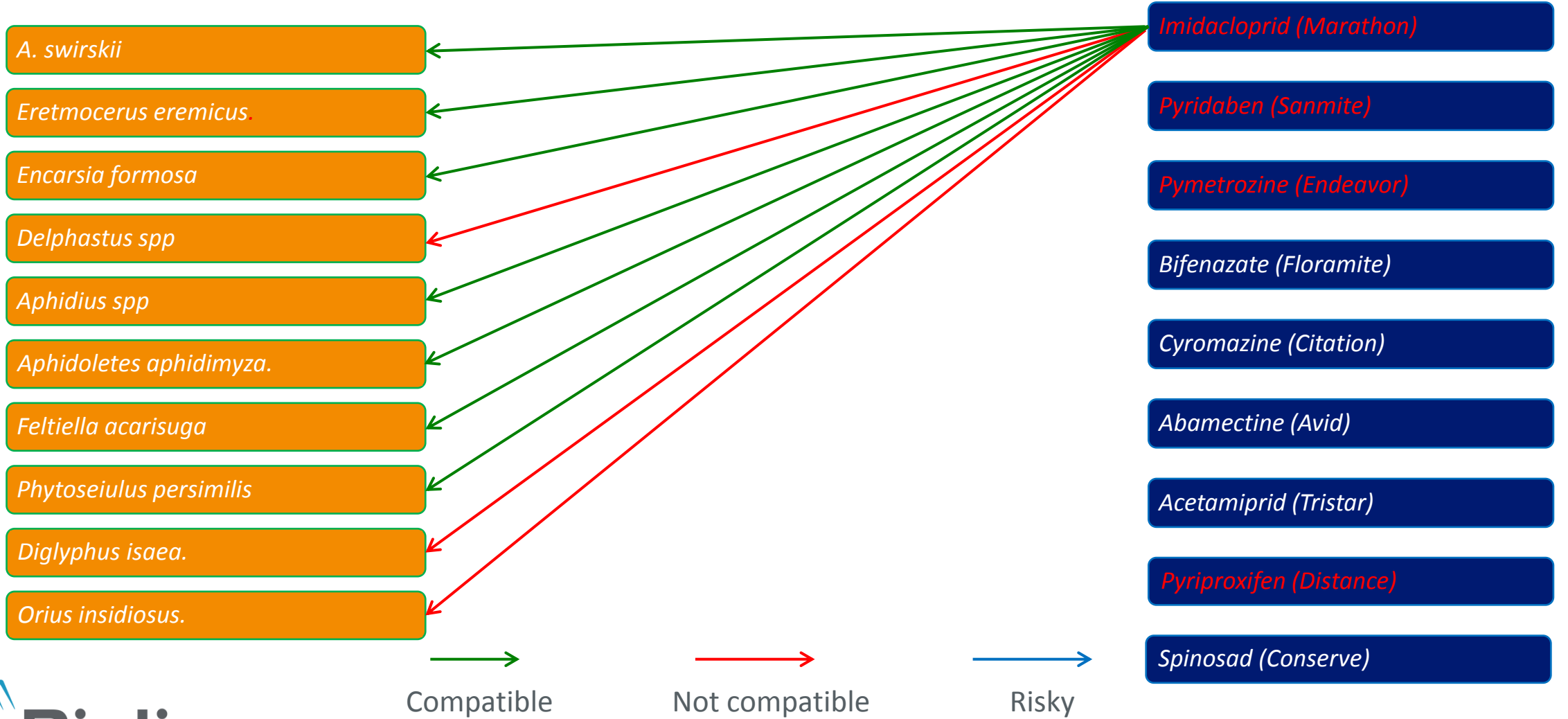
WF problem (3 Wks. later) → What options?





Real situation in cut gerbera production → Slippery Slope

WF problem (3 Wks. later) → Imidacloprid is used → easy to apply



Real situation in cut gerbera production → Slippery Slope



Imidacloprid was used to repair the whitefly situation, however.....

