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RESEARCH & INNOVATION CENTRE



# Thrips diversity in the greenhouse

Identification & biology of common and exotic thrips species found in protected culture

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1. Background
  - Why & when to ID thrips
  - Status of thrips species in Ontario
  - Development of grower-friendly thrips identification guide
2. Thrips ID basics
  - Collecting tips
  - Anatomy & terminology
3. Species profiles
  - Identifying features
  - Other species they resemble
  - Host plants & habits
4. How thrips management differs between species

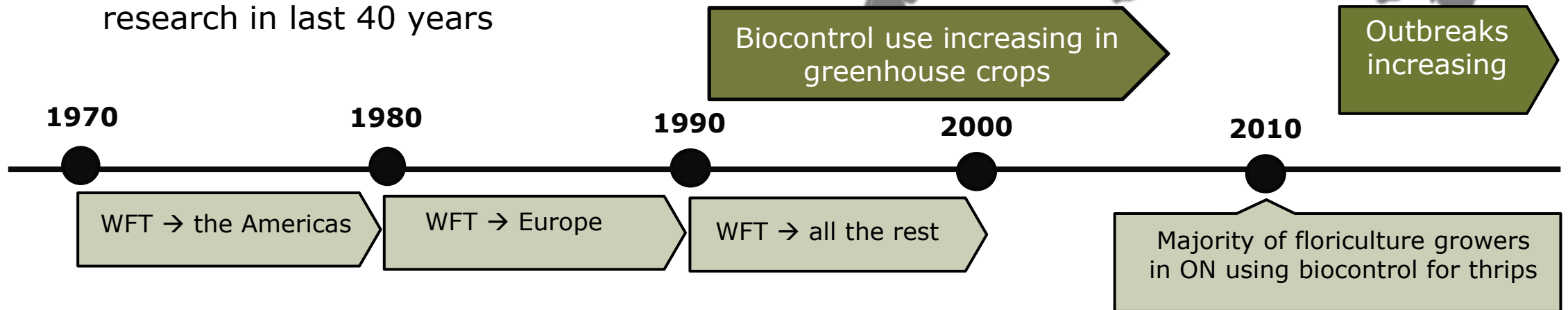
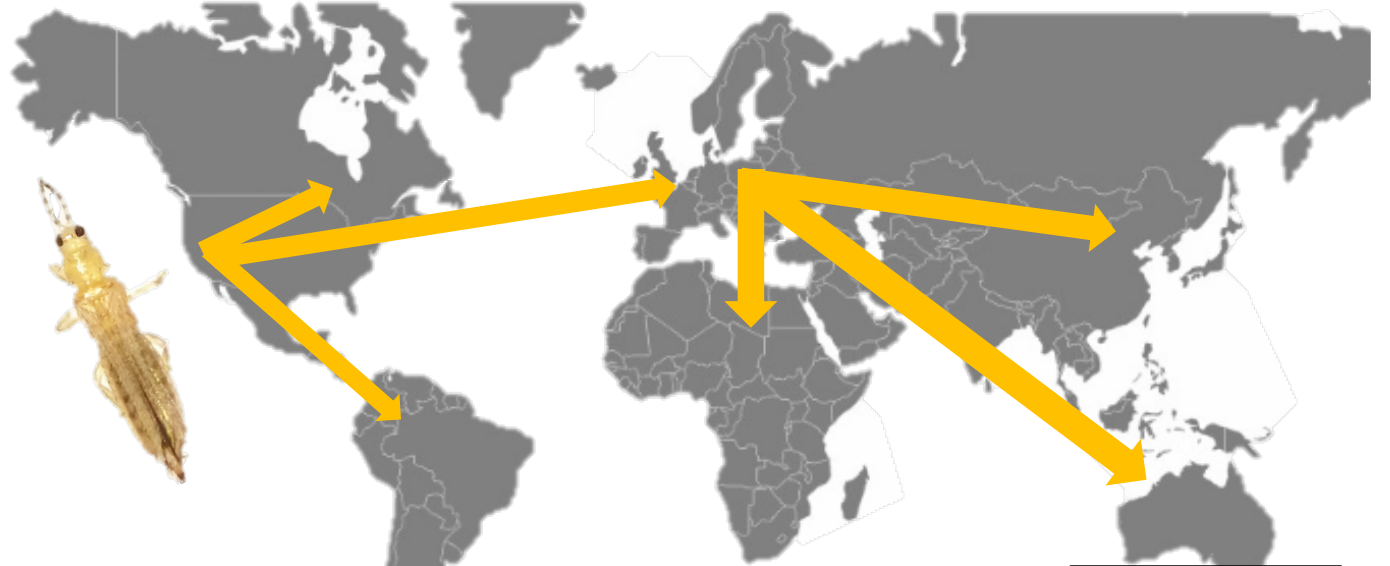
# A brief history of thrips

## How western flower thrips took over the world and changed IPM

### Western flower thrips (WFT)

*Frankliniella occidentalis*

- Originate in Southwest USA
- Extremely high rate of insecticide resistance
- Driver of biocontrol adoption in ornamentals
- Primary focus of thrips IPM research in last 40 years



# Why we started to ID thrips species

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In early 2010s, growers in Ontario started noticing more frequent/severe thrips outbreaks

Biocontrol-based IPM strategies that had worked for years couldn't cope

Identifying your pest is the IPM equivalent of **"did you try turning it off and on again?"** (i.e. step #1)

- Species can change efficacy of both biocontrol & pesticides
- Thrips identification often overlooked due to small size & prevalence of WFT



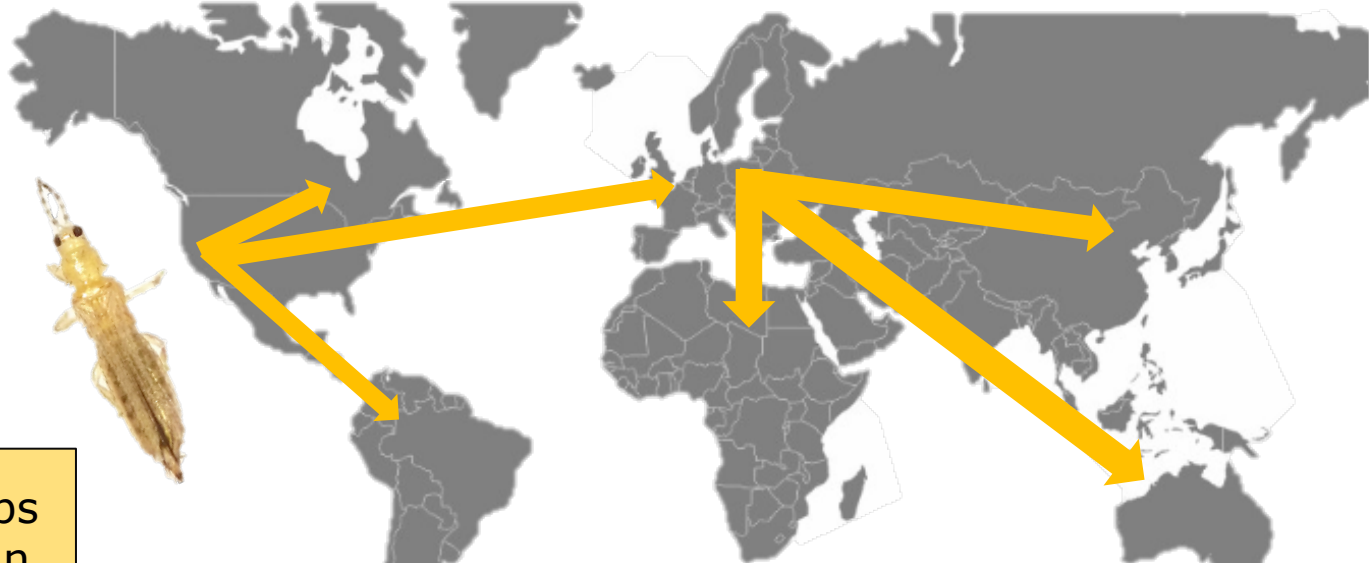
# A brief history of thrips

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### Western flower thrips (WFT)

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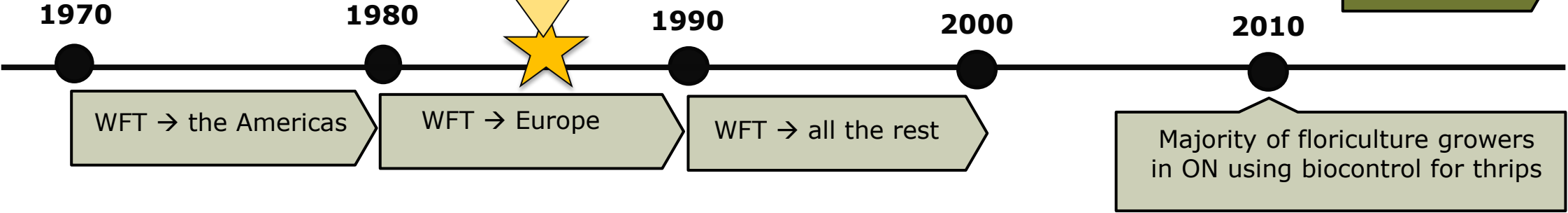
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1986: The last thrips survey conducted in GH crops in Ontario

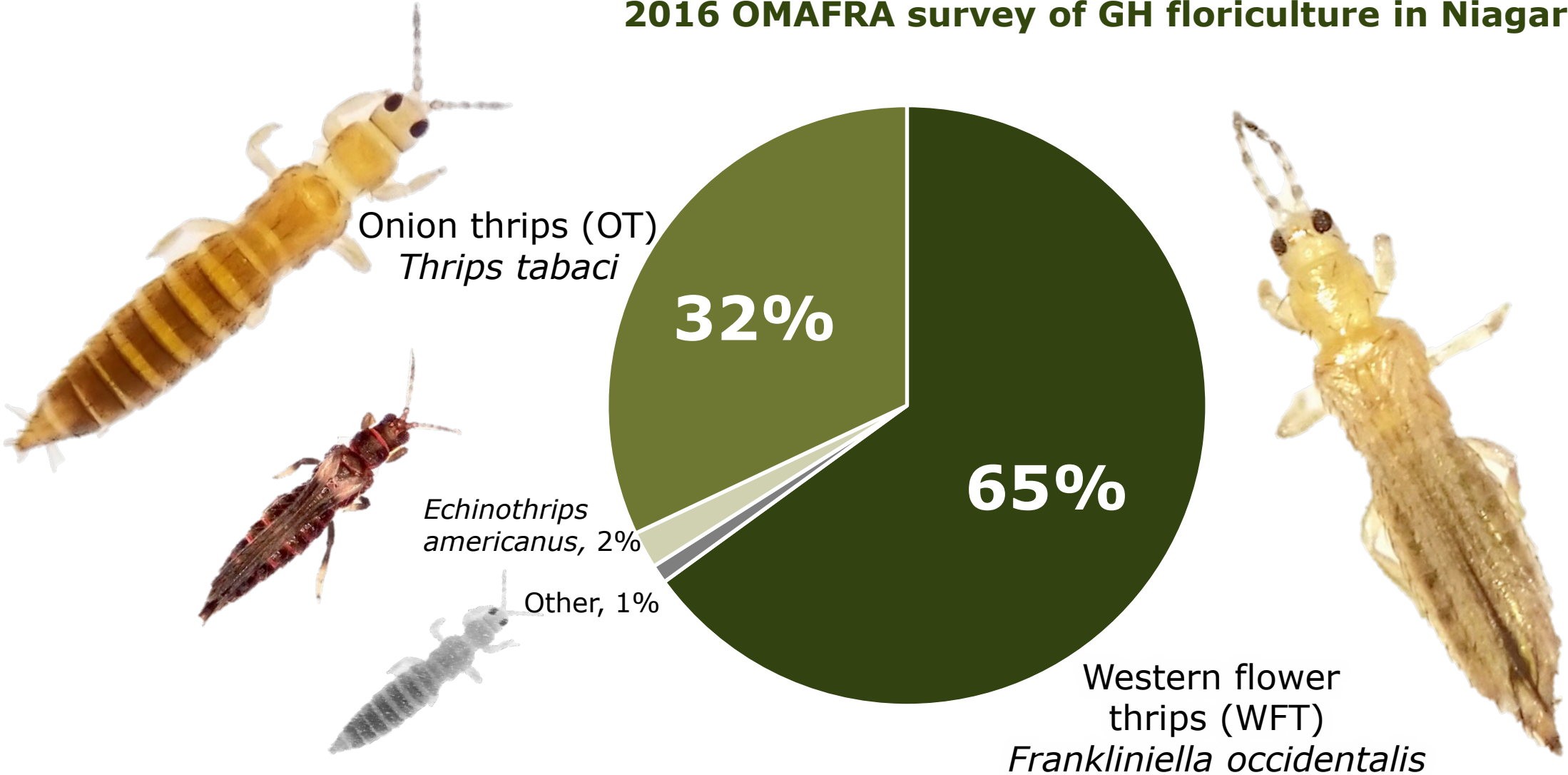
Biocontrol use increasing in greenhouse crops

