



IPM in Nurseries

Monitoring for pests, symptoms, and beneficials

Why monitor?

- ▶ Provides early warning of any developing problems
- ▶ Determines the cause and severity of issues
- ▶ Identifies locations that might require treatments (and those that don't)
- ▶ Determines time of treatment
- ▶ Evaluates any previous controls
- ▶ Builds a history of pest problems
- ▶ Improves crop quality and sales revenue



Planning

- ▶ Section the property into areas:
(1) Propagation (2) Greenhouse (3) Shade house (4) Outdoor
- ▶ Then divide every area into houses or bays (A to Z or 1 to 50)
- ▶ Draw a map of the property
- ▶ Organise plants of the same species or family in the same area. This will make it easier to treat with biologicals and sprays when necessary. Also group plants that are susceptible to the same key pests together (eg, mites).
- ▶ Monitor younger plants first and older plants later to reduce the spread of established pests to newly propagated areas.
- ▶ If there's a chance of transmitting infection whilst monitoring, use disposable gloves, boot covers and coats, and footbaths.

eg.

Younger	→	Older crop
Younger Gerberas		Older Gerberas
Younger Hibiscus		Older Hibiscus
Younger Ficus		Older Ficus



Chemical selection

- ▶ Create a list of insecticides and fungicides in stock
- ▶ Select only chemicals compatible with the IPM program
- ▶ Do not use highly toxic chemicals that will result in residues on foliage, soil, structures and flooring materials

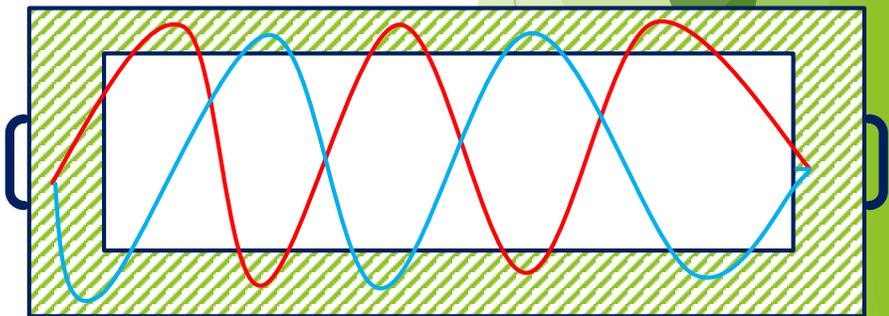
For example

Residues of chemicals like *Talstar*, *Procide*, *Durivo*, *Confidor* and *Regent* can last more than 12 months depending on the rates used.



Walking the Nursery

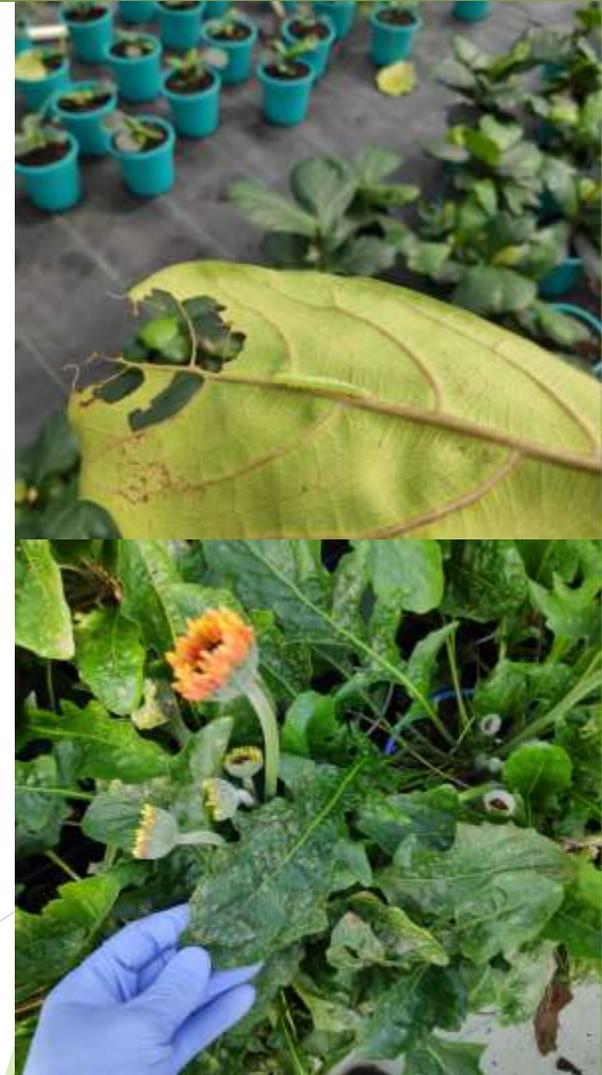
- ▶ Have a plan of where you will start and finish
- ▶ Always scan the area while walking through the crop, you can identify hotspots from a distance
- ▶ Monitor at least fortnightly and weekly in warmer conditions
- ▶ Check sticky and pheromone traps to detect pest migration. Replace regularly to identify pest incursions and buildups
- ▶ Look for signs of pest, disease and beneficials in the crop. Keep in mind not every insect or mite is a pest!
- ▶ Check areas where you will expect to find pests, not only random samples.
- ▶ Take a slightly different route each time to ensure entire area is covered over time (see diagram)
- ▶ Look for other problems such as weed hosts (inside and outside) water leaks, old crop debris, damaged screens, high heat and humidity levels, spray burn, fertiliser deficiencies and more