- *Amblyseius cucumeris*
- *Amblyseius swirskii*
- *Phytoseiulus persimilis*
- *Aphidius colemani*
- *Aphidius ervi*
- *Diglyphus isae*
- *Orius insidiosus*
- *Delphastus spp*
- *Aphidoletes aphidimyza*
- *Encarsia formosa*
- *Eretmocerus eremicus*

Note: Effect of imidacloprid on TSSM



Real situation in cut gerbera production → Slippery Slope



Real situation in cut gerbera production → Slippery Slope



Thrips & Leafminer control in cut gerbera:

- *Diglyphus isae*
- *Orius insidiosus*

What happened next:

- Leafminer population increases rapidly
- Thrips population increases
- Looper population increases (side effect *Orius*)
- Not able to 'repair' with BCA →

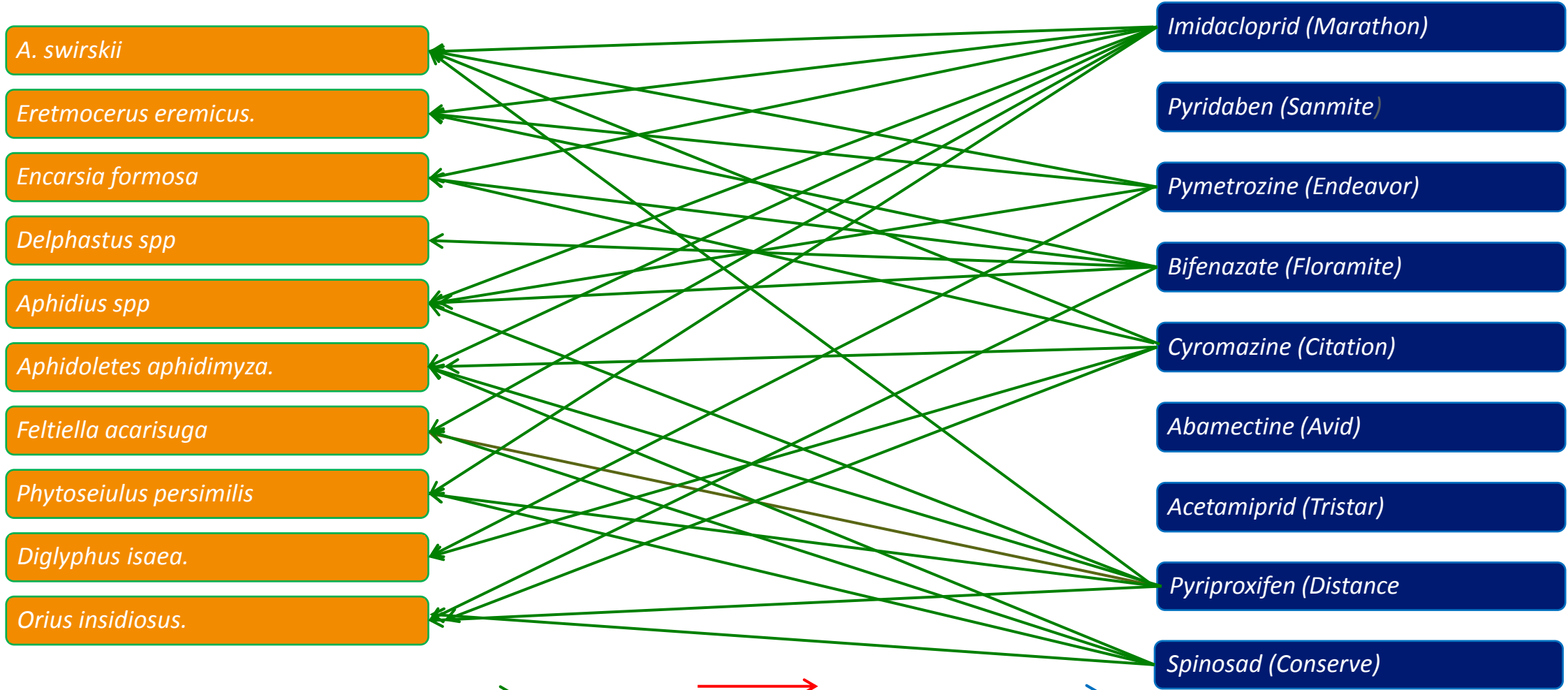
Next decision is to stop bio-program
all together 😞





Compatible with BCA's?

