Whitefly IPM Workshop.

A Lighter Touch, Bioforce Ltd and Tomatoes NZ.

Greenhouse Whitefly

Possibly the greatest threat to the profitability of our industry.

IPM

- **Integrated**: With various coordinated parts.
- **Pest**: A destructive organism that attacks our crop.
- **Management**: The process of controlling multiple elements to achieve the best possible outcome.

Elements of IPM

- Knowledge.
- Monitoring.
- Cultural/ Physical Control.
- Biological Control.
- Chemical Control.

Knowledge

- **You can not manage a pest you do not understand**.
- You need to know the lifecycle and recognise the developmental stages.
- You need to know which predators to introduce, and when.
- You need to know when to spray, which sprays to use, and how often to repeat the applications.

Monitoring

- The first element to control is knowing which pests are present.
- Scouting.
- Traps (light traps, sticky traps).
- Early detection of pests is everything. easier to kill ten than a million!)

How to Scout your crop

- Examine every second row every week.
- Move fast and look for signs of pests.
- Use a magnifying glass
- Stop regularly and examine the plant more closely.

Cultural/Physical Control

- **Hygiene**: No dead plants, good drains, clean the glasshouse when its empty, no visitors…

- **Weeds**: Pests live on weeds in and around the glasshouse, pull weeds, use ground coverings, spray a strip around the outside of the glasshouse.

- **Climate**:45 degrees C at 600w/m2 for 4 hours is proven to kill whitefly. (Empty glasshouse…)

- **Traps**: sticky traps, light traps, even attractant plants.

De-leafing, an opportunity for Cultural control.

- The whitefly, and Encarsia, lifecycles are up and down the crop.
- The whitefly pupae, and the parasitised pupae, are on the lower leaves.
- If you remove leaves before Encarsia emerge you are removing Encarsia.
- De-leafing onto the ground gives the Encarsia a chance to emerge.
- If the lower leaves are full of non-parasitised pupae remove them and prevent the whitefly from emerging in your crop!

Biological Control

- The application of natural enemies to suppress a pest population.

- For whitefly currently *Encarsia formosa*.

- In the near future more tools…

Chemical Control

- Physical mode of action sprays.
- Soft chemical sprays, low residue, low to no effect on biologicals.
- Hard chemical sprays. Total disruption of biological programs with long term residual effects.

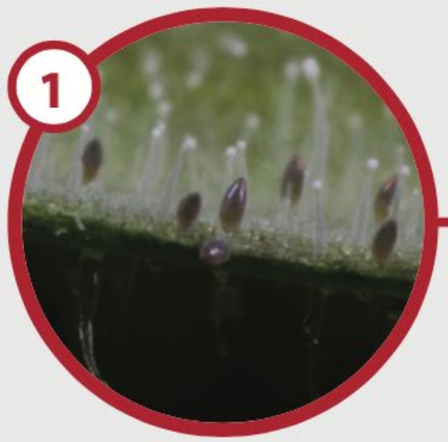
Knowledge

- Do you know what the lifecycle of a whitefly is?
- How long will it take from egg to egg?
- Which stages are attacked by predators?
- Which stages are vulnerable?

WHITEFLY IPM

LIFECYCLE STAGES

EGGS



The eggs will turn black before hatching

LARVAE

PUPAE

Pupae will be white if not parasitised

ADULT

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How Long is a Whitefly Lifecycle on Tomatoes?

- No ability to regulate temperature so metabolic rate linked to ambient temperature.