 Week 1
 Week 2

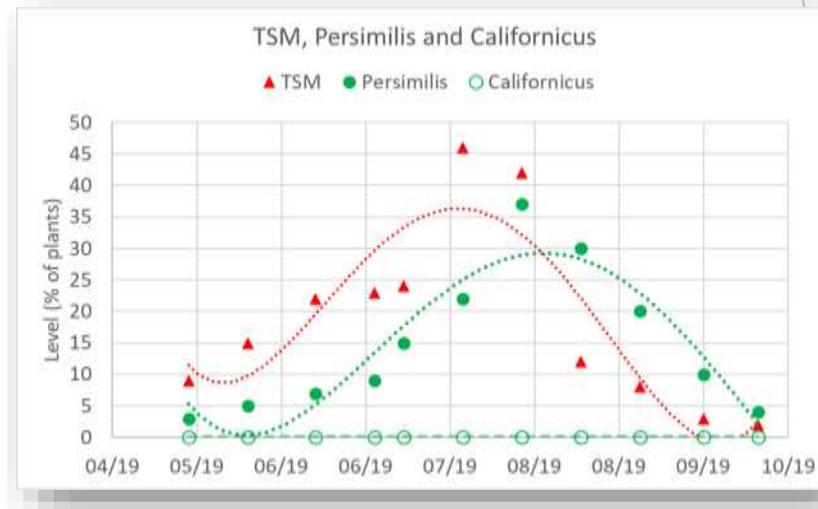
Inspecting the plants

- ▶ Do a scan of the leaf/whole plant without a hand lens first.
 - ▶ Use a hand lens to inspect leaves (particularly the underside), flowers and shoot tips. Focus on areas with damage, speckling and discolouration.
- ✓ *Very important to maintain a standard number of scouted plants and leaves.*
 - ✓ *Sample 50% of plants randomly and 50% plants that might have suspect symptoms. Monitor more plants near doorways, under vents and near walls.*
 - ✓ *Select 2 lower leaves and 2 top leaves from each plant. Sample 2 buds / flowers. Examine roots if required.*
 - ✓ *Some pests can be monitored by tapping into a white container, eg thrips, mirids.*
 - ✓ *At least 10 plants per 100m² per species of plant. This should only take 10-15 minutes.*
- ▶ If unsure of pests or symptoms, take a sample for ID and take some photos. Contact an industry expert. If severe a property visit might be advisable.
 - ▶ You will require a clipboard or phone, pen/pencil, flagging tape for hotspots, hand lens, gloves, containers for samples, replacement traps and a tool belt to carry items.



Recording

- ▶ Record your observations in a notebook or a template on your phone.
- ▶ Prepare data into a form or report. Numbers detected can be converted to a percentage and compared with previous reports.
- ▶ Develop a plan of action to control any issues (release biologicals, spray low toxicity chemicals, control weeds etc)
- ▶ Use your property map to report any hotspots.
- ▶ Encourage other employees to view hotspots and become familiar with pest symptoms. They can then report on any similar detections.

