Practical strategies for thrips control

Ashley Summerfield
Rose Buitenhuis
Majority of Greenhouse Floriculture industry located in Niagara region, Ontario, Canada

Ontario is the 4th largest in North America after Florida, California, and Michigan

Very high rate of biocontrol adoption
- Began switching to biocontrol in 1990s
- Relatively few registered pesticides
- Insecticide resistance in common pests

Most challenging pest: Western flower thrips, *Frankliniella occidentalis* (WFT)
Thrips species in floriculture greenhouse

Western flower thrips, *Frankliniella occidentalis*, dominant in both countries

**Ontario, Canada**
- **F. occidentalis**: 65%
- **T. tabaci**: 32%
- *Echinothrips americanus*: 2%
- Other: 1%

**Medillín, Colombia**
- **F. occidentalis**: 79%
- **F. panamensis**: 7%
- Franklminiella sp.: 6%
- Other (12 spp.): 8%

Source: S. Jandricic (OMAFRA), 2016
Source: Emilio Arévalo P. et al., 2003
Thrips parvispinus is quickly expanding its range – detections in Spain (2017), France, the Netherlands (2019), USA (2020)

First detected in Canada on imported tropical plants in 2021

Already showing resistance to Spinosad and Cyantraniliprole after 1 season of heavy spraying
On some crops (mandevilla, schefflera, hoya, pepper) growing tips and new leaves are distorted (similar to broadmite damage).
Visit ONfloriculture.com

• Results of ongoing *T. parvispinus* research, including on farm trials being conducted in Canada by Dr. Sarah Jandricic.

• Links to webinars and other resources
Increase in non-native thrips found on imports

More invasives found in last few years

• Increased surveillance
• Increasing global trade of plants
• Recent tropical foliage boom
• Deregistration of harder pesticides
• Climate change expanding ranges

*Thrips setosus* looks nearly identical to *T. parvispinus*, primarily found on hydrangea
Biocontrol use in Colombia

**Barrier:** Relatively few biocontrol agents commercially available in Colombia

**Goal for today:**
Show you how to use the tools you DO have for successful biocontrol-based IPM and reduce reliance on pesticides
Why switch from pesticides to biocontrol-based IPM?

Pesticide drawback & biocontrol benefits

**Pesticide-based pest management**
- Dangerous to human health
- Environmental harm
- Poor plant health
- **Pesticide resistance = they don’t work!**

**Biocontrol-based pest management**
- Safer for workers
- Better for the environment
- Better plant health
- Not affected by resistance
Successful IPM is more than biocontrol

**Plan ahead:** choose resistant varieties, strategic placement of attractive varieties

**Start clean:** prevent infestation with dips, screens & mass trapping

**Monitor** populations, make decisions based on data

**Biocontrol:** start early, use as long as possible

**Keep records:** use data to create thresholds & decision deadlines

**Spray:** only if necessary

**Support:** banker plants & quality outdoor habitat attract natural enemies & sustain susceptible pest populations

**Sell beautiful plants!**
Successful IPM is more than biocontrol

**Plan ahead:** choose resistant varieties, strategic placement of attractive varieties

**Start clean:** prevent infestation with dips, screens & mass trapping

**Monitor** populations, make decisions based on data

**Biocontrol:** start early, use as long as possible

**Keep records:** use data to create thresholds & decision deadlines

**Spray:** only if necessary

**Support:** banker plants & quality outdoor habitat attract natural enemies & sustain susceptible pest populations

**Sell beautiful plants!**
Attack all life stages to ensure success

1. 1st instar
2. 2nd instar
3. Adult
4. Pupa

- Foliage
- Substrate (top 2cm)
- 2 weeks total

2 weeks total
Phytoseiid mites (e.g. *A. swirskii*, *N. cucumeris*) only eat 1\textsuperscript{st} instar nymphs. Larger generalist predators (e.g. *Orius* species) can eat all nymphs and adults. Soil-dwelling predators (e.g. Rove beetles, *Hypoaspis*), and nematodes attack pupae.