Compatible with **MOST/SOME** biological control agents → Looks complicated ????



→ Compatible

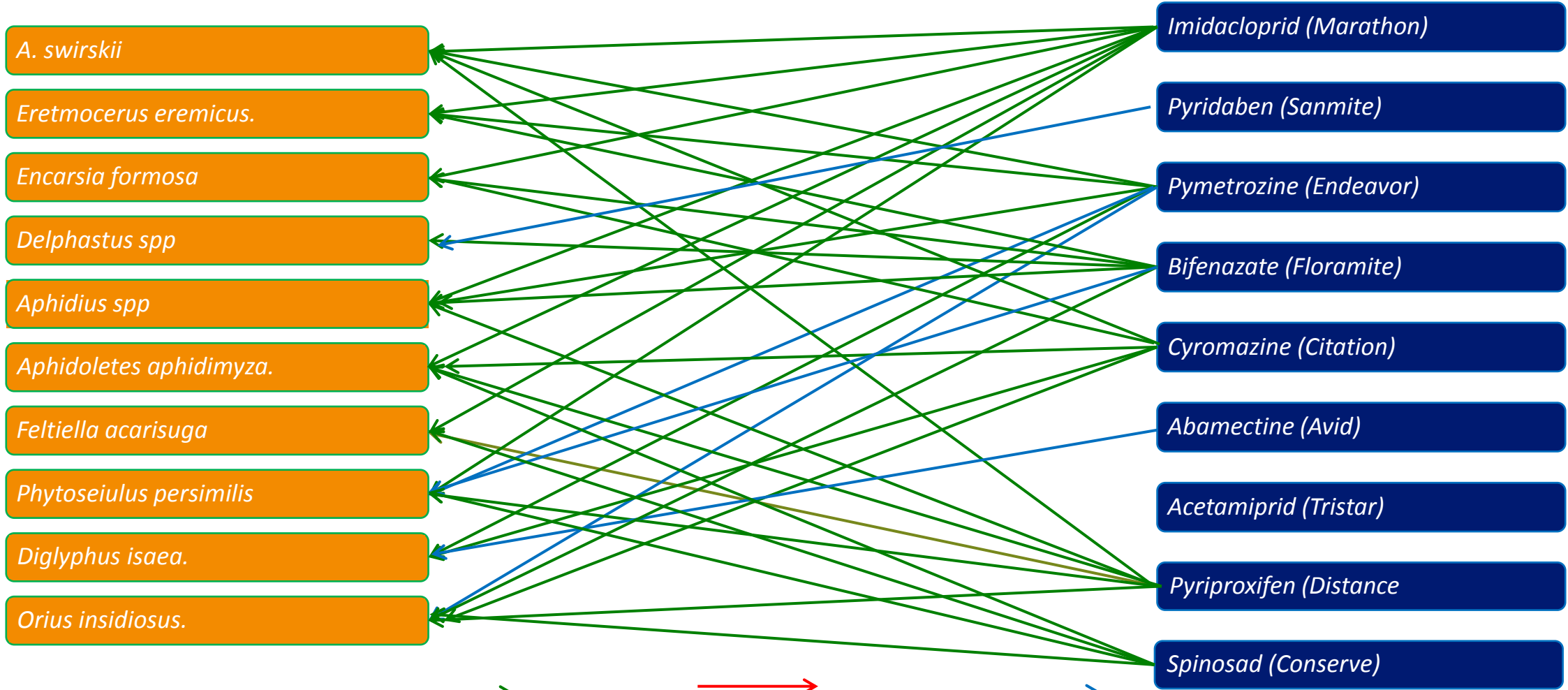
→ Not compatible

→ Risky



Compatible with BCA's?