Outbreaks increasing



# Current status of thrips in Ontario

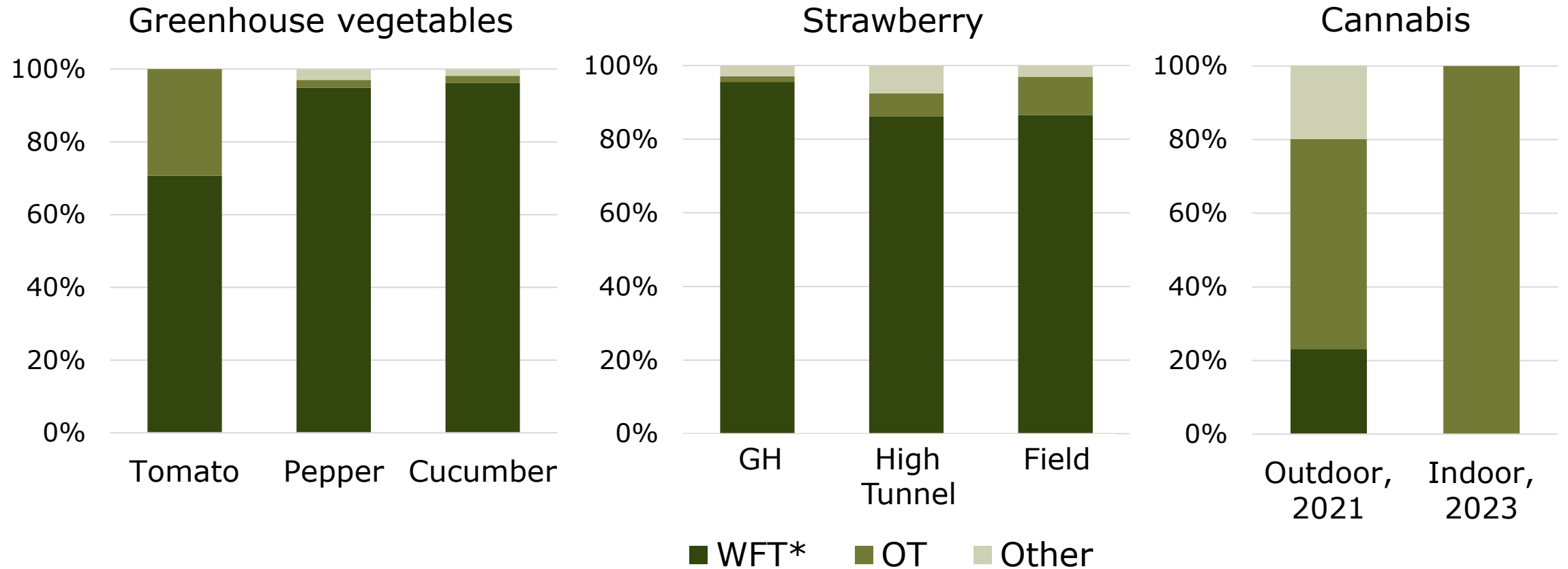
2016 OMAFRA survey of GH floriculture in Niagara



Data courtesy of Sarah Jandricic (OMAFRA)

# Current Status of Thrips in Ontario

2023 Survey of greenhouse veg., strawberry & cannabis (preliminary data)



\*WFT may also include other "Flower thrips" e.g. Eastern flower thrips



# Increasing non-native thrips found on imports

Thrips ID allows for early detection of invasive species

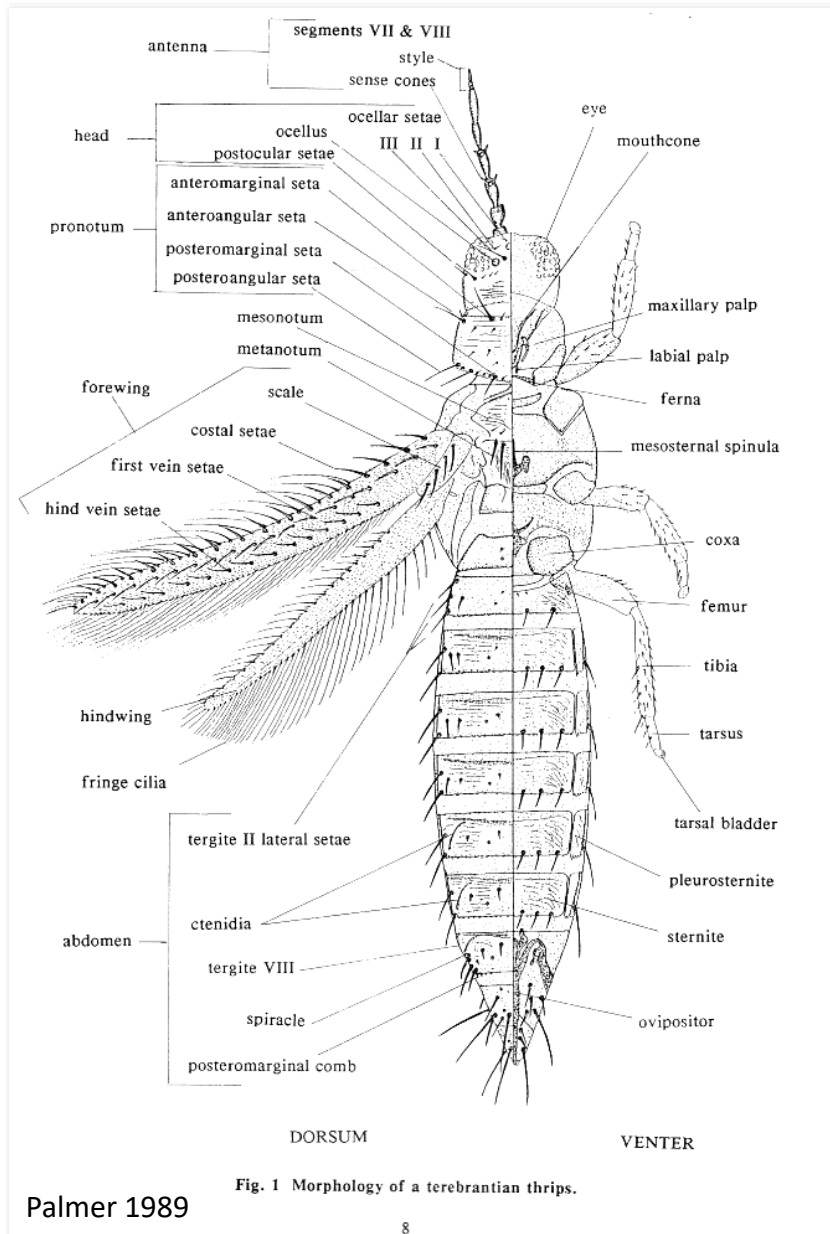
- More exotic thrips species found over last few years
- Many potential reasons:
  - Increased global trade
  - Recent tropical foliage boom
  - Climate change expanding inhabitable ranges
  - Deregistration of pesticides/ increased reliance on biocontrol
  - Increased surveillance?



## Occasional and potential invaders:

- *Bagnalliella* sp.
- *Chaetanaphothrips orchidii*
- *Dichromothrips corbettti*
- *Frankliniella bispinosa*
- *Frankliniella schultzei*
- *Gynaikothrips* sp.
- *Hercinothrips femoralis*
- *Heliothrips haemorrhoidalis*
- *Scirtothrips dorsalis*
- *Thrips palmi*
- *Thrips parvispinus*
- *Thrips setosus*

# The trouble with thrips ID



- Traditional dichotomous keys:
  - Most features only visible with a compound microscope
  - Mostly nonsense words
  - Often include hundreds of species found in a region
  - Often does *not* include potential invasives
  - A necessary evil for reliable identification



# Making thrips ID accessible

## Simple key to important thrips pests of Canadian greenhouses

By Ashley Summerfield and Sarah Jandricic



- Designed specifically for growers and consultants:
  - Only needs 40x dissecting microscope
  - Easy to understand language
  - Species typically found in Ontario GH crops
  - Includes potential invasive species
  - *Cannot* be used for official/conclusive identification

Download the latest edition at:  
[GreenhouseIPM.org/thripskey](https://GreenhouseIPM.org/thripskey)



# When should growers ID thrips?

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Any thrips activity that is out of the ordinary warrants a closer look:

- Reliable IPM program no longer working
- Sudden unexplained outbreak
- Unusual thrips damage
- Thrips outbreak in unusual crop
- Unusual looking thrips that are present in large numbers
- Before deciding to use pesticides

# Thrips ID basics: Collecting specimens, anatomy and terminology

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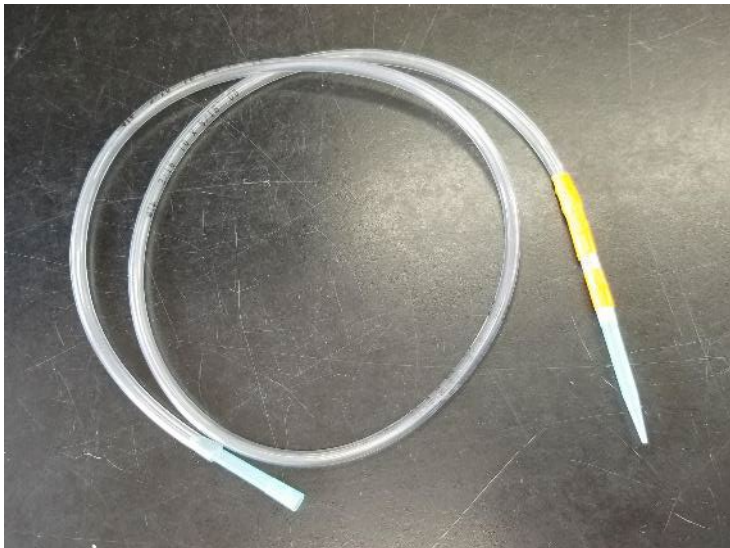
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# Collecting thrips