Entomopathogens (e.g. *Beauveria bassiana*) attack all stages. Spray to target foliar stages. Drench or use granular formulations to target pupae.

Attack all life stages to ensure success.
What is available in Colombia?

**Phytoseiid mites:** Not available to buy; not very mobile

**Large generalis predators (e.g. Orius):** Not available to buy; exist naturally & highly mobile

**Soil-dwelling predators:** Not available to buy; not very mobile

**Nematodes:** Available to buy: *Heterorhabditis* sp.

**Entomopathogens:** Available to buy
- *Beauveria bassiana*
- *Metarhizium brunneum*
- *Paecylomyces* sp.
Entomopathogenic nematodes target pupae in the soil – foliage applications do not work!

Application methods:
- Through the irrigation system
- “Sprench” (Spray & Drench)
  - Heavy spray to runoff
  - Use sprayer pressure below 300psi
  - Nematodes need to reach the soil
  - Use on young crops until canopy closes

Nematodes need oxygen to survive – apply to crop immediately after mixing with water
Tips for applying nematodes

Check out our YouTube video for tips on using entomopathogenic nematodes and how to do quality control checks:
Tips for applying microbial biopesticides

*Beauveria bassiana, Metarhizium brunneum (=anisopliae)*

Remember – these are living organisms!
Always use fresh product and follow storage directions

Microbials rely on direct contact so good spray coverage is critical

Foliar sprays should be a very fine mist to avoid runoff
- Low-volume mist (“LVM”):
  - Use cold foggers only! “Thermal” foggers will kill spores
- Hydraulic sprayer:
  - use low-flow nozzle that produces fine spray droplets
  - Move quickly through the crop, continuously waving the spray wand so clouds of mist coat undersides of leaves
Support natural enemies inside & outside the GH

**Plan ahead:** choose resistant varieties, strategic placement of attractive varieties

**Start clean:** prevent infestation with dips, screens & mass trapping

**Biocontrol:** start early, use as long as possible

**Monitor** populations, make decisions based on data

**Keep records:** use data to create thresholds & decision deadlines

**Spray:** only if necessary

**Support:** banker plants & quality outdoor habitat attract natural enemies & sustain susceptible pest populations

**Sell beautiful plants!**
Native generalist predators in Colombia

Predators will enter the greenhouse from outside if the conditions are right

Generalists in Colombia:
- *Orius insidiosus*, other *Orius* sp.
- Lacewings
- Syrphid flies
- Lady beetles
- Tiger flies (*Coenosia* sp.)
Natural enemies need natural habitat

Sprayed and mowed landscape around greenhouses don’t attract or support predators
Conservation Biological Control: Increasing beneficial insects by developing their resource habitats

Flowering, insecticide-free habitat:
• Attract & support beneficial insects
• Act as a trap plants for pests before they enter the greenhouse
• Suppress pest populations as beneficial insects within the habitat eat the pests

Outdoor habitat attracts beneficials & traps pests

Study in potted chrysanthemums in Ontario

Traps plants better at attracting dispersing thrips
- Place trap plants near entry points
- Create border of flowering plants outside GH which will also attract natural enemies
- Place susceptible varieties near entry points to serve as trap crop?

[Graph showing comparison between trap plants and crop plants for resident and dispersing thrips]

Companion plants bordering strawberry field.
Credit: University of Florida IFAS Extension
Supporting beneficials inside the greenhouse

Two rules for attracting & keeping generalists
1. Feed them
2. Don’t kill them with pesticides (can include biopesticides!)

Banker plants are non-crop plants that attract & support beneficial insects
• ‘Purple flash’ ornamental pepper
• Sweet alyssum

Supplemental food added to crop or banker plants attract & retain predators when pests are low, increase reproduction
• *Ephestia* eggs
• Brine shrimp eggs (aka *Artemia* cysts)
• Pollen
Commercial greenhouses have started to rear some of their own biocontrol agents

Easiest to rear: Rove beetles
(Dalotia coriaria, aka Atheta)

Supplies needed:
- plastic container
- soilless mix (coir, peat, or vermiculite)
- ground up chicken feed or dog kibble
Orius species are not as easy as Dalotia, but can also be reared on farm

- Supplies needed for mass rearing:
  - Glass jar with corrugated cardboard strips
  - Food source: *Ephestia* eggs, Brine shrimp eggs (aka *Artemia* cysts), pollen

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*. 