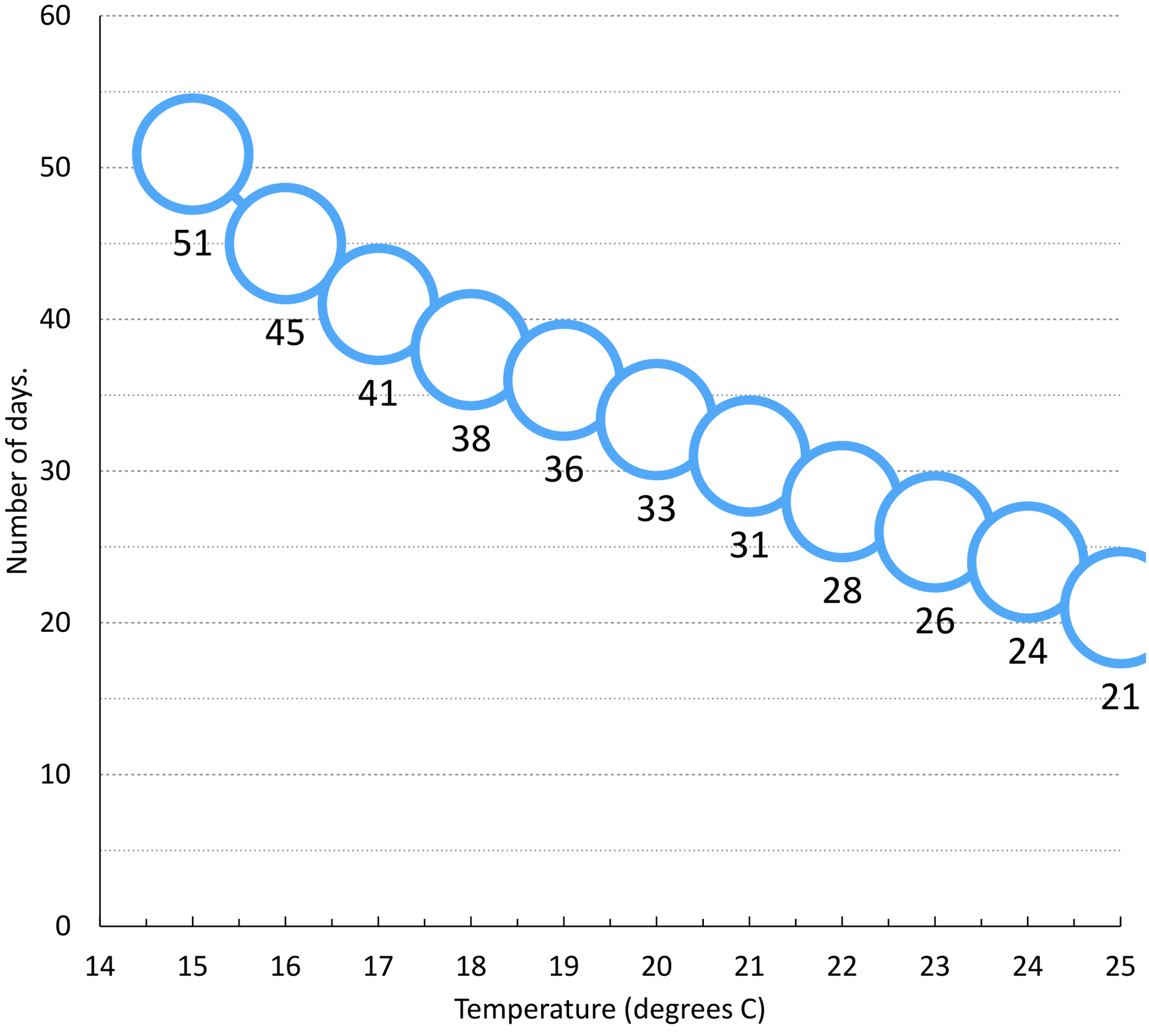
- All chemical reactions proceed more quickly as temperature increases.

- At -3 degrees C eggs survive 15+days!

- Whitefly development ceases above 35 degreesC

- Egg to egg time is a complete lifecycle. (egg hatch, development to adult, egg deposited).

Whitefly Egg to Egg Time on a Tomato Plant.



When you see 1 whitefly, you already have 1000.

- **Scouting is essential to IPM success.**

- Pest control must begin before pests are established.

- Use the tools! Scouting, Sticky traps, pheromone traps, light traps….

- Scouts must be active from the beginning and equipped with a magnifying glass.