- Tap over white surface (tray, paper, clipboard)
- Collect thrips (aspirator made out of silicone hose, pipette tips and very fine mesh)
- Transfer to 70% ethanol or isopropyl
- Store in well sealed vial/small container – ethanol evaporates very quickly!
- Can also be killed in freezer if no alcohol handy

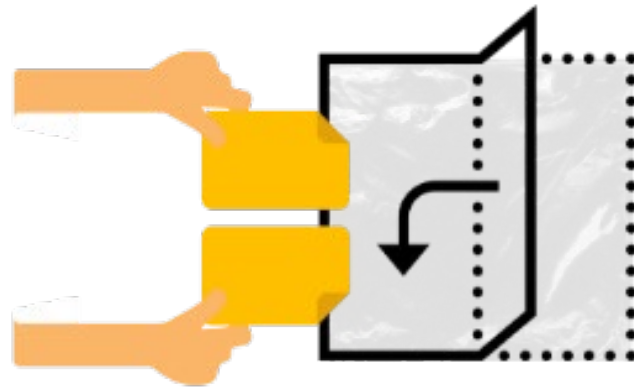


- Make your own aspirator:
  - Silicone tubing (e.g. for aquarium)
  - 3 x 1ml pipette tips (Amazon)
  - Very fine mesh fabric (100-mesh or smaller)

# Collecting sticky cards

Thrips species can often be identified on sticky cards:

- Yellow cards are better than blue for ID
- Wet glue cards preserve specimens better; thrips often shrivel up on “dry” glue cards



Wrap cards in clear plastic for transport or storage



Specimens can be removed by submerging in orange oil (best for freshly caught thrips)

# Proper positioning and life stage



← **Correct**  
Adult  
wing side  
facing up



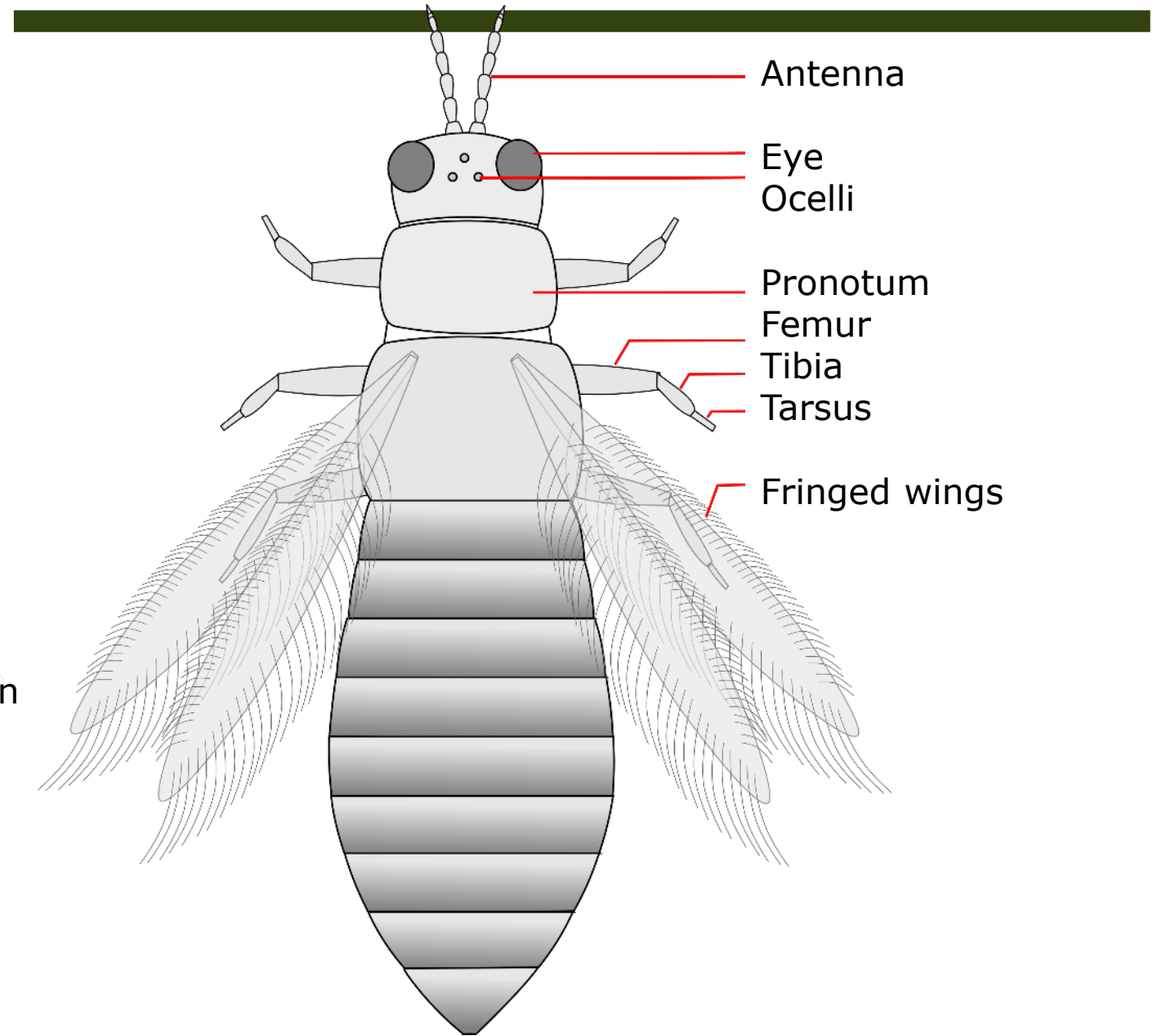
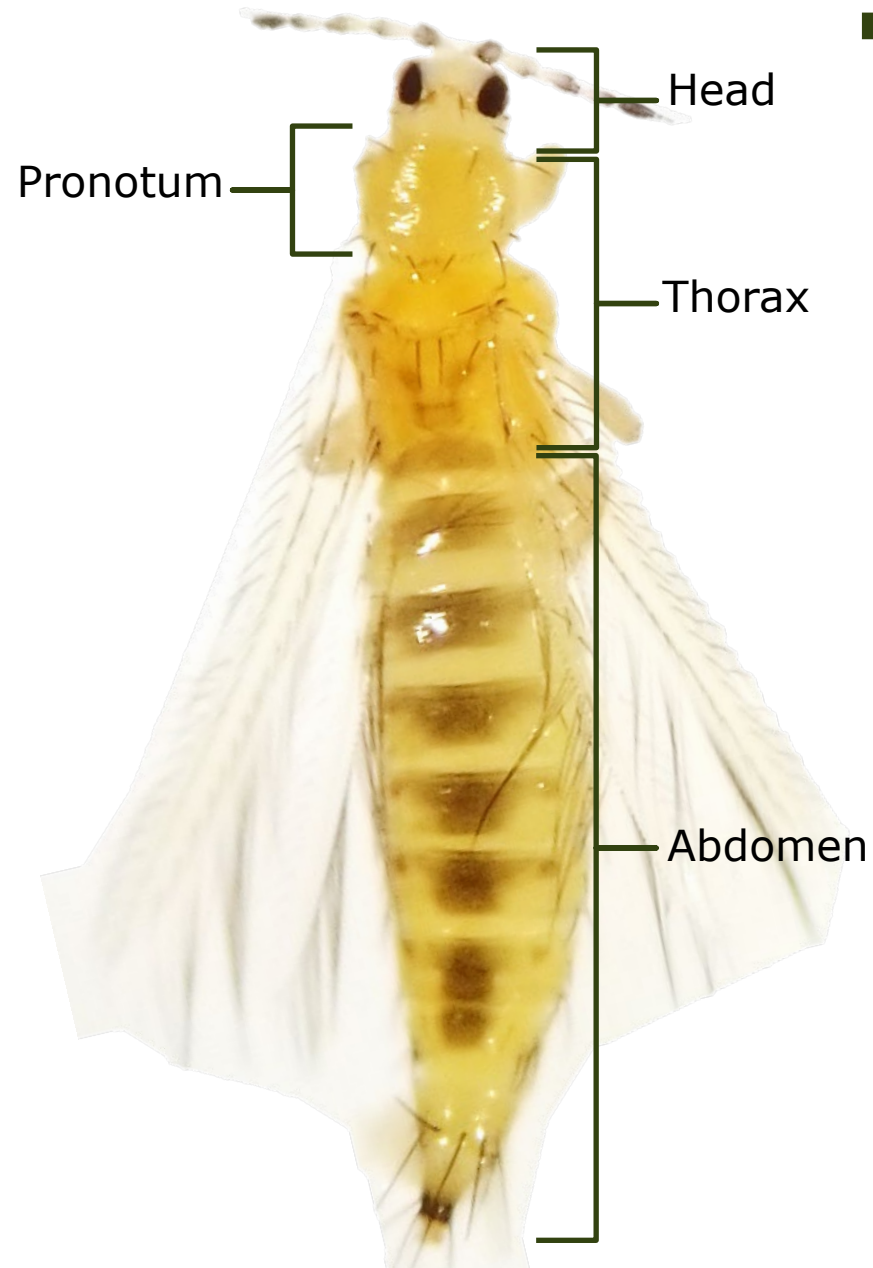
← **Incorrect**  
Legs and  
snout  
facing up