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*. 

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*. 

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*. 

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*. 

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*. 

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*. 

Bueno et al. 2006 paper: Evaluation of a rearing-method for the predator *Orius insidiosus*.
Products listed as “compatible” can still cause harm!

- Can kill up to 25% of beneficials and still be labeled “compatible”
- Usually only considers mortality, does not measure sub-lethal side effects

Sub-lethal effects on beneficial insects:
- Shorter life span
- Lower reproductive rate
- Poor larval development
- Reduced mobility
- Repellence

### Natural enemies

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>harmless or only slightly harmful&lt;br&gt;25% reduction</td>
</tr>
<tr>
<td>2</td>
<td>moderately harmful 25 - 50% reduction</td>
</tr>
<tr>
<td>3</td>
<td>harmful 50 - 75% reduction</td>
</tr>
<tr>
<td>4</td>
<td>very harmful &gt; 75% reduction</td>
</tr>
</tbody>
</table>
Koppert website & app
Biobest app coming soon

Insecticides have different side effects depending on:
- Species
- Life stage
- Application method

Remember to check effects on all beneficals

**Pesticide side effects resources online**

<table>
<thead>
<tr>
<th>Species</th>
<th>Orius laevigatus</th>
<th>Aphidius colemani</th>
<th>Diglyphus isaea</th>
</tr>
</thead>
<tbody>
<tr>
<td>abamectin</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>chlorfenapyr</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>dichlorvos</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>flonicamid</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>imidacloprid</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>spinosad</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
</tbody>
</table>

- **adult**
  - Orius laevigatus: 3 (SP), 2 (DR)
  - Aphidius colemani: 1 (SP), 3 (DR)
  - Diglyphus isaea: 3 (SP), 3 (DR)

- **nymph**
  - Orius laevigatus: 4 (SP), 1 (DR)
  - Aphidius colemani: 4 (SP), 1 (DR)
  - Diglyphus isaea: 3 (SP), 3 (DR)

- **larva**
  - Orius laevigatus: 1 (SP), 1 (DR)
  - Aphidius colemani: 4 (SP), 1 (DR)
  - Diglyphus isaea: 1 (SP), 1 (DR)

- **persistence**
  - Orius laevigatus: 1 - 6 w
  - Aphidius colemani: 0 w
  - Diglyphus isaea: 2 - 3 w
Preserving natural enemies pays off

More predators = fewer pests

Sampled thrips & predators in Mexican mango orchards

• Predators were mostly anthocorids (such as *Orius* species)

• Nearly twice as many predators in the no-spray orchard

• After initial peak, no-spray orchard had less WFT & more predators compared to sprayed orchard

**Start clean & prevent infestations**

**Plan ahead:** choose resistant varieties, strategic placement of attractive varieties

**Start clean:** prevent infestation with dips, screens & mass trapping

**Monitor** populations, make decisions based on data

**Biocontrol:** start early, use as long as possible

**Spray:** only if necessary

**Keep records:** use data to create thresholds & decision deadlines

**Support:** banker plants & quality outdoor habitat attract natural enemies & sustain susceptible pest populations

**Sell beautiful plants!**
The best IPM strategy is to keep pests out in the first place!

Sources of infestation:
- Outdoor populations
- Imported plant material
- Other parts of your farm!

Ways to reduce infestations:
- Insect screening
- Mass trapping
- Cutting dips
- Sanitation & work-flow
**F. occidentalis (WFT)**

Number of WFT caught inside GH highly correlated to number outside

Caught twice as many WFT outside than inside = well established in Canada landscape

WFT originally believed unable to overwinter but have since adapted

(Broadbent & Hunt 1991)
Screens that exclude thrips will also exclude most other flying pests, e.g. aphids, whitefly, leaf-miner.