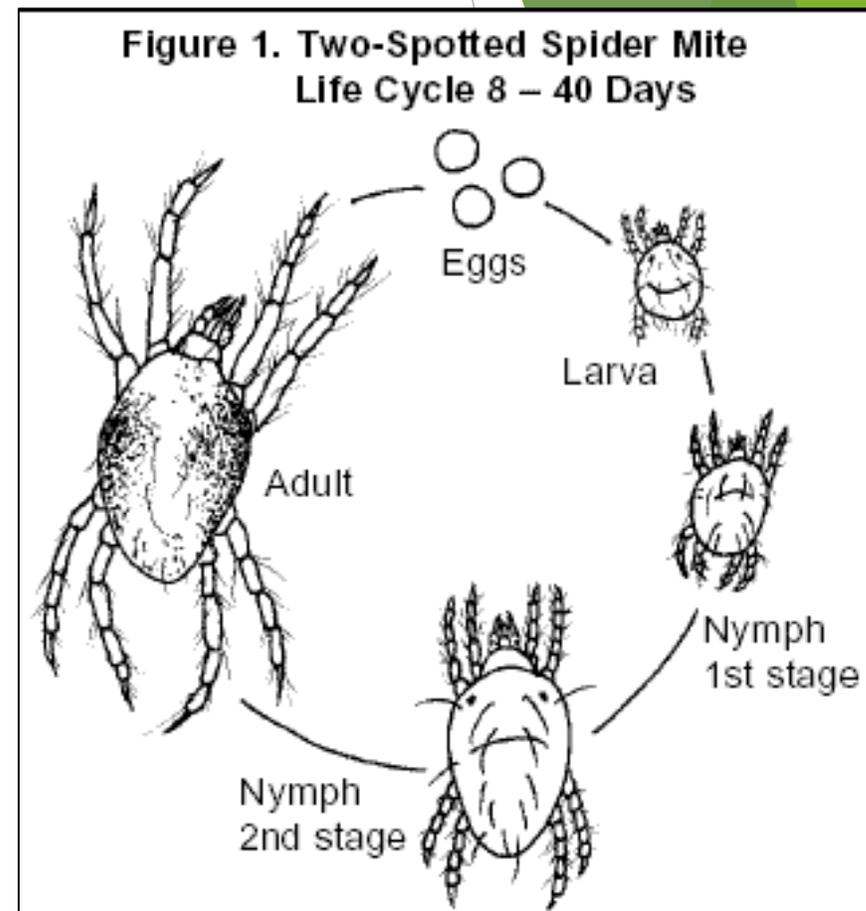


Grower: **BIOLOGICAL SERVICES - MONITORING DATA**

Date	LMP	SSM		Preds		SSM		Preds		SSM		Preds	
		SSM/Level	Preds/Level	SSM/Level	Preds/Level	SSM/Level	Preds/Level	SSM/Level	Preds/Level				
23/1/2019	30	9	L	4	L	13	LM	9	LM	13	LM	11	M
13/2/2019	30	12	L	3	L	8	LM	7	LM	8	LM	6	M
3/04/2019	30	6	L	2	L	6	L	6	L	3	L	1	L
25/3/2019	30	4	L	0	L	8	L	3	L	7	L	1	L
15/4/2019	30	2	L	7	LM	8	L	8	LM	7	LM	4	L
13/5/2019	30	6	L	4	L	5	L	4	L	9	L	1	L
24/6/2019	30	7	L	3	L	5	L	3	LM	9	L	0	L
5/08/2019	30	15	L	2	L	12	LM	2	L	17	LM	0	L



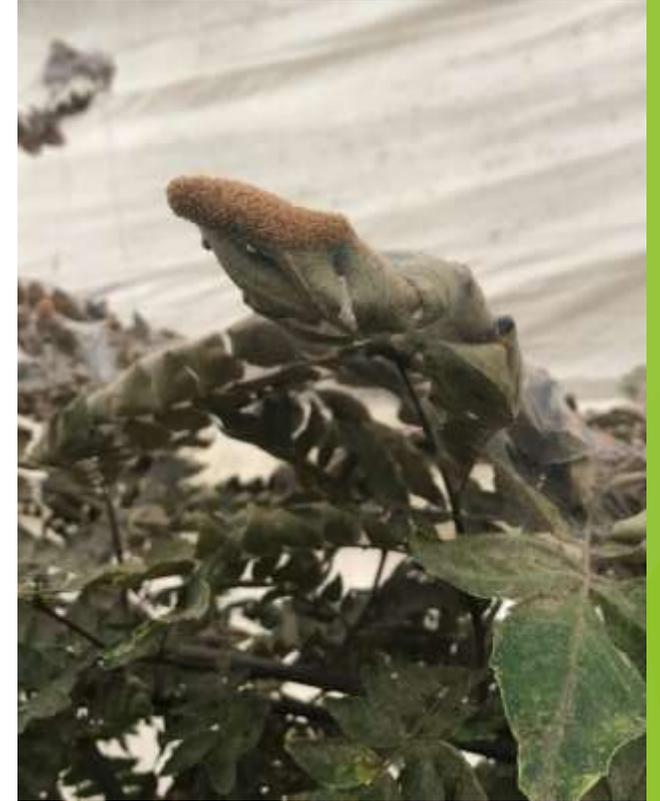
TWO-SPOTTED MITE (TSM)