Compatible with **MOST/SOME** biological control agents → Looks complicated ????



→ Compatible

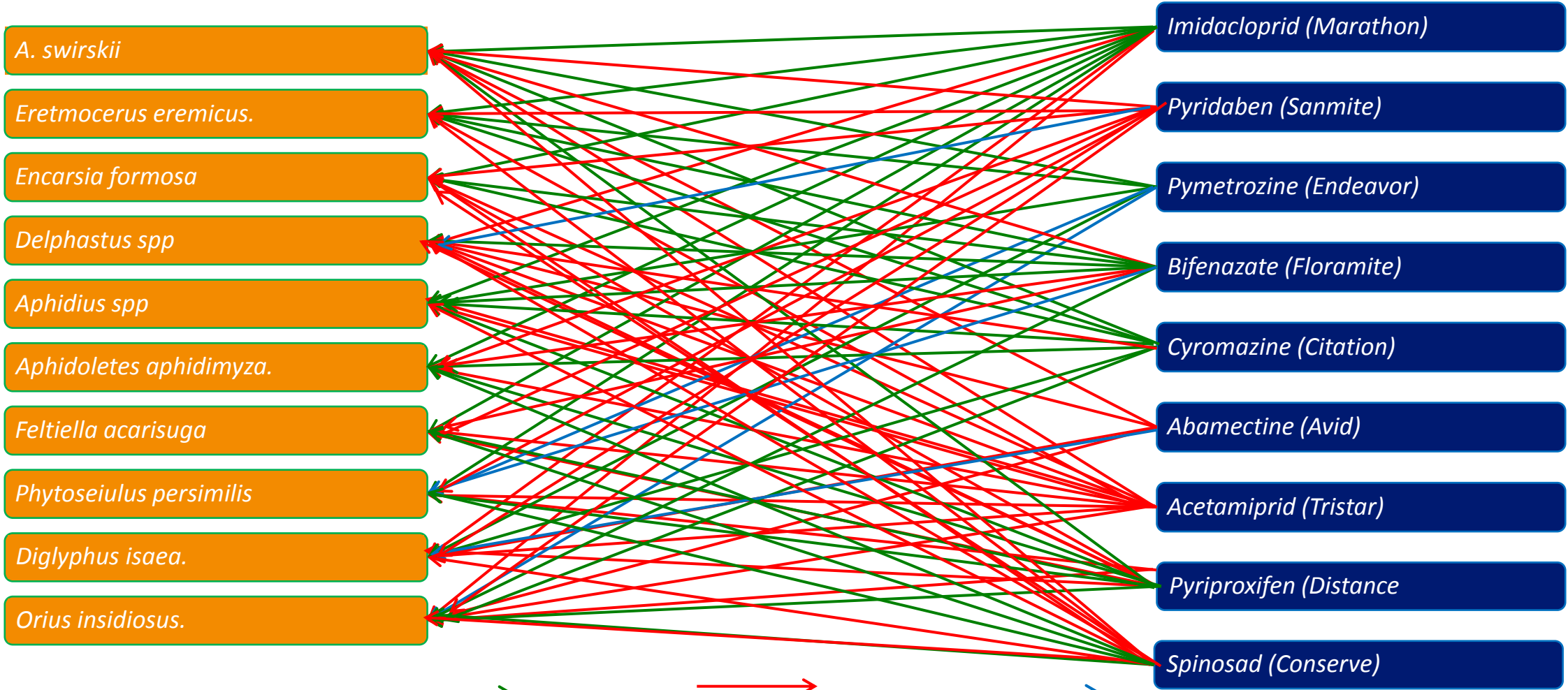
→ Not compatible

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Compatible with BCA's?

Compatible with **MOST/SOME** biological control agents → Looks complicated ????