**Incorrect** →  
Larva



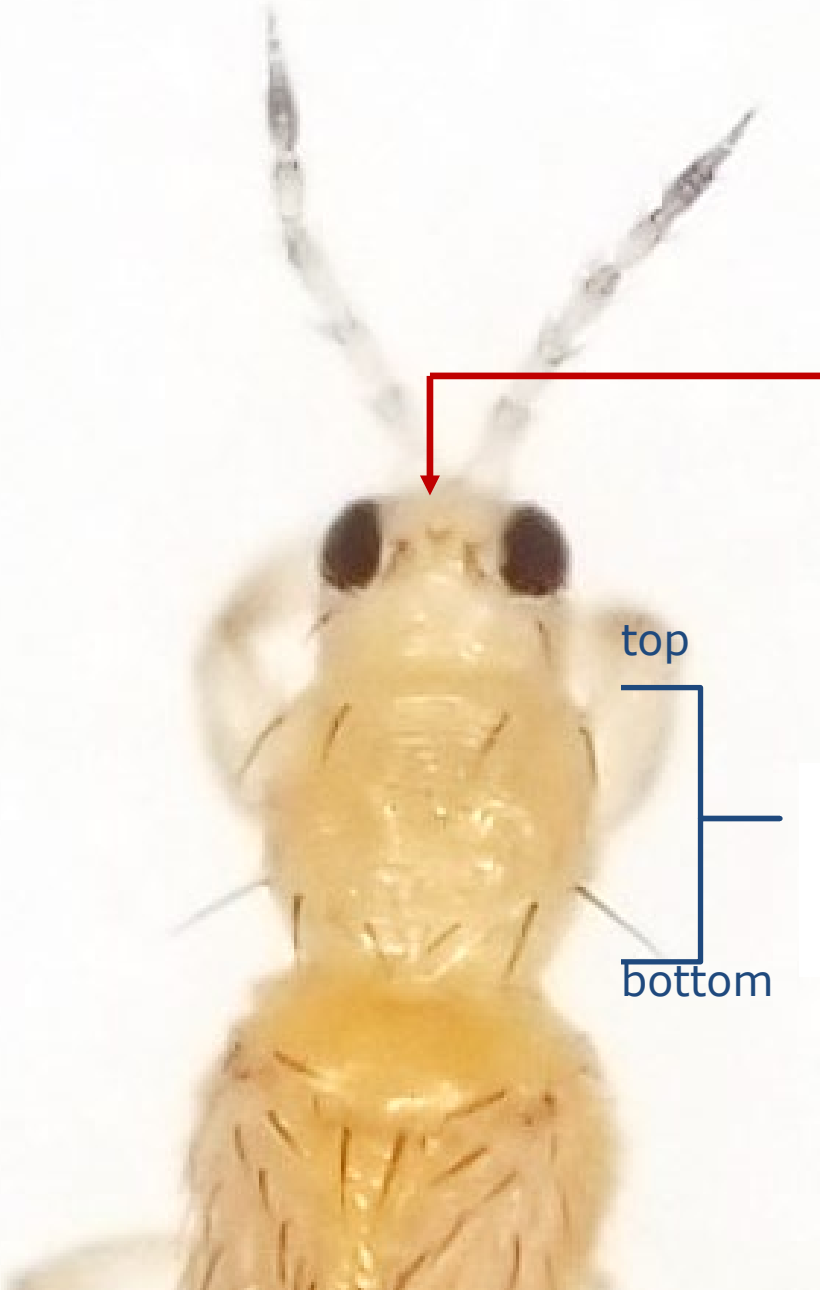


# Thrips anatomy



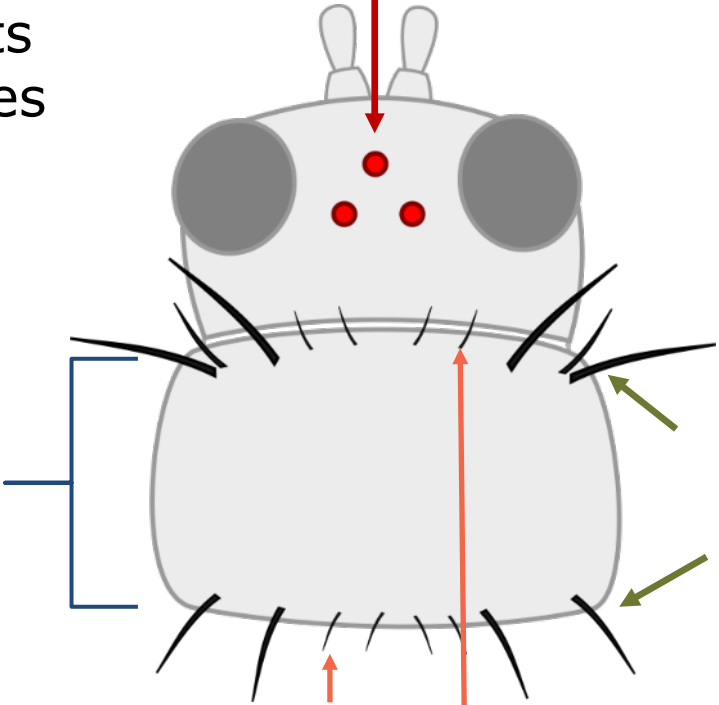
# Important ID features

## Head and pronotum



### Ocelli

pigmented spots between the eyes



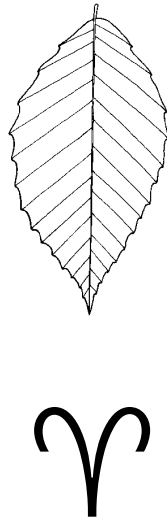
**Pronotum**  
body segment below the head

**Major setae**  
long coarse hairs

### Minor setae

Usually too small to see

# Female vs. male

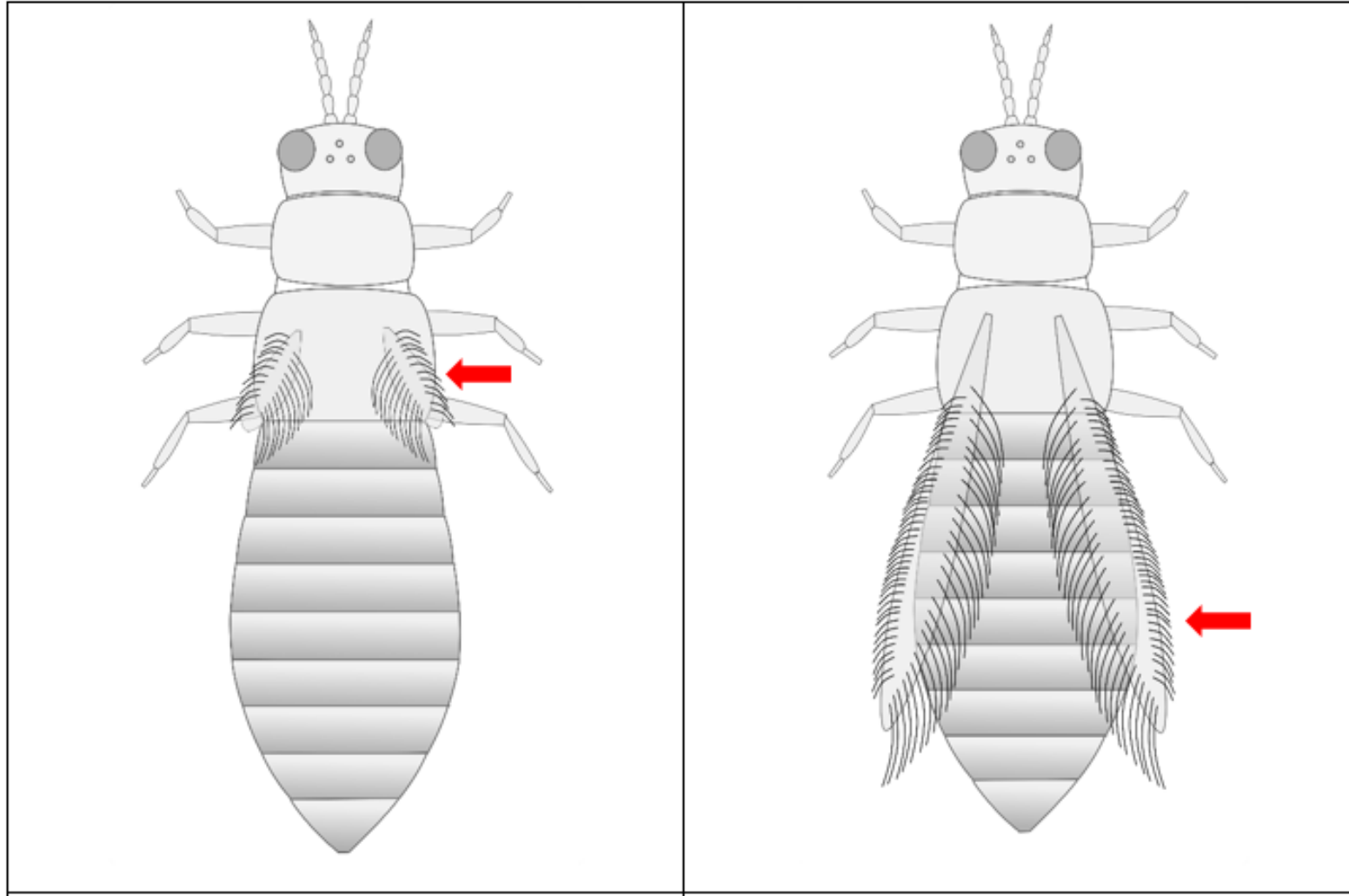


- Females:
  - Ovipositor inside abdomen visible on light-medium coloured thrips
  - Ovipositor looks like a double fish hook
  - Abdomen wider, comes to a point like a beech leaf

- Males:
  - Smaller than females, often paler in colour
  - Orange blobby reproductive organs
  - Abdomen skinny, even width throughout with blunt rounded end (like a hot dog)

# First question to ask: does it have wings?

6.

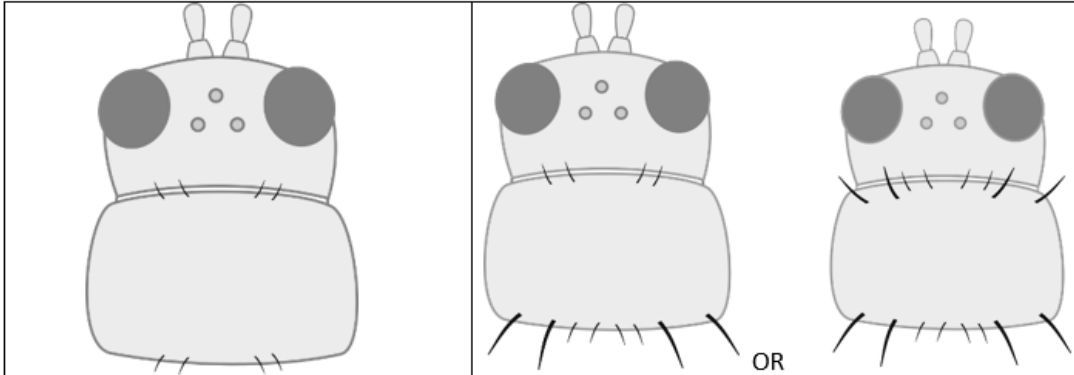


Look at 10-20 specimens to see if any are wingless

Only a few species have this feature, if you have wingless thrips it narrows the possibilities down very quickly!

# Using a dichotomous key

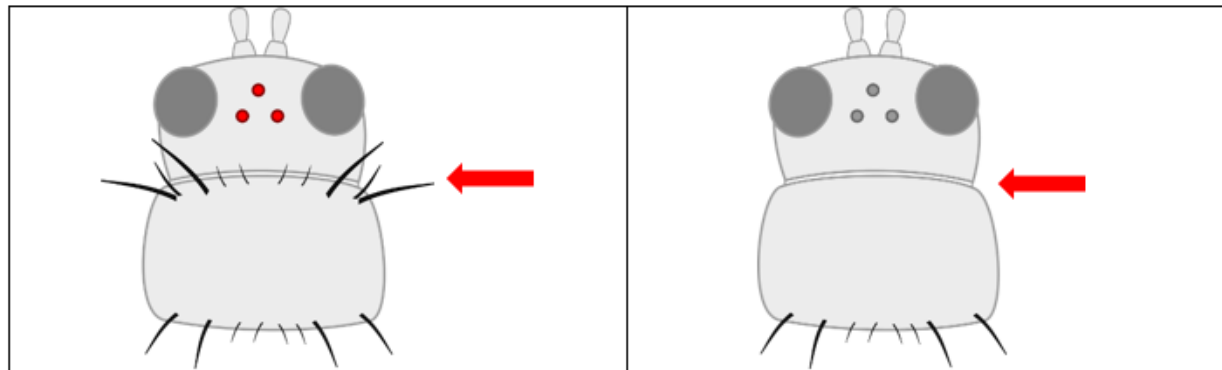
7.



a. Pronotum has no long coarse hairs, front legs entirely yellow(GO TO STEP 8)

b. Pronotum has long coarse hairs; note that these are more challenging to see on black thrips

9.



a. Pronotum has long coarse hairs on BOTH top and bottom of pronotum; no red pigment visible between the segments: most likely winged morph of *Franklinella fusca*; could

b. NO long coarse hairs or fine hairs on the top of pronotum; bottom has 2 pairs of long coarse hairs; red pigment may or may not be visible between segments

Start at the beginning

- Each step gives you 2 options
- Pick the option that is most like your specimen
  - If you don't get a match, you may have a species that isn't in the key - ask for help from an expert!