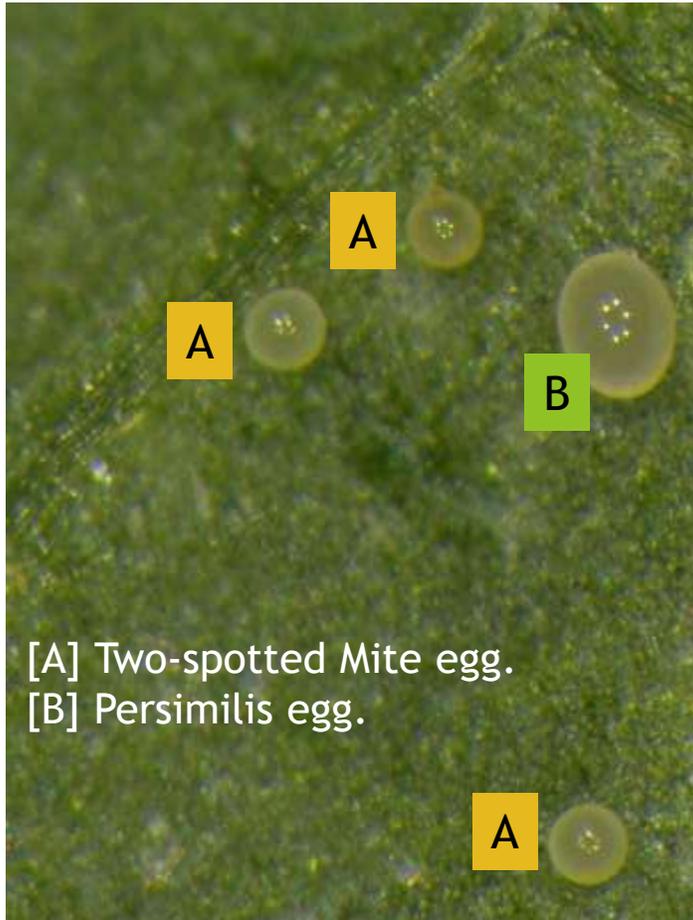
TSM DAMAGE SYMPTOMS



TSM DAMAGE SYMPTOMS

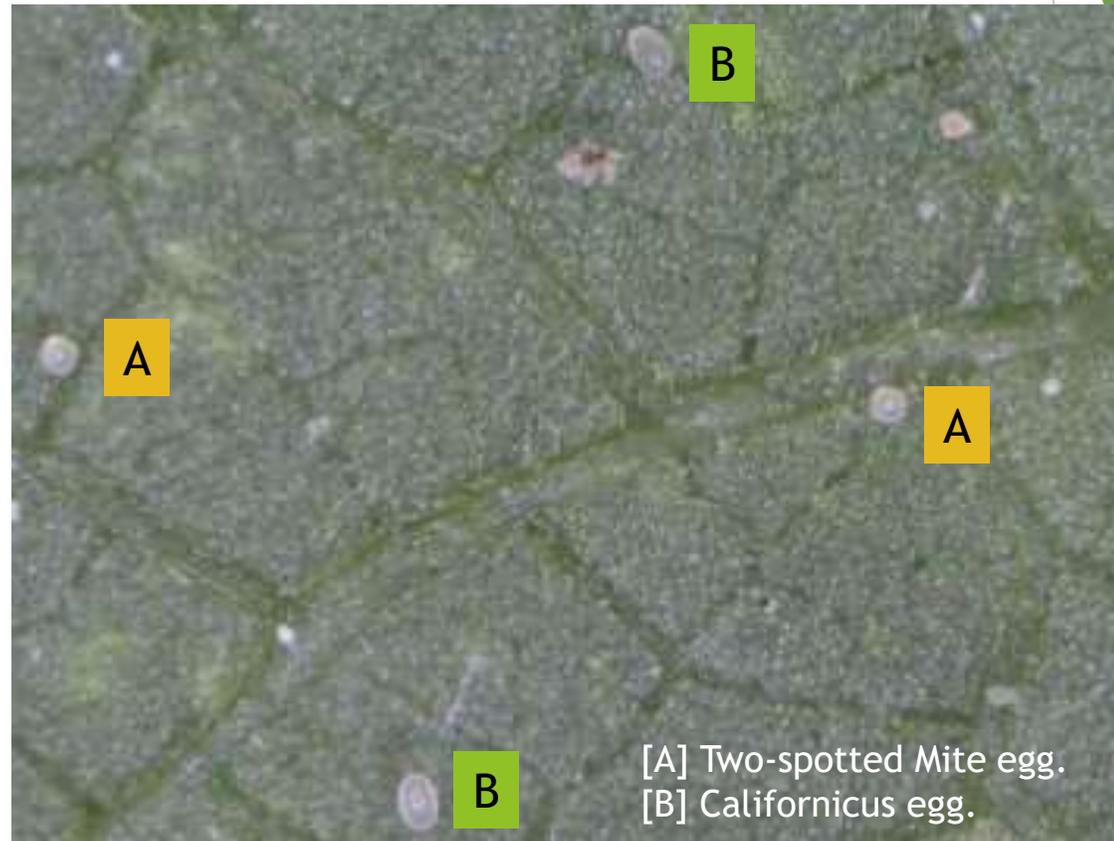


PERSIMILIS – TSM PREDATOR



Release rate:
5-10 bottles per hectare
depending on severity.

CALIFORNICUS – TSM PREDATOR



Release rate: 5-10 litres per hectare.

APHIDS



APHID DAMAGE

Honeydew from aphids.



APHIDIUS – APHID PARASITE



- ▶ Aphidius female can parasitise over 300 aphids in her 2-3 week lifetime
- ▶ Controls green peach aphid, cotton/melon aphid and a few others

Release rate:

Preventative, 0.15/m² per week or fortnight (3 vials/ha)

After detection, 0.5-1/m² per week for at least 3 weeks (10 vials/ha)

APHELINUS – APHID PARASITITE



Controls many species including some of the larger aphids.

Release rate:
1000-5000 per hectare x 3 to 5 releases.