Material with special optical properties enhance exclusion of coarser mesh if air flow is a concern.

Down-side: Screens also prevent entry of beneficials.
The great yellow vs. blue debate
• Conflicting studies which colour thrips prefer
• Preference may be influenced by environment
• Recent study found different WFT populations had different preferences (Lopez-Reyes et al. 2022)

Yellow generally catches more kinds of pests such as whiteflies, fungus gnats, shore flies

If you want to know the best colour for thrips – best to test them in your own facility!
Unrooted cuttings and other imported plants a frequent source of thrips
• More invasive thrips species have been found in recent years
• In-house mother stock can also be a source of infestation!
Unrooted cutting dips

- Immersion gives complete coverage of cuttings
- Biopesticides and/or reduced risk products
  - Less potential for resistance development
  - Minimal residues, highly compatible with biocontrol agents
- Stick cuttings and grow as usual

Watch our video on how to use cutting dips →
Dips improve the success of biocontrol

Landscape oil = mineral oil
BotaniGard 22WP = Beauveria bassiana

• Both Landscape Oil dips and BotaniGard 22WP dips reduced thrips populations
• Dips combined with biocontrol resulted in best thrips control
Results indicate that dips in BotaniGard 22WP or mineral oil reduce *T. parvispinus* by ~70%
## Dip efficacy and phytotoxicity

<table>
<thead>
<tr>
<th></th>
<th><strong>Hardy crops</strong></th>
<th></th>
<th><strong>Sensitive crops</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Bemisia</strong></td>
<td><strong>Thrips</strong></td>
<td><strong>TSSM</strong></td>
<td><strong>Bemisia</strong></td>
</tr>
<tr>
<td>Kopa 0.5% + BotaniGard22WP 1.25 g/L</td>
<td>70%</td>
<td>?</td>
<td>?</td>
<td>70%</td>
</tr>
<tr>
<td>Kopa 1-2%</td>
<td>85%</td>
<td>No effect</td>
<td>Some effect (not eggs)</td>
<td></td>
</tr>
<tr>
<td>BotaniGard 22WP 1.25 g/L</td>
<td>50%</td>
<td></td>
<td>?</td>
<td>50%</td>
</tr>
<tr>
<td>BotaniGard 22WP 2.5 g/L</td>
<td></td>
<td>High efficacy*</td>
<td>No effect</td>
<td>High efficacy*</td>
</tr>
<tr>
<td><em>Only in greenhouse trials</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nemasys 2.5 M IJ/L</td>
<td>No effect</td>
<td>Some effect</td>
<td>No effect</td>
<td>Some effect</td>
</tr>
<tr>
<td>SuffOil-X 0.1%</td>
<td>70%</td>
<td>75%</td>
<td>&gt;95%</td>
<td>70%</td>
</tr>
<tr>
<td>SuffOil-X 0.5%</td>
<td>?</td>
<td>75%</td>
<td>&gt;95%</td>
<td>?</td>
</tr>
<tr>
<td>Landscape Oil 0.1%</td>
<td>80%</td>
<td>&gt;95%</td>
<td></td>
<td>80%</td>
</tr>
<tr>
<td>Landscape Oil 0.5%</td>
<td>85%</td>
<td>&gt;95%</td>
<td></td>
<td>85%</td>
</tr>
</tbody>
</table>
## Dip efficacy and phytotoxicity