# Species profiles of thrips found in greenhouse crops

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# First, a rant about common names

- Common names lead to confusion!
  - Multiple common names per species
  - Changes between region (even *within* a region)
  - Often based on either visual characteristics or host plant
    - Many species may share visual characteristics and hosts
- Stick with Latin names – they don't change between regions:
  - They *may* change if taxonomists re-classify species
  - If you can remember the names of bios (e.g. *Encarsia*, *Aphidius colemani*, *Metarhizium*) you can remember thrips species names!



*Conversations about "banded thrips" make me feel like I'm in an Abbott & Costello routine*

# Western flower thrips (WFT) (*Frankliniella occidentalis*)

Very common, widespread globally

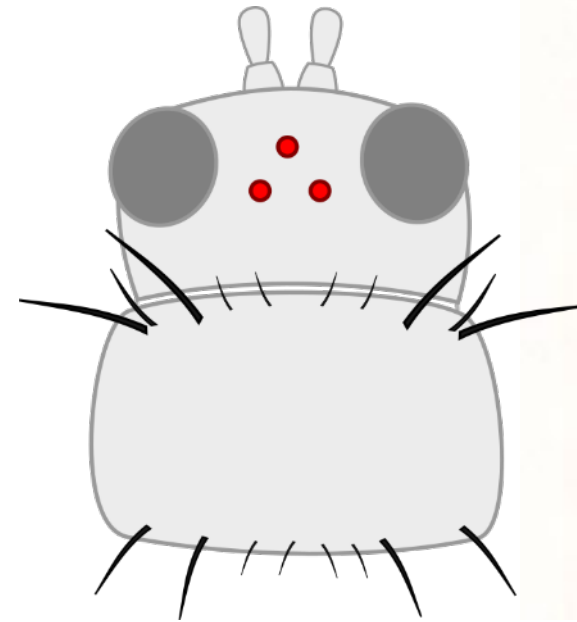
## Main ID features:

### Ocelli

- Dull red / rust colour

### Major Setae

- Very pronounced  
Long coarse hairs on both top & bottom



## General impressions:

- One of the largest species you'll see
- Base colour is yellow with variable amounts of brown
- Noticeably VERY HAIRY, especially on head & pronotom

**Note:** Eastern Flower Thrips (*F. tritici*) looks nearly identical





# Onion thrips (OT) (*Thrips tabaci*)

Very common, widespread globally

## Main ID features:

### Ocelli

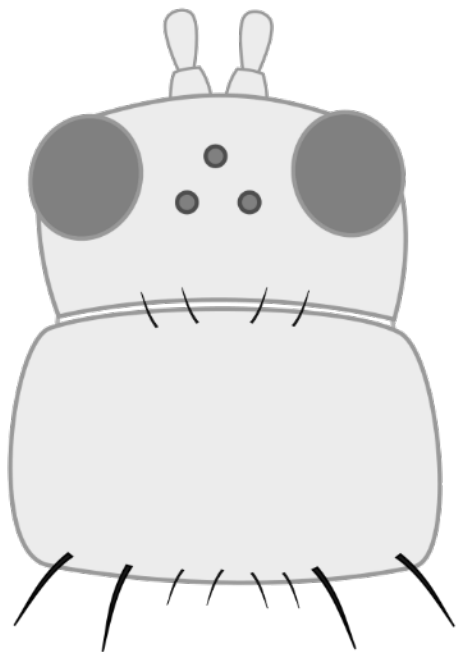
- Grey, often looks like it has no ocelli

### Major Setae

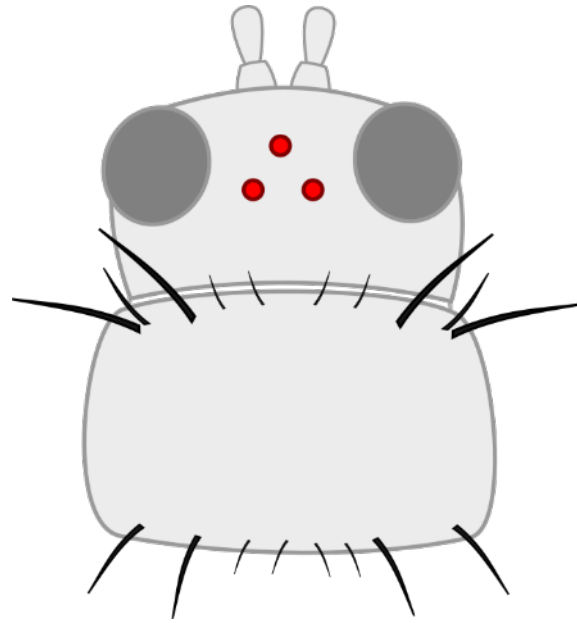
- Long coarse hairs only on bottom of pronotum

## General impressions:

- Smooth, clean lines, not noticeably hairy
- Drab in colour, ranges from beige-yellow to medium brown
- Smaller than WFT females, same size as WFT males



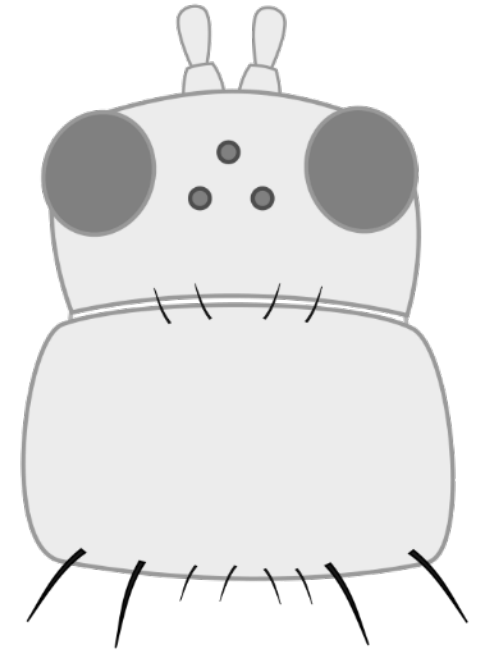
## WFT



- Red Ocelli
- Major Setae on **TOP & BOTTOM** of pronotum
- Long coarse hairs visible on head



## OT



- Grey/absent Ocelli
- Major Setae on **BOTTOM ONLY** of pronotum
- Head not noticeably hairy

# *Thrips nigropilosus* (Chrysanthemum thrips, CT)

Common, widespread in temperate regions



## Main ID features:

- **Has a wingless morph**
- Bright red ocelli that blur together
- Hairs on **bottom** of pronotum **only**
- Pronotum often has dark blotches

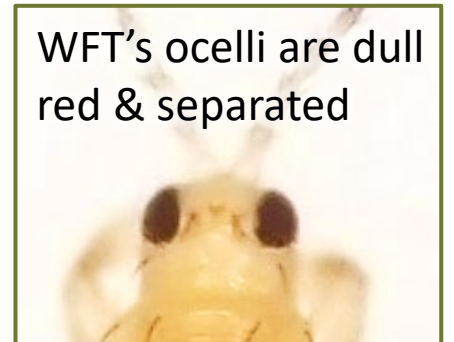
## May be confused with:

WFT, chili thrips, melon Thrips

## Hosts & Habits:

- Limited host range  
(mums, marigolds, asters)
- Patchy distribution throughout crop
- Heavy damage to bottom leaves

WFT's ocelli are dull red & separated



# *T. nigropilosus* vs. *T. palmi* vs. *Scirtothrips dorsalis*

Advanced ID – requires compound microscope

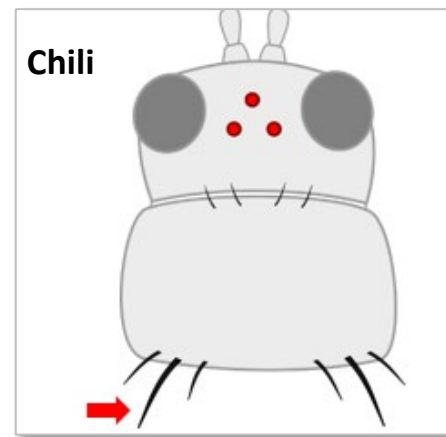
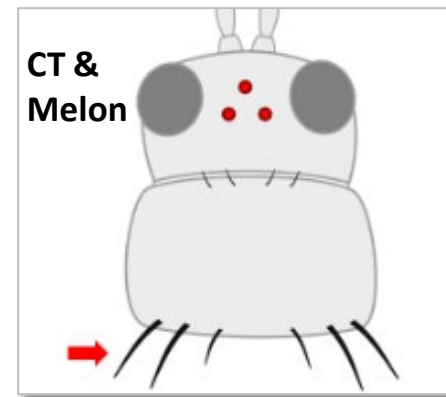
Melon thrips (*Thrips palmi*) & chili thrips (*Scirtothrips dorsalis*) look very similar to CT (*T. nigropilosus*)

Distinguishing features, dissecting scope:

- CT has a wingless form, the others do not

More features visible under compound microscope, require taxonomic expertise

- Melon & Chili are rare, non-native species
- If you have a species like this **and it is not** on mums, marigolds or asters, consult an expert!



# Common yellow thrips species



	<i>F. occidentalis</i> (WFT)	<i>T. tabaci</i> (OT)	<i>T. nigropilosus</i> (CT)
Size	Large	Small	Small
Body	Yellow base colour with variable amounts of brown	Uniform light to medium brown	Yellow base colour, sometimes brown patches on pronotum
Pronotal setae	Top & Bottom	Bottom only	Bottom only
Ocelli	Dull red, separate	Grey/not visible	Bright red, blend together
Damage	Feeding damage on flowers, foliar damage on upper leaves	Do not damage flowers, foliar damage throughout	Do not damage flowers, foliar damage on bottom

# *Frankliniella fusca* (Tobacco thrips)

Common, local; may be *F. intonsa* depending on region



## Main ID features:

- All body segments very dark brown to black
- Wings uniformly light brown
- Major setae on top & bottom of pronotum
- Dull red ocelli (hard to see)
- Face not as hairy as WFT
- *F. fusca* has a wingless form, but *F. intonsa* does not

## May be confused with:

*T. setosus*, *T. parvispinus*, dark morph WFT or OT

**Hosts & Habits:** wide host range, habits similar to WFT



# Colour variation in WFT & OT

Why body colour is NOT a reliable ID feature



- WFT and OT range from very pale to brown
- Darker morphs more common in cooler months



# Dark coloured thrips: wings not banded



	<i>F. fusca</i> / <i>F. intonsa</i>	Dark WFT	Dark OT
Size	Large	Large	Small
Body	Uniform dark brown; abdomen sometimes darker	Patchy blotchy brown with golden base; abdomen often darker than head & thorax	Uniform light to medium brown
Pronotal setae	Top & bottom	Top & Bottom	Bottom only
Wings	Uniform; may be absent	Uniform	Uniform
Ocelli	Dull red, hard to see	Dull red	Grey/not visible
Between segments	Not red	Not red	Not red



# *Echinothrips americanus* (Poinsettia thrips)

Common, local, widespread globally



## Main ID features:

- Large species (similar to WFT)
- All body segments very dark brown to black
- Reddish-orange pigment visible between segments
- Distinct white band at top of wings
  - bands not visible on wet specimens or sticky cards
- Major setae on bottom of pronotum only (hard to see)

## May be confused with:

Japanese flower thrips (*T. setosus*), Vanda thrips (*Dichromothrips corbetti*), Banded greenhouse thrips (*H. femoralis*)

## Hosts & habits: wide host range

- Pupate on leaves
- Foliar feeders, prefer lower leaves
- Slow moving, not active fliers