LADYBIRDS – APHID PREDATORS



Ladybird eggs



Ladybird pupa



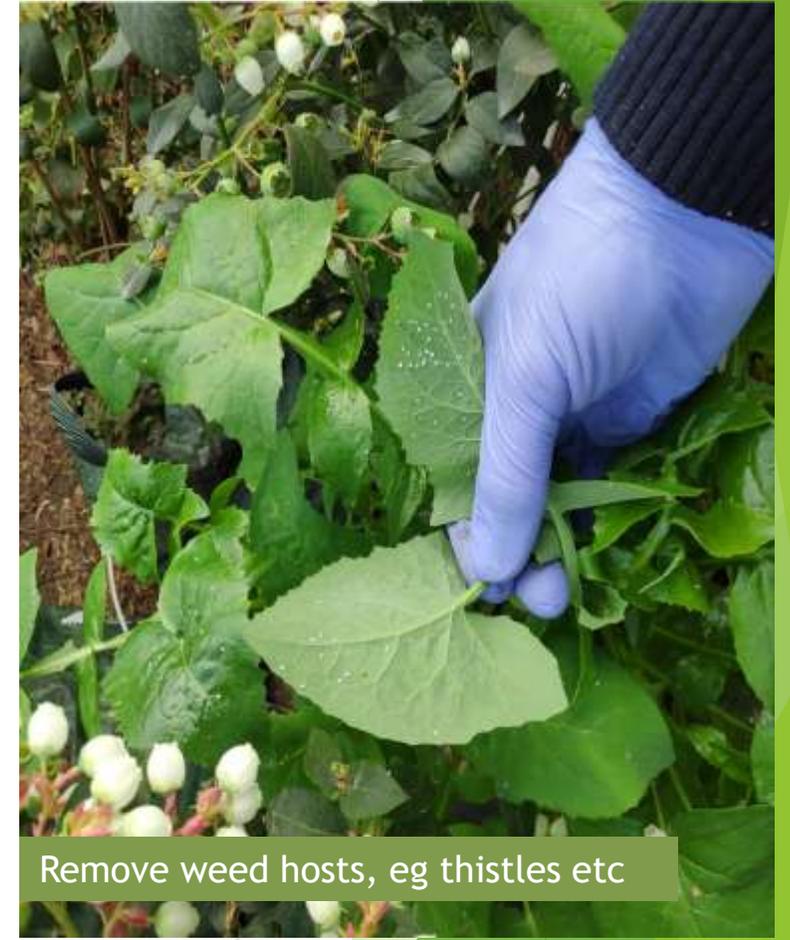
Ladybird larvae



Hippodamia adult

Release into hotspots or varieties known to regularly suffer from aphid infection.

WHITEFLY (Crops and Weeds)



Important to determine if the species is Greenhouse whitefly or Silverleaf whitefly.

WHITEFLY DAMAGE (Tomato Crop)



Honeydew and sooty mould

ENCARSIA & ERETMO CERUS – WHITEFLY PARASITES



Encarsia adult laying eggs



Eretmocerus

Release parasites at
1-2/m² weekly.



Encarsia pupa (black)



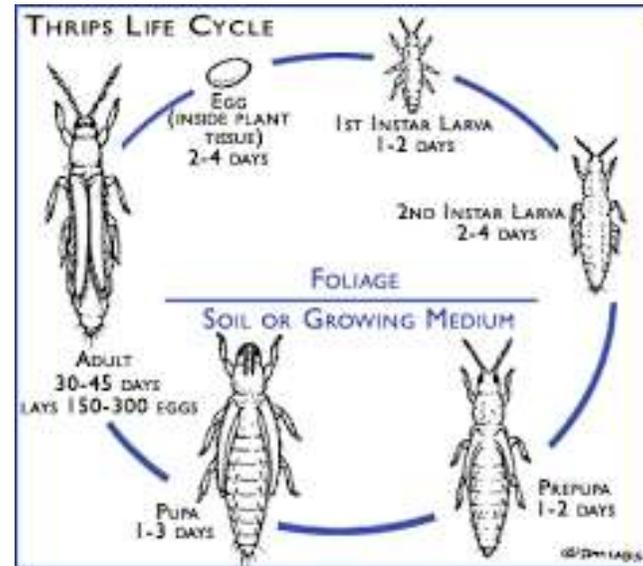
Eretmocerus pupa (light yellow)