<table>
<thead>
<tr>
<th>Hardy crops</th>
<th>Sensitive crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>(mandevilla, chrysanthemum, ivy geranium)</td>
<td>(poinsettia, osteospermum, mini rose, petunia)</td>
</tr>
<tr>
<td><strong>Bemisia</strong></td>
<td><strong>Bemisia</strong></td>
</tr>
<tr>
<td><strong>Thrips</strong></td>
<td><strong>Thrips</strong></td>
</tr>
<tr>
<td><strong>TSSM</strong></td>
<td><strong>TSSM</strong></td>
</tr>
<tr>
<td>Kopa 0.5% + BotaniGard22WP 1.25 g/L</td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>?</td>
</tr>
<tr>
<td>Kopa 1-2%</td>
<td>85%</td>
</tr>
<tr>
<td></td>
<td>No effect</td>
</tr>
<tr>
<td>BotaniGard 22WP 1.25 g/L</td>
<td>Some effect (not eggs)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>BotaniGard 22WP 2.5 g/L</td>
<td>High efficacy*</td>
</tr>
<tr>
<td>*Only in greenhouse trials</td>
<td>No effect</td>
</tr>
<tr>
<td>Nemasys 2.5 M IJ/L</td>
<td>No effect</td>
</tr>
<tr>
<td></td>
<td>Some effect</td>
</tr>
<tr>
<td><strong>SuffOil-X 0.1%</strong></td>
<td>70%</td>
</tr>
<tr>
<td></td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>&gt;95%</td>
</tr>
<tr>
<td><strong>SuffOil-X 0.5%</strong></td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td>&gt;95%</td>
</tr>
<tr>
<td><strong>Landscape Oil 0.1%</strong></td>
<td>80%</td>
</tr>
<tr>
<td></td>
<td>&gt;95%</td>
</tr>
<tr>
<td><strong>Landscape Oil 0.5%</strong></td>
<td>85%</td>
</tr>
<tr>
<td></td>
<td>&gt;95%</td>
</tr>
</tbody>
</table>

Mineral oil-based products highly effective, may cause phytotoxicity in sensitive crops.
## Dip efficacy and phytotoxicity

<table>
<thead>
<tr>
<th></th>
<th>Hardy crops</th>
<th>Sensitive crops</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bemisia</td>
<td>Thrips</td>
</tr>
<tr>
<td>Kopa 0.5% + BotaniGard22WP 1.25 g/L</td>
<td>70%</td>
<td>?</td>
</tr>
<tr>
<td>Kopa 1-2%</td>
<td>85%</td>
<td>No effect</td>
</tr>
<tr>
<td>BotaniGard 22WP 1.25 g/L</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>BotaniGard 22WP 2.5 g/L *Only in greenhouse trials</td>
<td>High efficacy*</td>
<td>No effect</td>
</tr>
<tr>
<td>Nemasys 2.5 M IJ/L</td>
<td>No effect</td>
<td>Some effect</td>
</tr>
<tr>
<td>SuffOil-X 0.1%</td>
<td>70%</td>
<td>75%</td>
</tr>
<tr>
<td>SuffOil-X 0.5%</td>
<td>80%</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>Landscape Oil 0.1%</td>
<td>85%</td>
<td>&gt;95%</td>
</tr>
</tbody>
</table>

*Only in greenhouse trials

Beauveria bassiana was effective for thrips, did not cause phytotoxicity.
## Dip efficacy and phytotoxicity

<table>
<thead>
<tr>
<th>Hardy crops (mandevilla, chrysanthemum, ivy geranium)</th>
<th>Sensitive crops (poinsettia, osteospermum, mini rose, petunia)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bemisia</td>
</tr>
<tr>
<td>Kopa 0.5% + BotaniGard22WP 1.25 g/L</td>
<td>70%</td>
</tr>
<tr>
<td>Kopa 1-2%</td>
<td>85%</td>
</tr>
</tbody>
</table>

Soaps were only effective for whitefly, but caused some phytotoxicity; can be used at lower rate in combination with *Beauveria bassiana*
**Dip efficacy and phytotoxicity**