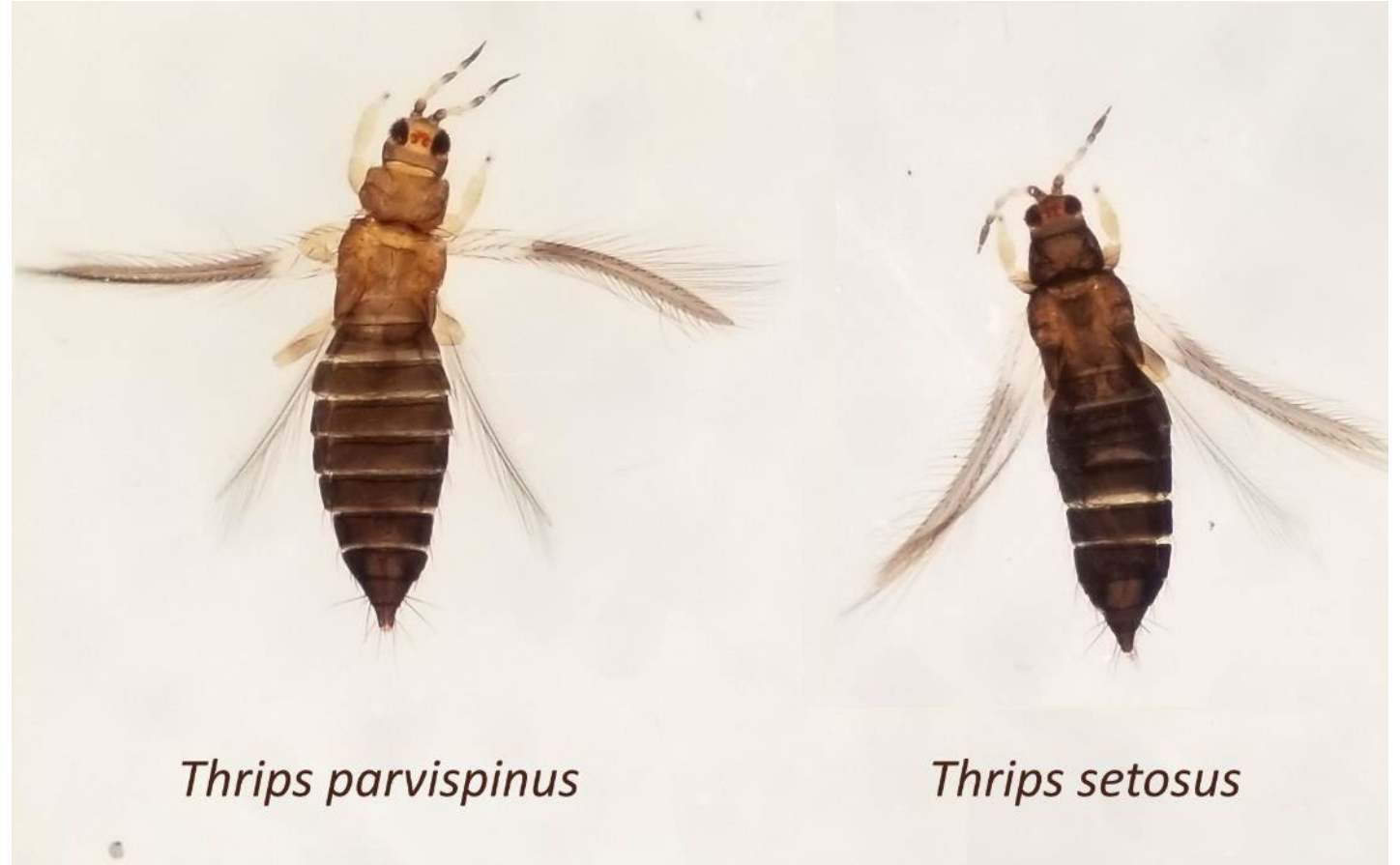


# *Thrips parvispinus* & *Thrips setosus*

Two lookalike new exotic pests

## Main ID features:

- Small (similar to OT)
- Bright red ocelli that bleed together
- Head and thorax paler than abdomen
- Clear band at base of wings
- Major setae on bottom only on pronotum
- Males are yellow



# *Thrips parvispinus*

North America = “Pepper thrips”; Europe = “Tobacco thrips”



*Thrips parvispinus* M & F

## Distinguishing features:

- Head and thorax medium brown-tan
- Abdomen distinctly darker
- Do not look like *Echinothrips* when alive

## May be confused with:

dark morph OT or WFT

## Hosts:

- In Canada, intercepted mainly on tropicals – mandevilla, anthurium, schefflera, hoyo
- Major pest of pepper and gardenia in other areas



# *Thrips parvispinus*

Increasingly common exotic species, tropical

**Damage:** Causes leaf deformity, stunted growing points in some crops (mandevilla, schefflera, hoya, pepper)

- May resemble broad mite damage
- Other hosts (anthurium, hibiscus) damage similar to WFT

## **Pesticides:**

- very likely to develop resistance
- resistance to spinosad and cyantraniliprole developed in Canadian GH after one growing season



# ***Thrips setosus*** (Japanese flower thrips)

**Uncommon, exotic species, temperate**



## **Distinguishing features:**

- Head & thorax *sometimes* lighter than abdomen
- Clear bands on wings more distinct on live specimens

## **May be confused with:**

*Echinothrips americanus*

## **Hosts:**

- In Canada, has only been found on *Hydrangea* so far
- Wide host range includes many greenhouse crops (ornamentals, strawberry, vegetables)
- Able to survive outdoors in our climate
- Less likely to develop insecticide resistance



# *Dichromothrips corbetti* (Vanda thrips)

Rare exotic species, tropical



## Main ID features:

- All body segments very dark brown to black
- Reddish-orange pigment visible between segments
- Distinct white band at top of wings
- No major setae pronotum

## May be confused with:

*Echinothrips americanus*, *T. setosus*

## Hosts & Habits:

- Only found on orchid species
- Active, fast moving
- Feed on leaves and flowers



# Dark coloured thrips: banded wings



	<i>Echinothrips</i>	<i>T. parvispinus</i>	<i>T. setosus</i>	<i>D. corbetti</i>
Size	Large	Small	Small	Large
Body	Uniform black	Head & thorax lighter than abdomen	Head & thorax sometimes lighter than abdomen	Uniform black
Pronotal setae	Bottom	Bottom	Bottom	None
Ocelli	Red, separated	Bright red, blended	Bright red, blended	Red, separated
Inner colour	Red	Not red	Not red	Red
Damage	Foliage only, lower leaves	Upper leaves, growing tips, distorted leaves	Foliar damage	Orchids only, leaves & flowers

# *Hercinothrips femoralis* (Banded greenhouse thrips)

Occasional invader, exotic species, tropical



## Main ID features:

- Big & chunky, abdomen very broad
- No major setae on pronotum
- Ocelli dull red
- Wings have 3 pale bands that appear white when alive/dry or clear when wet
- Head & thorax with vertical dark bands

## May be confused with:

Unlikely

## Hosts & Habits:

- Often found on tropical houseplants
- Very messy, leaves large black spots of excrement
- Pupates on leaves

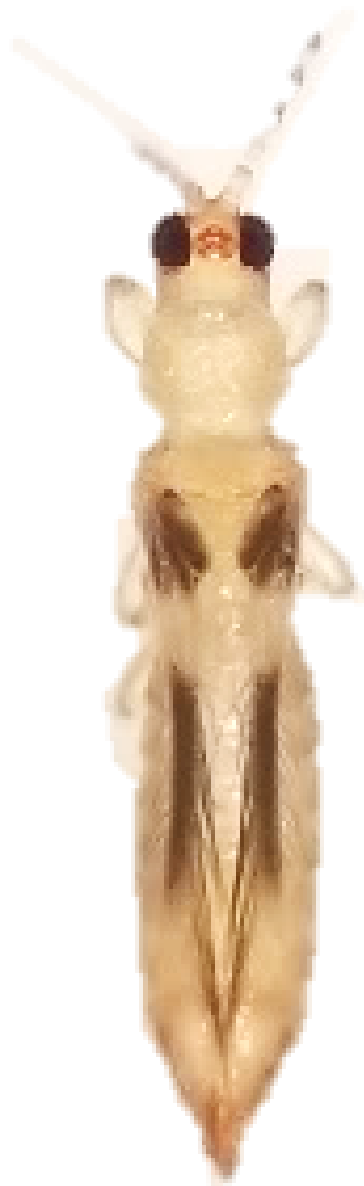
**Caution:** "Banded thrips" is the most frequently misused common name





# *Chaetanaphothrips orchidii* (Orchid thrips)

Occasional invader, exotic species, tropical



## **Distinguishing features:**

- Very small
- Bright red ocelli that bleed together
- Dark brown bands on wings

**May be confused with:** Chili thrips

## **Hosts & habits:**

- Typically found on tropical house plants (*Ficus*, *Monstera*, *Philodendron*)
- Hides deep in crevices where leaf meets stem & unfurled leaves

# Soybean thrips (*Neohydatothrips variabilis*)

Common, native species (formerly *Sericothrips variabilis*)



## Distinguishing features:

- Small size
- Distinct wide horizontal bands across head, thorax and abdomen

**May be confused with:** Unlikely

## Hosts & behavior:

- Pest of soybeans, other legumes; possible pest of cucumbers, cannabis
- Common outdoors, frequently found on sticky cards in summer

# *Aeolothrips fasciatus*

**Native beneficial, predator of other thrips species**



- Predatory species
- HUGE (almost as big as Atheta)
- Thick legs
- Jet black
- 3 very distinct white bands on wings
- Yet another “Banded thrips”!

# Advanced ID (why you still need experts)

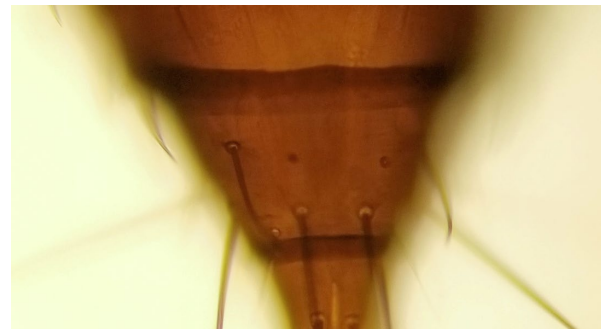
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“Official” ID still requires an expert (aka experienced taxonomist)

- Many species of *Frankliniella* and *Thrips* are crop pests & look nearly identical
- Confirmation requires compound microscope and experience

When to seek help:

- Rare or invasive species are suspected
- Host plant or damage patterns are unusual for species
- ID characteristics don't *quite* match
- Gut instinct!