→ Compatible

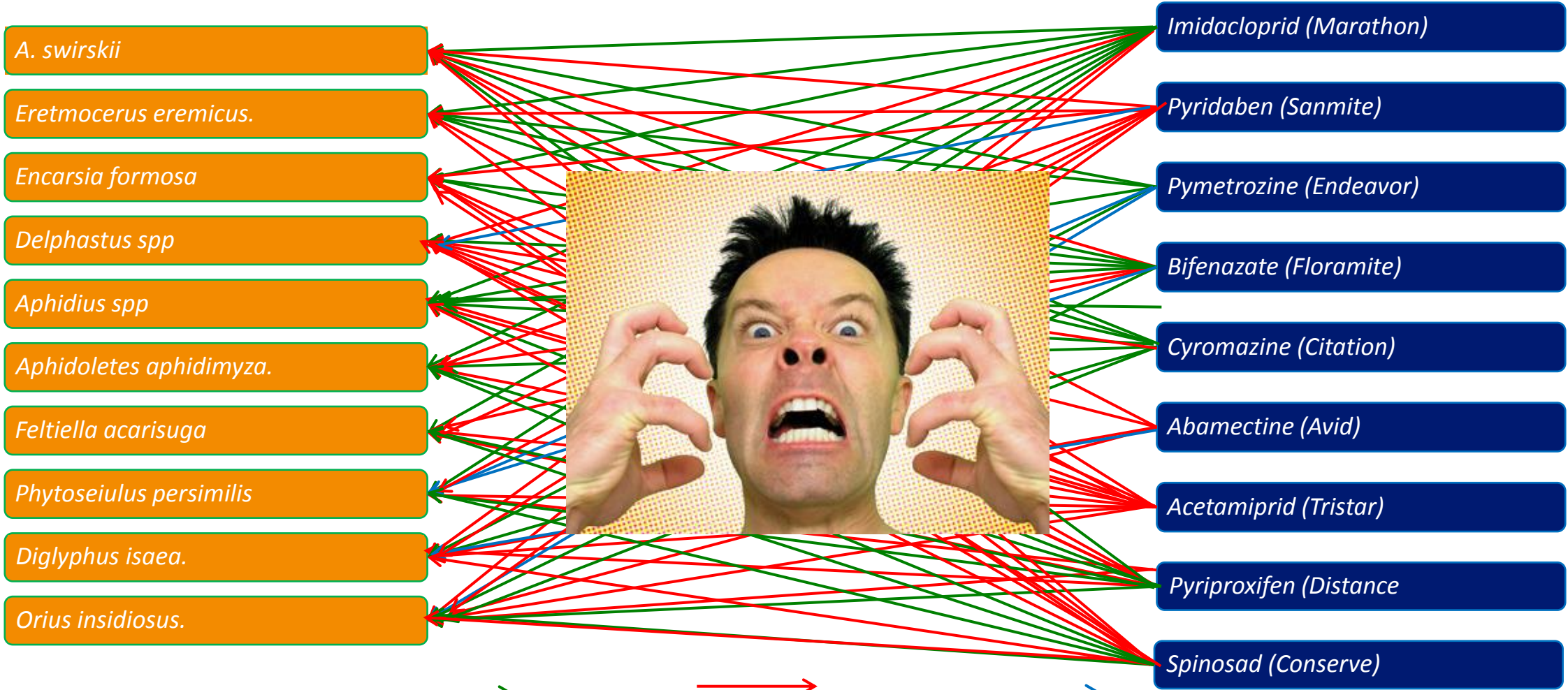
→ Not compatible

→ Risky



Compatible with BCA's?

Compatible with **MOST/SOME** biological control agents → Looks complicated ????