ENCARSIA PARASITISM

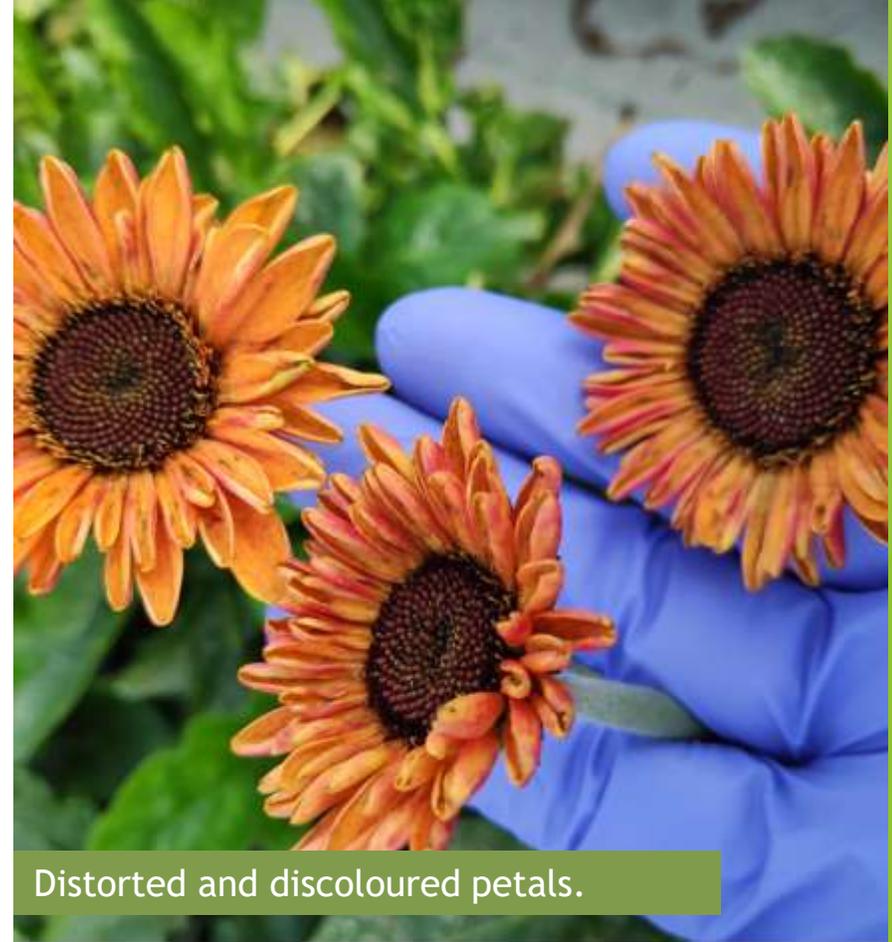


THRIPS

Western flower thrips (WFT)



THRIPS DAMAGE



Thrips controls supplied by Biological Services

- ▶ **Hypo-A** *Hypoaspis aculiefer*. Applied to media at seeding/planting
- ▶ **Cucumeris** and **Lailae**. Applied to foliage of plants
- ▶ **Orius** *Orius tantillus*. Used in crops that have suitable flowers, or in conjunction with banker plants. Need pollen to breed and persist.



Hypo-A

Release at 5-20 litres/ha



Cucumeris

Release at 5-20 litres/ha



Orius

Release at 2-10 /m²



ORIOUS – THRIPS PREDATOR



Adult Orius feeding on thrips.



Juvenile Orius feeding on thrips.



Orius emerging from egg.



Juvenile Orius just hatched.

Banker Plants



200-500 bankers/ha in crops without suitable flowers to maintain Orius. Suitable bankers include basil, alyssum, chillies and capsicums.

CUCUMERIS – THRIPS PREDATOR



Cucumeris feeding on thrips juvenile.

T.LAILAE – THRIPS/WHITEFLY PREDATOR

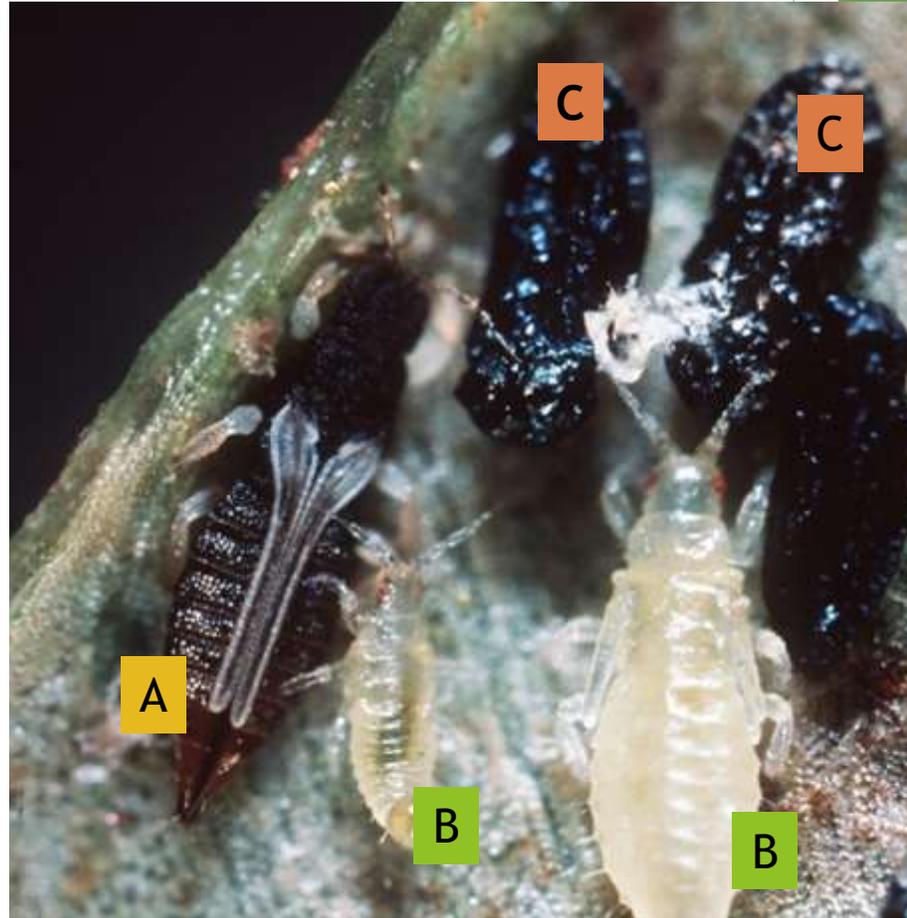


Lailae feeding on second instar thrips.

THRIPOBIUS – GREENHOUSE THRIPS PREDATOR



Thripobius adult wasp.



