Notes from Strawberry Bug IPM workshop

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Beneficials and predators

These can be either commercially available for release or naturally occurring. They can be insects, mites, fungi, nematodes or viruses.

Check your consignment

- Important that you check your consignment to make sure your beneficials arrive in good health i.e. not dead
- High temperature/low humidity in summer through the supply chain, including at release, can kill off your beneficials before they get to work for you
- No or very low humidity is particularly bad for P. persimilis (2 spot predator). Transport in vermiculite is more risky in summer.

Releasing beneficials in strawberries

Question: when is the best release time for predatory mites (P. persimilis)?

Most beneficials (insects/fungi/nematodes) require time to establish and bring down pest populations so that an immediate effect is not evident. Two exceptions to this are Montdorensis (thrip larvae predator) and Trichogramma (moth egg parasite, e.g. light brown apple moth, loopers, diamondback, heliothis) which have an immediate impact.

Most growers agreed late October/ early November was the ideal time for introducing the predatory mite persimilis as an inoculant beneficial, but this was site specific. A good guide was when no further frosts were expected.

Release of *P. persimilis* on table top strawberries requires more care as it is a drier environment. Table top growers add humidity through mist to encourage establishment. Table tops also are less likely to have a continuous or touching canopy early in the season so that even distribution up and down the rows was considered important. Distribution could start or be more concentrated at doorways where more likely for 2-spot to establish first but even distribution on every row is important.

Trimming of strawberries in mid-summer also offers a challenge to P.persimilis as much of their canopy cover is removed and humidity is reduced. Releasing at this time would be challenging.

Dust

Dust is more detrimental to predators than pests. It is an irritant and can seriously impact on beneficial populations.

Shelter belt plants as natural predator hosts

The aim is not to provide a nice sanctuary for your pest. Pests tend to prefer introduced plants and natural predators are generally adapted to native plants. The preferred plants to have around your crop to encourage natural predators are flowering natives.

Sulfur

Rate and timing of application is important. This is damaging at 6kg/ha but safer at 2 kg/ha.

Repellents vs attractants:

Question: Is it useful to use compost or inter row substrate such as poppy mulch that could potentially repel pests?

Caution was raised about making sure that you are not providing a food source or comfy habitat for pests. However, the use of composts is generally beneficial.

Chemical persistence, protected cultivation and beneficials

Pesticides that disrupt beneficial populations can be an option if used appropriately. However, things to consider include:

- Are there many life stages of the beneficial present? There will be a faster recovery of beneficial insects if more life stages are present to begin with (eggs, larvae, nymphs etc)
- Pesticides have a longer residual life when not exposed to natural rainfall or UV. This is the case for poly tunnel production. This is an important consideration when reintroducing beneficials as the pesticide will have a longer residual life;
- A pesticide used once is less disruptive than multiple applications. When a pesticide is used consecutively then it increases the residual life and also knocks out more life stages of beneficial insects;
- Timing of application is a useful tool. For example an end of season 'clean up' spray can be useful in some circumstances but can be very disruptive in other circumstances.

Fertilisers and pests:

Does plant nutrition impact on pest infestation/damage? Are they less attractive at different nutrition status?

Not a lot is known about this.

Thrips

Thrips can be pests or predators of pests. The quickest way to check if your thrip is a goodie or a baddie is to check to see if it has a tube at its rear end. This is the predatory tubular black thrip, a predator of western flower thrips and other thrips. When juvenile, this thrip is bright red and looks like a mini chilli.

Study of thrips on strawberries in Victoria:
150 adult onion and plague thrips/flower were 'caged' on a number of Albion strawberry flowers. The fruit produced was assessed for damage. Only minor damage at most was observed.

Questions:

1. Are thrip juveniles responsible for the damage? Maybe the wrong life-stage to replicate damage was present on the flower (just adults)? Maybe adults are in dispersal/ mating phase not eating phase. Maybe no damaging life stage of thrip was present during critical stage of floral development/fruit set? Would the result have been different if another life stage had been caged on the flower? Anecdotal evidence from growers who have ceased thrip chemical management has found no increase in thrip damage.
2. Was the strawberry variety used (Albion) indicative of most strawberry varieties or was it less sensitive to thrip damage than other varieties?

Western Flower Thrip (WFT) *Frankliniella occidentalis*:

Are WFT resident in Tasmania and what is the risk to tunnel and outdoor strawberries?

Lionel Hill (DPIPWE entomologist) commented that WFT is well established in greenhouses/glasshouses throughout Tasmania. It occasionally turns up outdoors from recently released glasshouse plants or occasionally on flowering weeds immediately adjacent to glasshouse. Establishment outside of any significance has not been encountered. Lionel described that in the Sydney basin, glasshouse growers can have significant WFT infestation inside their glasshouse but thrips can be hard to find in flowering weeds just outside the glasshouse. This reinforces the view that WFT generally is a poor competitor and may have many natural predators outdoors. WFT are free to establish in an environment which has had high or inappropriate insecticide use resulting in a very low or absent natural predator population. So WFT has potential to establish in Tasmanian protected cultivation in particular where insecticide use has eliminated any natural or introduced predator population. Flowering white clover would probably be pretty attractive to a WFT.

Plague Thrips/Onion Thrips
Orius (minute pirate bug) is a voracious feeder on thrips larvae but is also a general predator. It likes pollen and nectar so a flowering plant is a great banker plant for this commercially available predator. Biobest have screened a number of plants to work out which ones are best for Orius. Initially a pepper plant 'black pearl' was found useful. Now the small, easily grown, long flowering plant 'sweet alyssum' (*Lobularia maritime*) has proved to be a great host for orius (see attached sheet on banker plants).