→ Compatible

→ Not compatible

→ Risky



Pepper Crops and Compatibility – Timing Is Everything

Major Pest Issues:
Thrips and Aphids



BCA's Used:

- *Amblyseius cucumeris*
- *Amblyseius swirskii*
- *Phytoseiulus persimilis*
- *Aphidius spp* and other aphid
BCA's





Pepper Crops and Compatibility – Timing Is Everything

And very important is *Orius insidiosus* as generalist:

- Released in March → 4 introductions - 1 per m² (10 ft²)
- Aphid control with BCA's critical during this time! WHY?
- Effect of Pymetrozine (Endeavor[®]) on *Orius* → reduction of 50% + 1 week residual
- 50% loss during establishment time = reduction and delay of establishment



Pepper Crops and Compatibility – Timing Is Everything



- Released in March → 4 introductions - 1 per m² (10 ft²)
- No interruption due to pro active approach for controlling Aphids
- July → > 100 *Orius*/m² (10 ft²)
- Aphid outbreak
- Effect of Pymetrozine on *Orius* → reduction of approx. 50%, however...
- 50% loss of 1 OR 100 per m²
- Remaining *Orius* will maintain control of thrips → Timing is Everything



Ornamental Propagation – Calculated Low Risk



Seed and Liners

- Typical pest problems → Fungus gnats, thrips, aphids, whitefly.

BCA's used during propagation:

- *Amblyseius cucumeris* (sachet on stick)
- *Hypoaspis miles/Stratioclealaps scimitus* (Hypoline)
- *Atheta (Dalotia) coriaria* (Staphyline)
- *Steinernema feltiae* (Exhibitline sf)
- *Aphidius colemani* (with banker plants)



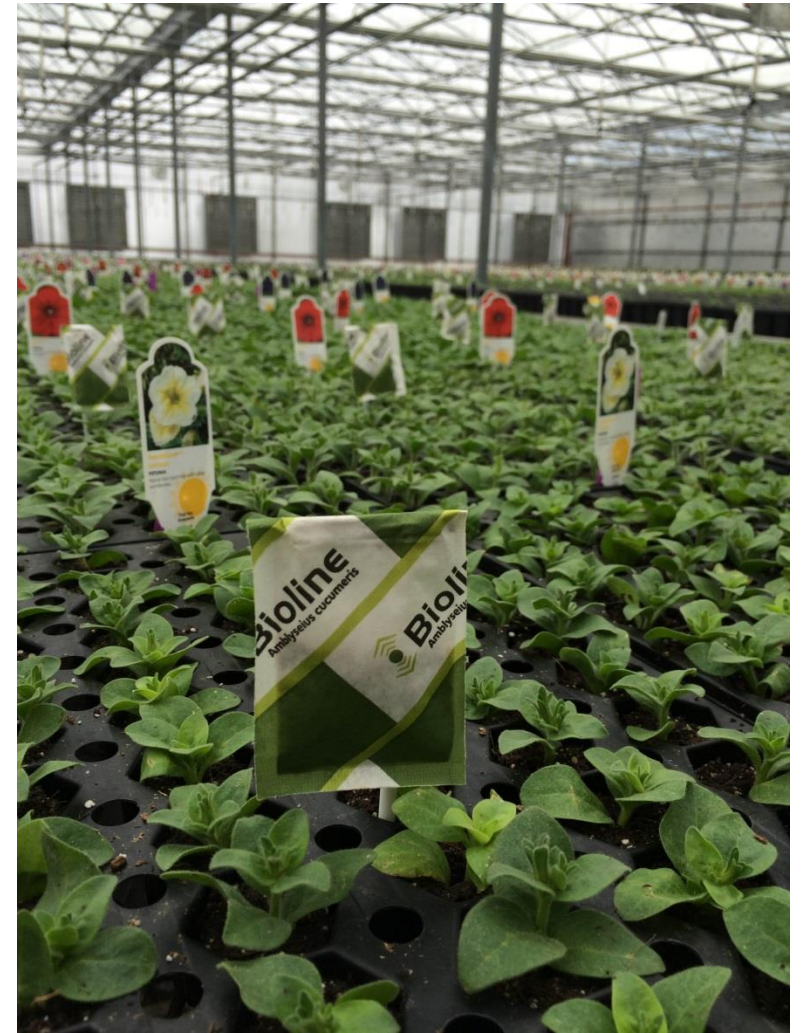
Ornamental Propagation – Calculated Low Risk



Seed and Liners

Some safer choices during propagation!