# ***F. Schultzii*** (common blossom) & ***F. bispinosa*** (Florida flower)

**Advanced ID – requires compound microscope**

Both would key to WFT

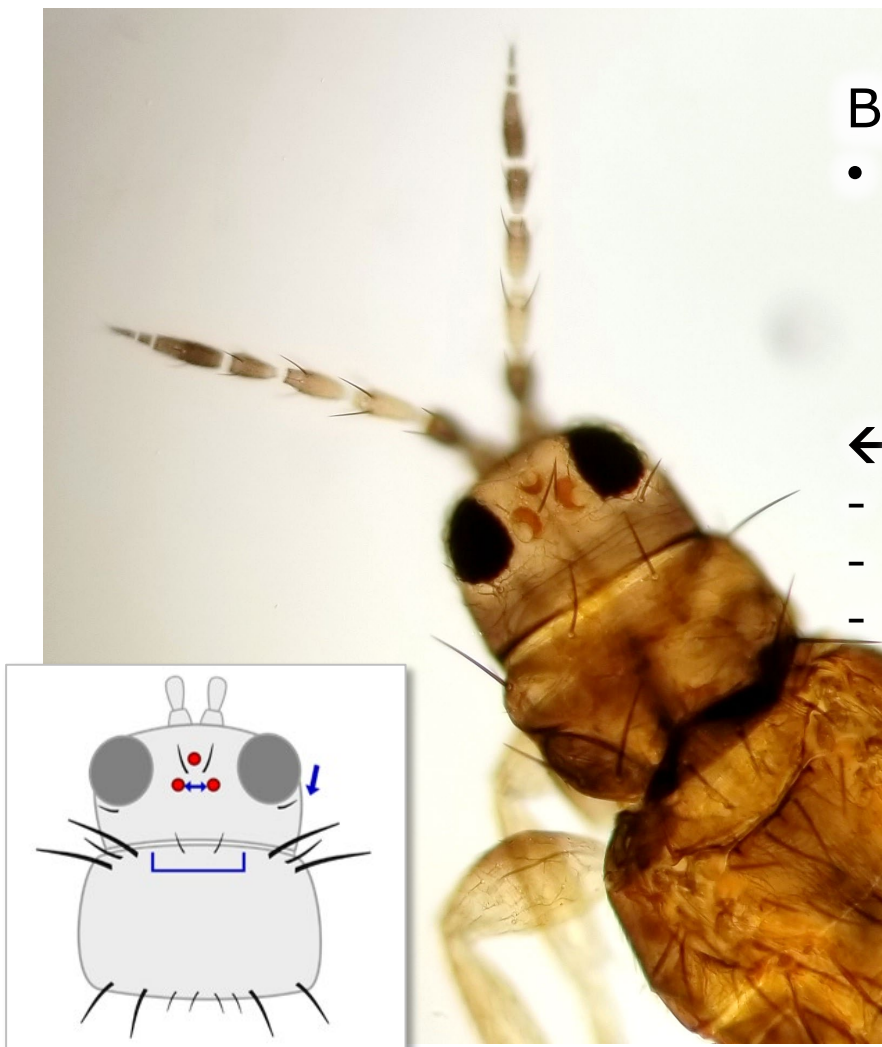
- Can't be 100% certain of most *Frankliniella* species without the help of an expert

## ← ***Frankliniella schultzei***

- Similar size as WFT
- Has dark & light morphs
- Males always yellow

## ***Frankliniella bispinosa*** →

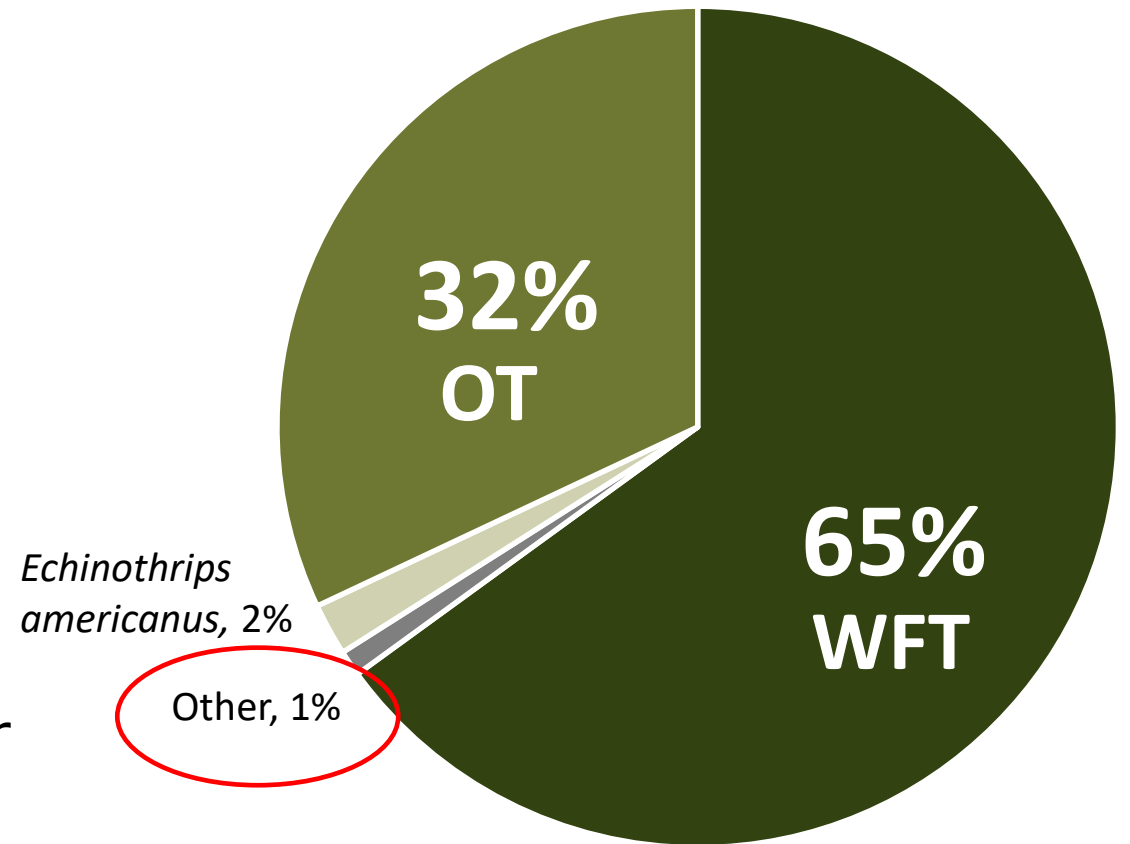
- Small (OT size or less)
- Only light morphs



# Don't Panic, Do be vigilant

Most thrips will be WFT or OT

- **Don't** be discouraged by species requiring advanced ID skills
- **Do** be aware of them so you don't become over confident
- **Don't** get hung up on one-offs if they aren't causing problems
- **Do** keep records & specimens
  - Record crop, origin (if known), observations on damage & behavior
- **Don't** keep potential problems hidden



# How does thrips IPM differ between species?

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# Any part of IPM system can be affected by species

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

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

**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

Sell beautiful plants!

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



# Monitoring

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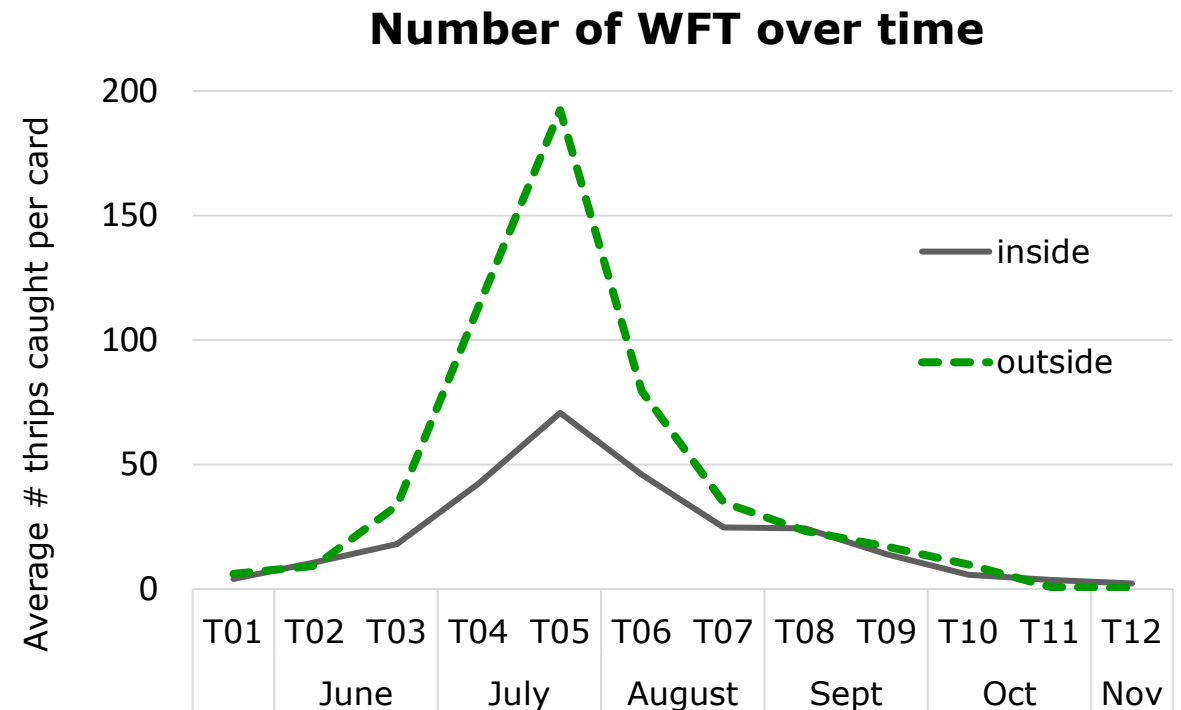


*Anaphothrips obscurus*  
is a non-pest species  
often caught on cards

- Plant taps are always your best bet:
  - Not all species are active fliers
  - Some species (*F. fusca*, *T. nigropilosus*) have wingless forms therefore won't get caught on cards
- Look for damage:
  - Unusual damage patterns often the first indication
- Don't let odd species on sticky cards freak you out:
  - Cards often catch "passers-by"
  - If a species is low in number **and** not causing damage, probably don't need to be concerned

# Mass trapping

- Can be used to catch local species near entry points:
  - WFT, OT, incoming *Frankliniella fusca*
  - 2019 study in Ontario found WFT pressure primarily driven by outside populations
- Not useful for wingless species and inactive fliers:
  - Resident *F. fusca* and *T. nigropilosus* populations
  - *Echinothrips americanus*



# Mass trapping

- The great yellow vs. blue debate:
  - Conflicting studies which colour is preferred
  - Preference influenced by environment and region
  - Best bet: run your own on-farm trial!
- Little to no data on colour preferences for most thrips species other than WFT and OT
- *Echinothrips* prefer blue but don't fly much
- Mass trapping can help manage *T. parvispinus*:
  - Highly active species, prone to hopping
  - Place cards just above crop canopy
  - The more cards, the better!