<table>
<thead>
<tr>
<th></th>
<th>Hardy crops</th>
<th>Sensitive crops</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(mandevilla, chrysanthemum, ivy geranium)</td>
<td>(poinsettia, osteospermum, mini rose, petunia)</td>
</tr>
<tr>
<td><strong>Product</strong></td>
<td><strong>Bemisia</strong></td>
<td><strong>Thrips</strong></td>
</tr>
<tr>
<td>Kopa 0.5% + BotaniGard22WP 1.25 g/L</td>
<td>70%</td>
<td>?</td>
</tr>
<tr>
<td>Kopa 1-2%</td>
<td>85%</td>
<td>No effect</td>
</tr>
<tr>
<td>BotaniGard 22WP 1.25 g/L</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>BotaniGard 22WP 2.5 g/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Only in greenhouse</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nemasys 2.5 M IJ/L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SuffOil-X 0.1%</td>
<td></td>
<td>75%</td>
</tr>
<tr>
<td>SuffOil-X 0.5%</td>
<td>?</td>
<td>75%</td>
</tr>
<tr>
<td>Landscape Oil 0.1%</td>
<td>80%</td>
<td>&gt;95%</td>
</tr>
<tr>
<td>Landscape Oil 0.5%</td>
<td>85%</td>
<td>&gt;95%</td>
</tr>
</tbody>
</table>

*Only in greenhouse* No effect

**Always test for phytotoxicity** when using a new product or application method! Formulations in Colombia might be different than in Canada.
If possible, start with a clean, empty compartment

- Only grow plants of the same age together – don’t mix old & young plants
- Thrips pupate in soil – steam soil, drench microbials (e.g. Beauveria bassiana), or wait at least 2 weeks before planting
- Have workers move from cleanest to most infested areas throughout the day

Source: your own farm

Sanitation & work flow reduce infestations from other parts of the GH
Insecticides, resistance & unintended consequences

**Plan ahead:** choose resistant varieties, strategic placement of attractive varieties

**Start clean:** prevent infestation with dips, screens & mass trapping

**Monitor** populations, make decisions based on data

**Biocontrol:** start early, use as long as possible

**Keep records:** use data to create thresholds & decision deadlines

**Spray:** only if necessary

**Support:** banker plants & quality outdoor habitat attract natural enemies & sustain susceptible pest populations

Sell beautiful plants!
WFT has resistance to 32 different active ingredients
(Arthropod pesticide resistance database)

Insecticide Resistance Management (IRM) strategies delay or reduce the severity of resistance

Avoid repeated use of the same Mode of Action (MoA)

- **MoA is listed on product label**
- Don’t need to understand *how* they work, just need to know the numbers
Don’t use the same MoA in sequential “windows”
• window = 1 generation of the pest

Rotate between 2 or more different MoA
What if resistance is already present?

IRM can help prevent resistance, but what if resistance is already there?

Resistance can persist over several months even in the absence of insecticides
• Spinosad 8 months (Bielza et al. 2008)
• Dichlorvos 4-8 months (Gholami et al. 2020)
• Acrinathrin 8 months, methiocarb 5 months, formetanate 6-8 months (Contreras et al. 2008)

Stability of resistance depends on:
• the type of chemical (Mode of Action)
• contact with residues
• presence of susceptible populations
Interbreeding with susceptible populations speeds up decline in resistance in the absence of spraying

With 100% resistant thrips the level of resistance remains unchanged after 8 months with no exposure

Even 25% susceptible thrips drops resistance level of population by 100-fold in just 2 months
Insecticide resistance often has a “fitness cost”
- E.g. lower reproductive rate, shorter life span, slower development

In the absence of insecticides, susceptible populations outcompete resistant ones

Starting population: half resistant, half susceptible

Susceptible thrips die, only resistant ones remain

Susceptible thrips outcompete resistant
Resistance management is more than rotation

Case study from Spain sweet pepper greenhouses

Murcia:
- Wide variety of indoor & outdoor crops
- Lots of pesticide-free outdoor habitat
- Biocontrol adoption 95% (2006)

Almeria:
- Mostly greenhouse pepper
- Very little pesticide-free outdoor habitat
- Biocontrol adoption 28% (2007)

F. occidentalis were sampled from greenhouses using chemical control and following IRM guidelines

Landscape diversity promotes susceptible thrips

Case study from Spain sweet pepper greenhouses

Both regions followed insecticide resistance management (IRM)

Pesticide-free “refuges” + more biocontrol use was key to maintaining susceptibility in Murcia

Good pesticide rotation practice alone is not enough!