- Botanigard WP
- Cease (*Bacillus subtilis*), Rootshield
- Citation[®], Endeavor[®], Mainspring GNL[®], Talus, Beleaf



Ornamental Propagation – Calculated Low Risk

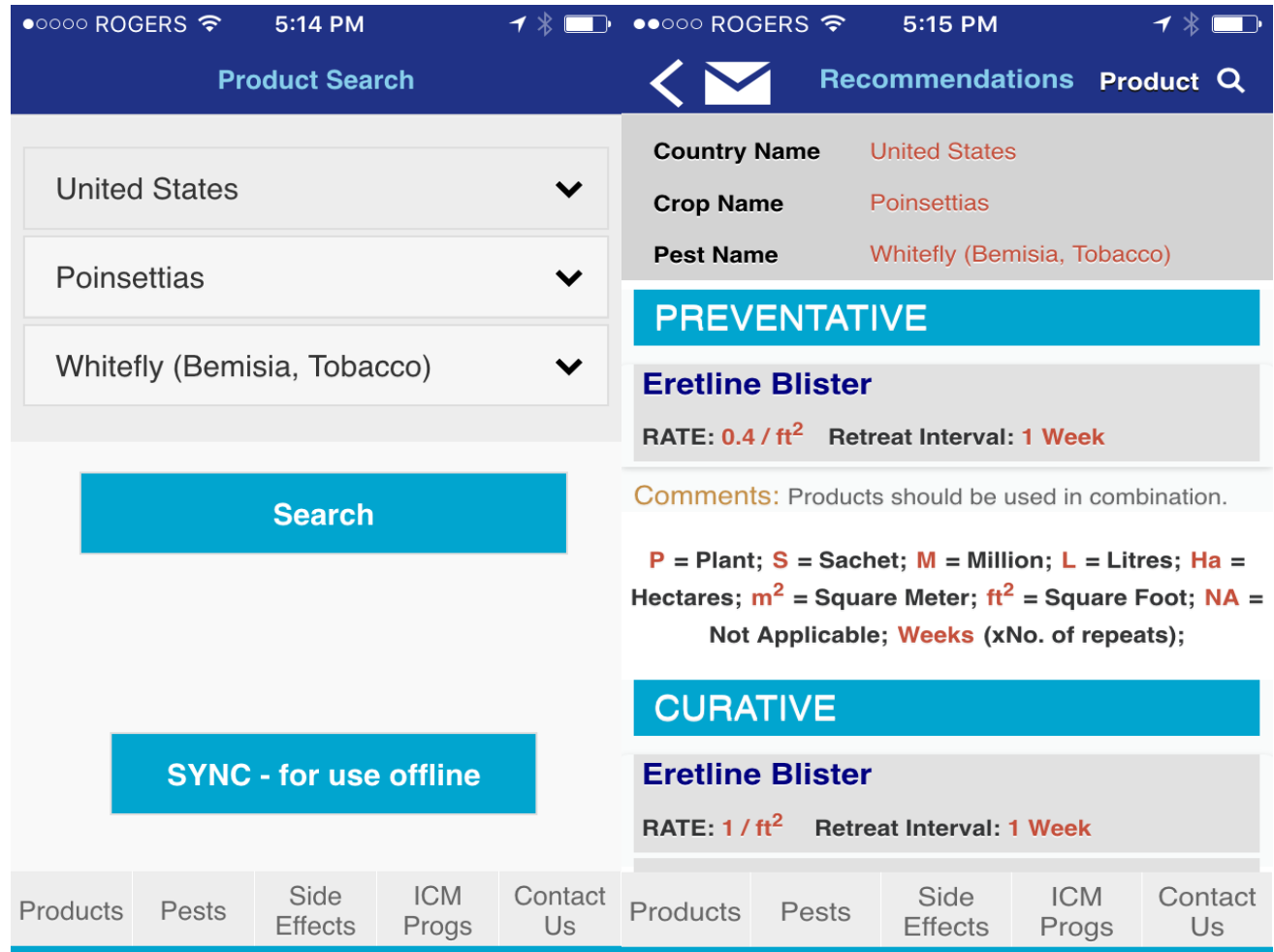


- Take your plants for a dip... Mix of Botanigard, Rootshield, and Nematodes



Bioline App – More Info about BCA's and Compatibility

- Apple, Android, and Microsoft compatible – free download
- Technical information per pest, BCA and strategies
- Compatibility data
- Trade name and A.I.