- [A] Greenhouse thrips adult
- [B] Greenhouse thrips juveniles
- [C] Parasitised thrips. Thripobius pupae

FUNGUS GNATS



- ▶ If pest numbers are high, larvae feed on roots and bore into young stems in crowns
- ▶ Indirect damage by creating entry points for fungal disease, eg phytophthora, pythium

HYPOASPIS – FUNGUS GNAT/THRIPS PREDATOR



Hypoaspis aculeifer



Hypoaspis mites

DALOTIA – FUNGUS GNAT/SHORE FLY/THRIPS PREDATOR



Dalotia adult

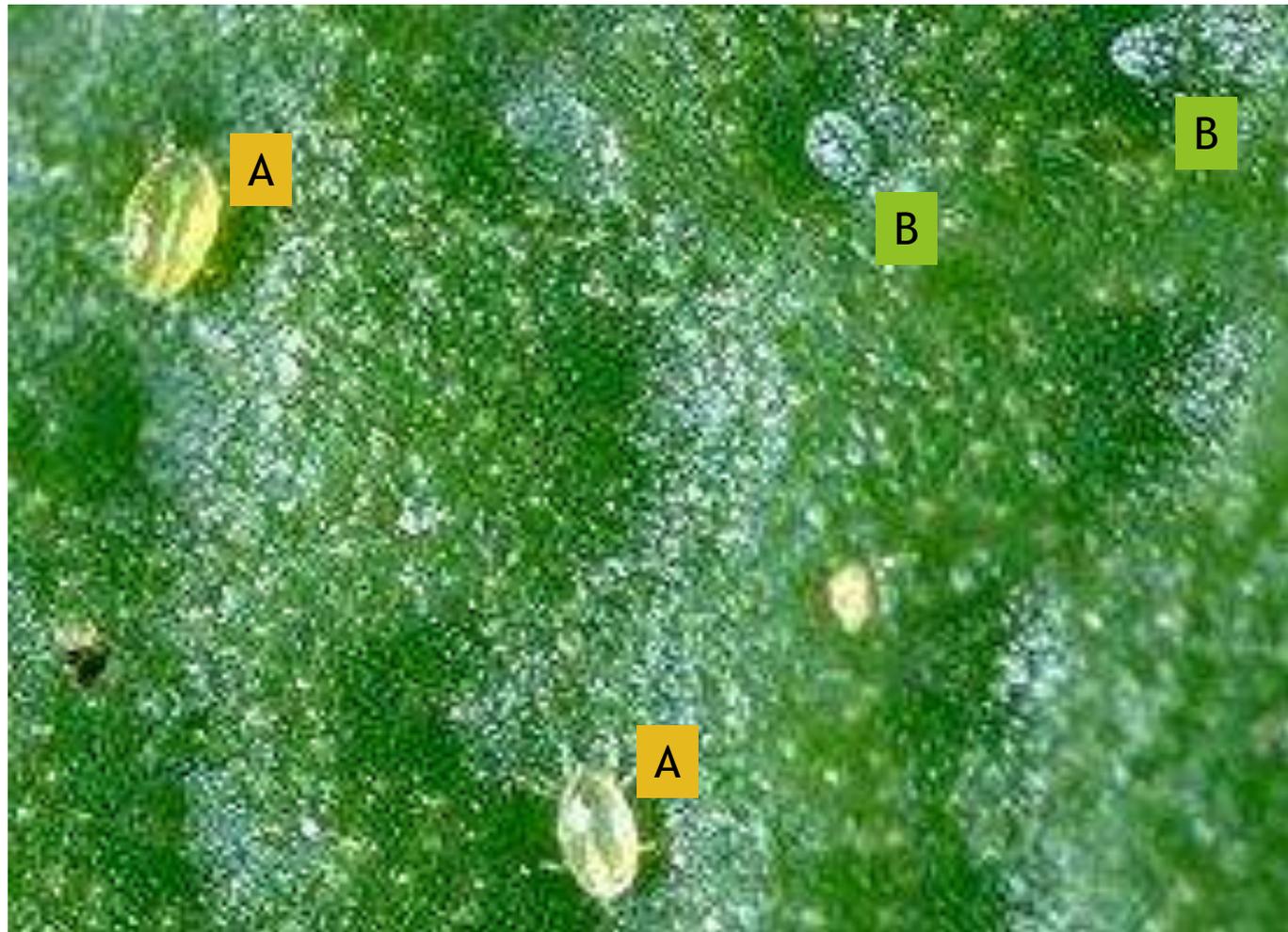


Dalotia larva (left)