Aphids

Pesticides for managing aphids are either not working due to resistance issues (Pirimor – green peach aphid resistance) or kill predatory mites (Movento) are harmful to bees (neonictinoids) or slow to work (Chess). Increased aphid pressure is predicted with increased warming. Brown lacewings are a useful predator but green lacewings are less so.

Catch crops

These can be useful for some pests, e.g. long grass for Rutherglen bug, but timing and monitoring are critical.

Study of Bugs infesting and damaging Victorian strawberries

What options are available?

Cultural:

Trap crops such as lucerne? No data yet.

Chemical:

- Synthetic pyrethroids (SP), but these are not selective
- Organophosphate (Malathion) at half strength but residual
- Oils – again not selective
- Success-Neo: possible effects on persimilis and cucumeris

A question was raised about spraying the inter-row: This would have to be done very carefully and drift is an issue. It would also affect beneficial populations resident in inter-row.

Biological:

Predators of bugs include other bugs such as damsel bugs but none commercially available.

Which bugs caused the most damage?

Mirids

Mirids were found to be the most damaging. These include crop mirids (broken back bug) green mirids and brown mirids. They all cause similar symptoms and are managed similarly. Mirids can be distinguished from aphids by their antennae. Mirids have very stout antennae whilst aphids have slender delicate antennae. Mirid damage is caused by their toxic saliva which injects into the plant as they feed.

Mirids carry-over in 2 year old crops and breed easier than Rutherglen bugs in crops.

Lygaeids

These include Rutherglen bug, strawberry bugs. They tend to be more a contaminant or tainting issue and damage viewed from caging trials was classed as minor.

Nick commented that he had observed mirids and Rutherglen infesting at the same time.

Damage symptoms on strawberries and level of tolerance:

There are multiple causes of distortion/malformation in strawberries including bug damage. This might be mildew or poor pollination. The degree of damage (% of crop or % of strawberry) that is acceptable is up to individual business but must be weighed up against the potential for uncontrollable levels of pests due to IPM failure.

Predicting bug infestations:

Drying off of surrounding vegetation and northerly winds were key predictors of bug infestation.

Other discussion

Commercial supply of new beneficials
There is potential to develop fungi for aphid management but cost and likely demand will drive this.

Commercial development is dependent on supply and demand/chicken and egg! If a suitable beneficial fungi is found then factors such as cost of rearing and commercial demand will determine if it is a viable proposition for a biocontrol company.

The quarantine restrictions on entry to Tasmania are governed by the Animal control act and beneficials that are allowed in can be accessed from this site:

http://dpipwe.tas.gov.au/biosecurity/quarantine-tasmania/importing-animals/unrestricted-entry

New beneficials would have to be approved through Rod Andrewartha (Chief Quarantine officer). This is often done in consultation with Nature conservation department.

Pest	Beneficials	Cultural	Chemical (support)
2 Spotted mite ***T. urticae***	• P.persimilis (c) • Californicus (c) more tolerant of pesticides than persimilis • Stethorus (n)	Prefer humidity; keep humidity up, temperature down, micro mist.	Milbenknock= softest Acramite -= resistance Vertimec – use early only
WFT **(western flower thrip)**	• Cucumeris (c) • Montdorensis (c) – less persistent • Hypoapsis (c) • Orius (c)	Lure-M (sticky trap) inside glasshouses or tunnels only	Develops resistance very quickly
Plague/Onion thrips	• Orius (c) general predator • Montdorensis (c) used as a bio insecticide	Trap crop – cosmos? Bank crops (Orius) - alyssum	Be careful under plastic Success neo + sugar – will kill beneficials Timing is important, apply when 2-spot under control
Mirids and other bugs	• Nabid bud *Nabis kinbergi* (n) eat larvae • Damsel bug(n) eat nymphs	**Alternatives:** Mozzie zappers for small areas Mercury vapour lights on one side to draw bugs away not into crop Trap crop – Knott grass Bug vac's – but not selective	**All non selective** Maldison Bug master(carbaryl) Chlorpyrifos as an end of season clean up Potential new chemistry coming from DuPont
Aphids	• Aphidius wasp (c) • Hover flies (n) • Ladybirds (n) • Brown lacewing (n)	Hoverflies love cloches and are really useful early in spring Weed control is important	Pirimor – does it work? Volatile – fumigates aphids and only knocks out a proportion of wasps Transform – 2 applications maximum – is disruptive and an end of season only option

(c) = commercially available

(n) = not commercially available

Pest	Beneficial	Cultural	Chemical (Support)
Heliothis • ***Punctigera (early)*** • ***Armigera (on warm winds)*** **Loopers**	• Damsel bugs • Trichogramma wasps (c) but need correct species, only attack eggs		BT, (dipel) great for loopers but not armigera Vivus (virus) Success
Crickets/Grasshoppers		Control dry grass, use permitter baiting - bran flakes and lorsban	
Black vine weevil	Nematodes (c) must be >16°C and grubs must be big		
Portuguese millipede		Like organic matter	
Slugs and snails		Baiting: Multiguard (Iron chelate) is safest; metaldehyde (not so disruptive)	
Earwigs		Potential for pheromone baiting	Insecticide bait traps

(c) = commercially available

(n) = not commercially available