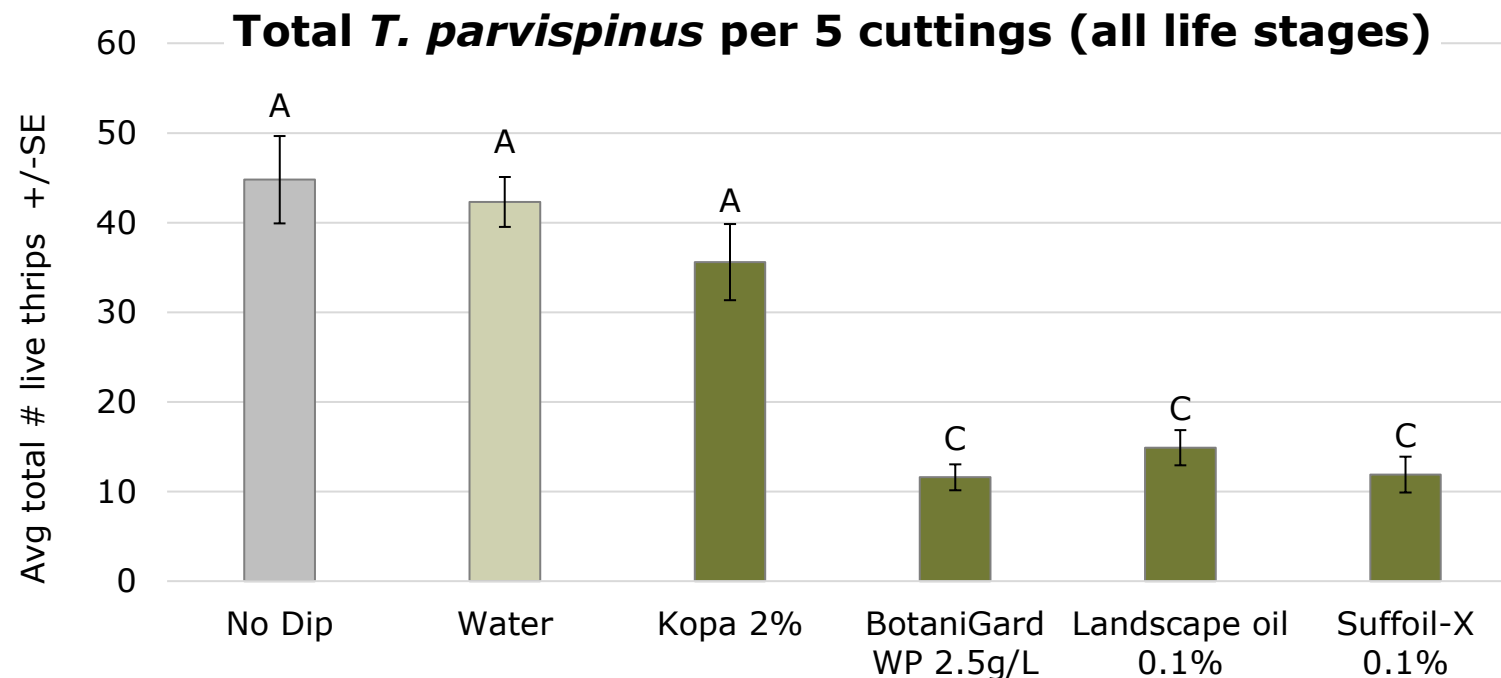
Sarah Jandricic (OMAFRA) inspecting sticky cards in on-farm trial testing colour preference



Small monitoring cards placed in Mandevilla pots to trap *T. parvispinus* (credit: S. Jandricic)

# Cutting dips for imported plant material

- Cutting dips proven effective for WFT and *T. parvispinus*:
  - Mineral oil products reliable and effective for multiple pests, may cause phyto
  - Botanigard effective under right conditions, better for sensitive crops



How to use cutting dips YouTube video

# Biocontrol options for diverse thrips species

Very little research on most thrips species:

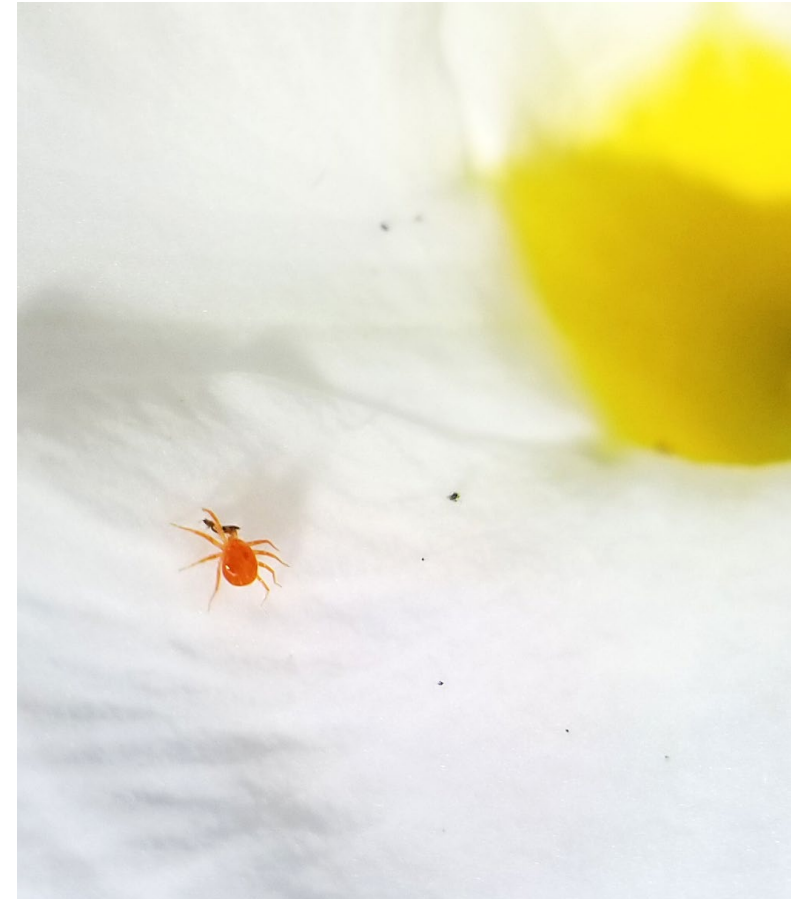
- Most biocontrol research has focused on WFT

Phytoseiid mites (*A. swirskii*, *N. cucumeris*):

- Effective for WFT
- May be less effective for OT
- NOT effective for *T. parvispinus*, *Echinothrips*

Large generalists (*Orius*, *Dicyphus*, *Anystis*):

- Research suggests they are more effective for OT, *Echinothrips*, *T. parvispinus*, *T. setosus*



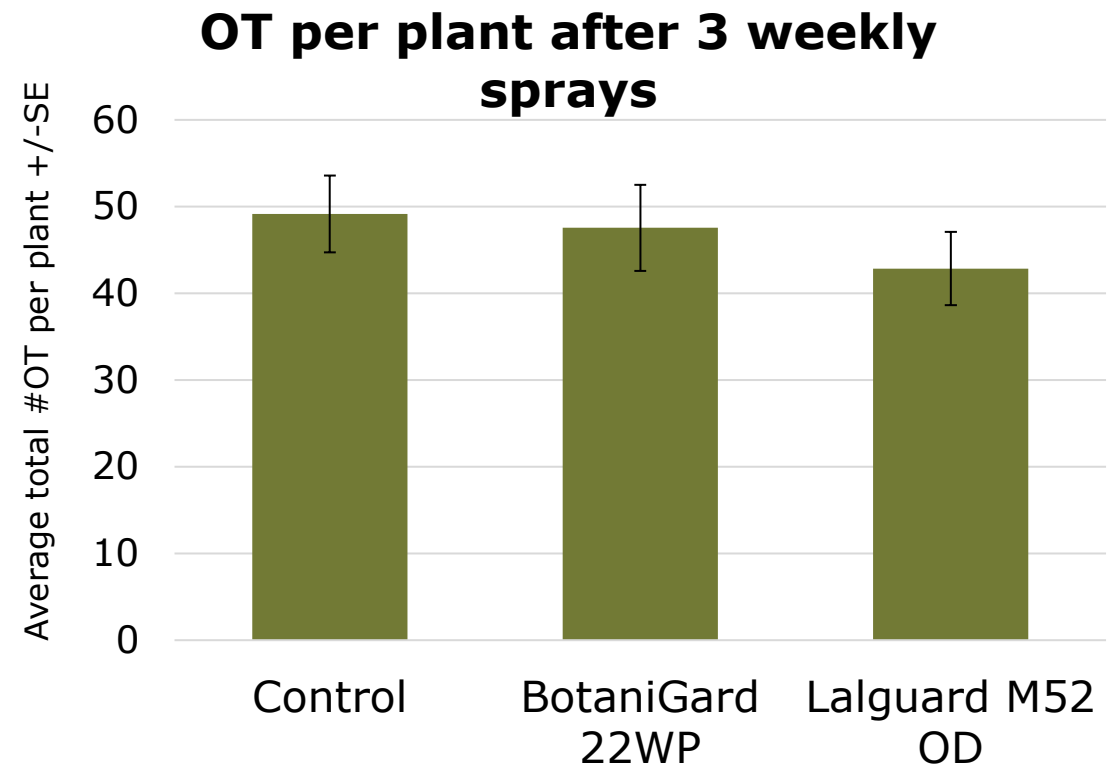
# Biocontrol options for diverse thrips species

## Biopesticides:

- WFT, OT and *T. parvispinus* all susceptible to *B. bassiana* in laboratory trials
- Poor efficacy in GH trials for OT

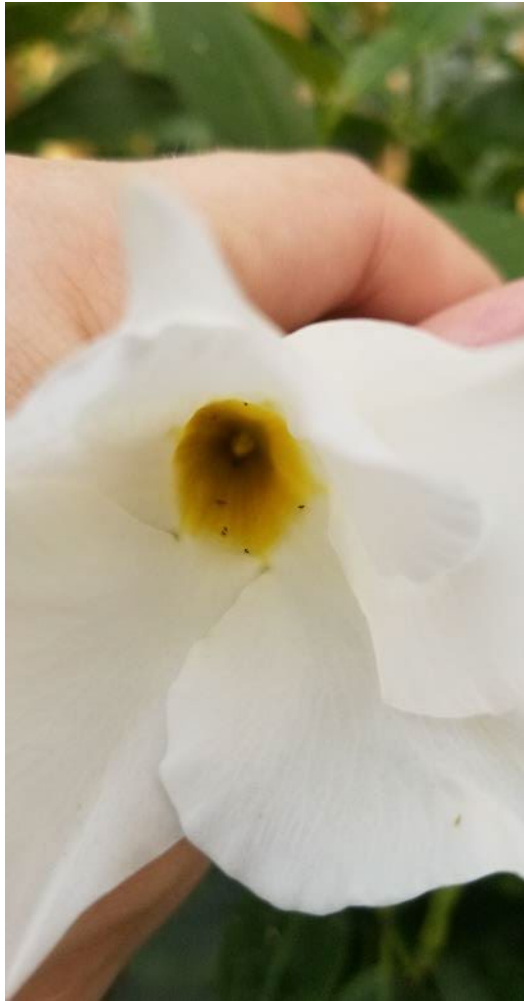
## Nematodes and soil-dwelling predators:

- Will not work for species that pupate on leaves – *Echinothrips*, *Hercinothrips femoralis*, *Dichromothrips corbetti*?

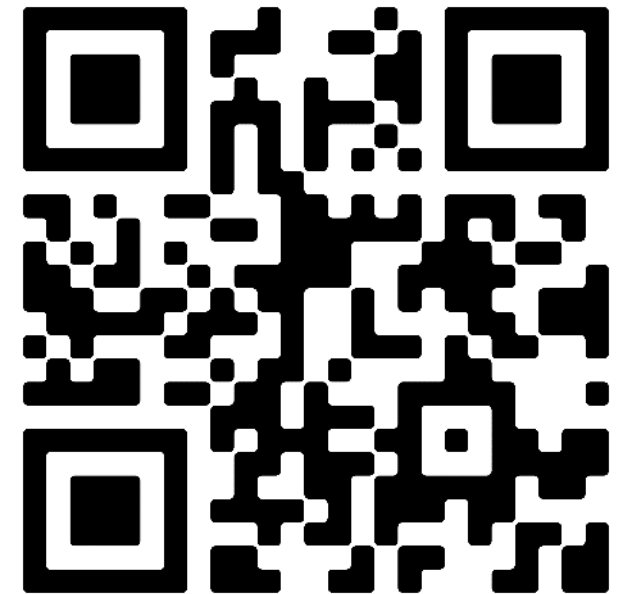


# *T. parvispinus* ongoing research

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- Vineland is waiting for funding to conduct research trials
- Many researchers in USA, Canada, and Europe working on this pest
- Visit **[ONfloriculture.com](https://www.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



# Any part of IPM system can be affected by species

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

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

**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

Sell beautiful plants!

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



# Thank you

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