Dalotia feeding on fungus gnat larva

BROAD MITE



[A] Broad mite adults / nymphs
[B] Broad mite eggs

BROAD MITE DAMAGE



Stunted growth tips

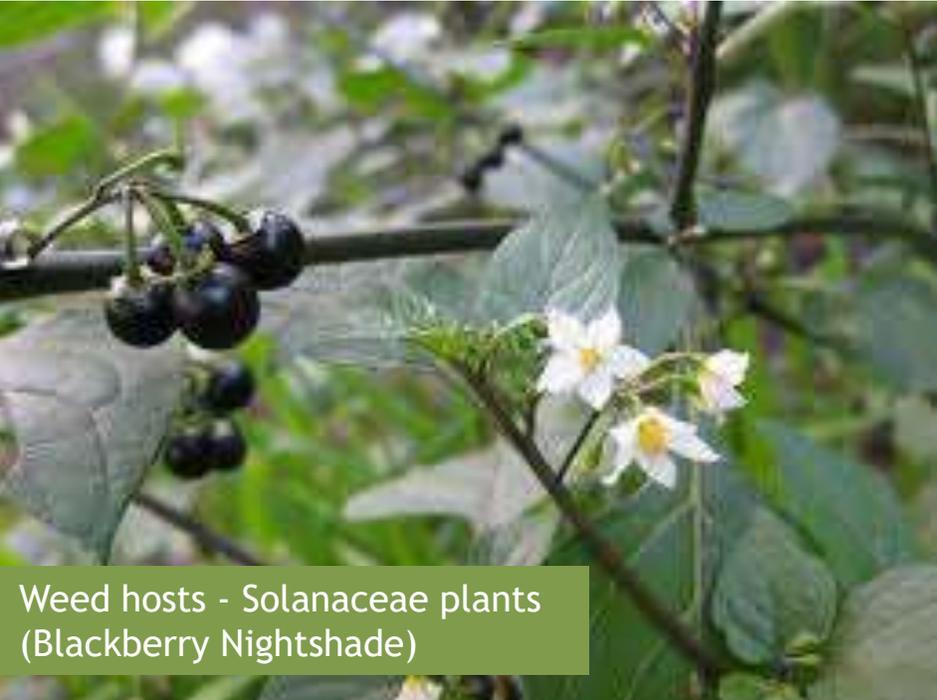


Scarring on fruit and new growth terminated



Curling/distortion of new growth

TPP – Tomato Potato Psyllid



Weed hosts - Solanaceae plants
(Blackberry Nightshade)



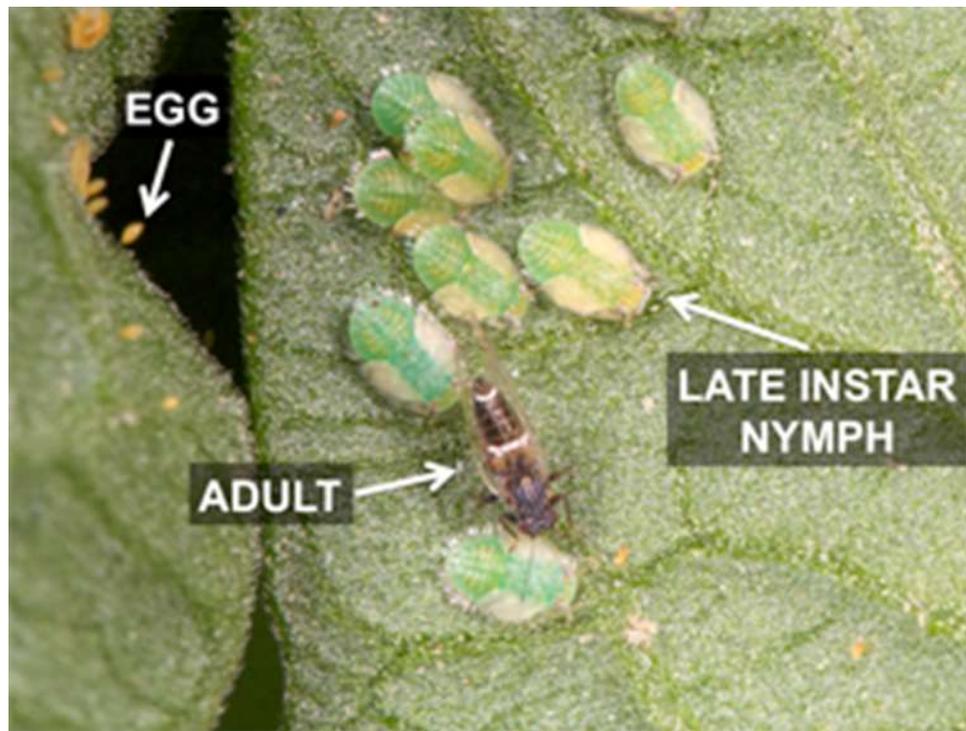
TPP adult

1. Weed Control: Target Blackberry Nightshade.
2. Group all Solanaceae plants in the same area in the nursery
3. Use yellow sticky traps to monitor incursions
4. Monitor the traps weekly
5. Chemical control if necessary

TPP – Tomato Potato Psyllid



TPP egg/adults



- ▶ Recommended Government/AQIS pesticide applications of Talstar, Confidor, Lannate are all very toxic to IPM. Some leave residues for many months and even years in greenhouses.
- ▶ **Alternatives:** Benevia, Mainman, and Vertimec are more effective and less residual.



About us

We are one of Australia's largest biological control companies and we are on a mission to help future-proof pest control in agriculture. Since 1971, we have been helping commercial businesses achieve healthy and sustainable yields through the use of beneficial insects and mites combined with on-site integrated pest management consultancy across Australia.

Questions or want more information?

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