Create safe space for susceptible thrips

Outside the greenhouse:
• Pesticide-free flowering plants
• Same habitat that supports beneficial insects

Inside the greenhouse:
• Banker plants
• Only spray varieties that absolutely need it
• Use non-chemical means as long as possible

Monitoring & making the most of your data

**Plan ahead:** choose resistant varieties, strategic placement of attractive varieties

**Start clean:** prevent infestation with dips, screens & mass trapping

**Biocontrol:** start early, use as long as possible

**Monitor:** populations, make decisions based on data

**Keep records:** use data to create thresholds & decision deadlines

**Support:** banker plants & quality outdoor habitat attract natural enemies & sustain susceptible pest populations

**Spray:** only if necessary

**Sell beautiful plants!**
How & why to invest in monitoring

Best ways to monitor for thrips:
1. Plant taps
   - good balance of speed & quality
   - can count adults and larvae
2. Sticky traps
   - fastest, but variable accuracy, adults only
   - lag time between crop & cards
3. Destructive plant washes
   - time consuming, but most accurate data

Monitoring data can be used to:
- track seasonal pest pressure
- determine efficacy of management interventions
- determine which varieties get more thrips
- Create action thresholds
Plot data to track pest pressure over time

Seasonal thrips pressure in chrysanthemum greenhouses in Canada

Keep track of fluctuations in pest pressure over time
• When does pressure peak?
• How does pest pressure compare to previous years?
• Do you see any trends that explain these patterns?

If peaks are consistent, can use this information to prepare before things get bad
Monitor to see if interventions are working

- Are pest numbers decreasing?
- Are predator numbers affected?
- Can compare over time to see if resistance is developing

![Number of thrips before & after sprays](chart)

- **#WFT**
- **#OT**
Using data to choose better varieties

Commercial trial in Garden Mums in Ontario

Compared 6 varieties of yellow garden mums

- Some varieties much more attractive than others
- Preference changed with plant age
- Once flowers opened thrips chose the plants with the most flowers, regardless of variety
- Keep notes – this information rarely provided by breeders
There is no standard action threshold for thrips – crops have different tolerances

- Collect standardized monitoring data (i.e. use the same “unit” size every time)
- Record data on crop damage as it relates to salability, % crop losses
- You will need to experiment based on previous years data to develop reliable action thresholds that balance program cost and crop losses

**Using data to create action thresholds**

- "**Economic Injury Level**" is the number of insects required to cause crop losses
- "**Economic Threshold**" is the number of insects when management action should be taken

The goal is to *prevent* crop losses, so Economic Threshold is lower than the Economic Injury Level
Using data to track program success

Example from Whitefly IPM in poinsettia production in Ontario

- Like thrips, *Bemisia* whitefly highly resistant “Q biotype” is outcompeted by susceptible “B biotype” when not spraying
- OMAFRA developed whitefly IPM program to minimize spraying as good or better than pesticides

% of Crop Infested with *Bemisia*, mid October 2017

% of Crop Infested with *Bemisia*, mid October 2018

Better outcome with biocontrol in high pressure year

Source: S. Jandricic, Ontario Ministry of Food, Agriculture and Rural Affairs (OMAFRA)
Core components of good IPM

Plan ahead: choose resistant varieties, strategic placement of attractive varieties

Start clean: prevent infestation with dips, screens & mass trapping

Biocontrol: start early, use as long as possible

Monitor populations, make decisions based on data

Keep records: use data to create thresholds & decision deadlines

Spray: only if necessary

Support: banker plants & quality outdoor habitat attract natural enemies & sustain susceptible pest populations

Sell beautiful plants!
Learn more with AFE’s online resources

Visit the AFE Thrips & Botrytis Research Library:

derowment.org/tb/
Thank you

Ashley.summerfield@vinelandresearch.com