The screenshot displays the Bioline App interface on a mobile device. The top status bar shows the time as 5:14 PM and 5:15 PM, along with signal strength, Wi-Fi, and battery icons. The app header includes 'Product Search' and 'Recommendations' tabs. The search results are filtered by 'United States', 'Poinsettias', and 'Whitefly (Bemisia, Tobacco)'. A 'Search' button is visible. The 'Recommendations' section shows a 'PREVENTATIVE' recommendation for 'Eretline Blister' with a rate of 0.4 / ft² and a retreat interval of 1 Week. A 'CURATIVE' recommendation for 'Eretline Blister' is also shown with a rate of 1 / ft² and a retreat interval of 1 Week. The bottom navigation bar includes 'Products', 'Pests', 'Side Effects', 'ICM Progs', and 'Contact Us'.

Bioline App:

The screenshot shows the Bioline App interface on a mobile device. The top navigation bar includes a back arrow, 'Side Effects', 'Product' with a search icon, a mail icon, 'Search Return', and another 'Product' with a search icon. The status bar at the top shows 'ROGERS', signal strength, Wi-Fi, and the time '5:17 PM'.

On the left, there is a filter menu with the following options: 'Filter by Trade', 'Conserve (Spraying)', 'Kontos', 'Safari', 'Amblyseius swirskii', 'Phytoseiulus persimilis', and 'Orius spp.'. A 'Search' button is located below the filter menu.

The main content area displays a comparison table of pesticides. The table is organized into three sections, each with a header row and two data rows. The data rows include 'Application method', 'Toxicity Rating', and 'Persistence (In days)'. Toxicity ratings are shown in colored circles: orange for 3, red for 4, green for 1, and orange for NA.

Amblyseius swirskii	Spinosad (Spraying)	Spirotetramat	Dinotefuran
Application method	S	S	S
Toxicity Rating	3	3	1
Persistence (In days)	7	NA	NA

Phytoseiulus persimilis	Spinosad (Spraying)	Spirotetramat	Dinotefuran
Application method	S	S	S
Toxicity Rating	2	4	1
Persistence (In days)	7	NA	NA

Orius spp.	Spinosad (Spraying)	Spirotetramat	Dinotefuran
Application method	S	S	NA
Toxicity Rating	4	1	NA

At the bottom of the app, there is a navigation bar with five tabs: 'Products', 'Pests', 'Side Effects' (which is highlighted in dark blue), 'ICM Progs', and 'Contact Us'. Below the navigation bar, there are two 'Disclaimer' links and two 'Bioline' logos.

Compatibility - Keys to Success



- Think carefully and investigate before jumping the (spray) gun
- Is it really necessary to spray or are there other options?
- Is the situation close to or past 'tipping point'?
- Determine → 'Slippery Slope', 'Timing Is Everything' or 'Calculated Low Risk' with choice of pesticide
- When successful with BCA's, **stick with appropriate release rates!**



Compatibility - Keys to Success



- Propagation is an important part of production process for biocontrol and integrated approach - Foundation of rest of the crop!!
- Often more complex systems (cut gerbera situation)
- Calculated low risk products - Resistance management!!
- Try to think about entire IPM system
- If absolutely necessary, choose the best possible option and think about what the possible outcome might be on other pest problems and BCA's





Biological control is preventing problems, not fixing them!
Biocontrol works!

It is people (managing) that makes biocontrol an effective strategy!



Questions & Discussion?

Thank You!

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