Video Presentation

Whitefly Control Masterclass

Available to watch here:
https://www.youtube.com/watch?v=PwHiVr82WdE

Highlights and key points?

Start EARLY with predators, help them when you need to…

- Weekly predator introduction.
- Physical mode of action spray the heads, knock down adults without interfering with *Encarsia*.
- Use soft chemistry, low damage to predator numbers, low residue.

When?

- When should I introduce more predators?
- When should I add different predators?
- When should I spray the heads?
- When should I use soft chemistry?
- When should I go NUCLEAR….

What should you do?

What about now?

Failing to plan is planning to fail.

What is the Plan?

The plan…

- Must be specific.
- Must be simple.
- Must allow for variables.
- Must include various elements of IPM.

WHITEFLY IPM

DECISION MAKING TREE

START HERE

Step 1: Plant and begin to introduce *Encarsia* at a rate of 1/m²/week

1-5 Whitefly per plant head

Step 2: Add *Encarsia* at a rate of 1/m² x the average number of whitefly per head every week

1-5 Whitefly per plant head

Keep doing the same

5-20 Whitefly per plant head

Determine the percentage of *Encarsia* parasitism

80% or more

You're OK, The *Encarsia* are winning, keep doing the same thing

Less than **80%**

Adults only

"Fly in" infestation, 2 physical mode of action sprays at a 4 day interval to knock them down

Complete lifecycle?

Apply a physical mode of action spray 3 times with a 4 day inteval to break the lifecycle

20+ Whitefly per plant head

Determine the percentage of *Encarsia* parasitism

80% or more

You're OK, The *Encarsia* are winning, keep doing the same thing

Less than **80%**

Spray SOFT Agchem by label, follow with 4 physical mode of action sprays at 4 day intervals *(SOFT Agchem includes cyantraniliprole, flonicamid, spinosad, spiromesifin, and pyrproxyfen)*

Repeat Step 2 with a double *Encarsia* rate for the first 2 weeks

NOTE 1: If you start to develop a few dirty plants in an area, release *Buchananiella whitei* (Pirate bugs) as *Encarsia* do not like dirty plants!

NOTE 2: If you see psyllid attempt two spot sprays if you are quick enough or treat with the same SOFT Agchem you can use for whitefly.

NOTE 3: If you are running at a 24 Hour average temperature below 16 °C the *Encarsia* will not work. Instead try a physical mode of action spray every two weeks until its warmer.

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The Key Points

- Scout regularly and thoroughly.
- Introduce predators early and regularly.
- support the predators with physical mode of action sprays.
- Give extra support with soft chemistry as required.

Why a 4 day spray interval?

- Spray day-1-2-3-4-Spray day.
- The eggs take about 7 days to emerge across our average glasshouse temperature range.
- Pupae take about 3-4 days to emerge.
- The freshly emerged (0-4 day) larvae are the easiest to kill with physical mode of action sprays.
- The first spray reduces the adult pressure and kills many juveniles.
- The second spray kills the newly emerged adults and larvae.
- A third spray 4 days later would kill the remaining larvae as they emerge.

How many Sprays Applications?

- In a low level infestation one spray of just the heads will reduce the adult population and help the Encarsia keep up.

- If the whitefly numbers increase due to a “fly in” we would recommend two sprays to knockdown the adults and the majority of the juveniles. Any further juveniles will feed your *Encarsia* population.

- If there is a complete lifecycle, you need 3 sprays at a 4 day interval to break the lifecycle.

- If its a real mess… time for the soft chemistry as directed followed by physicals until its looking pretty clean. Then back to IPM

When Do I Go NUCLEAR!

- Going NUCLEAR means spraying the hardest chemicals you can get, preferably all mixed in one tank… Kill Everything.
- Kills all beneficials.
- Hard to impossible to establish new predators.
- Very hard on the plant.
- very hard on your staff.
- Unfortunately, the whitefly have largely developed immunity to these chemicals so they will be OK.
- I have not witnessed a successful full chemical whitefly program since I started working on this project.

New Tools.

What do we need?

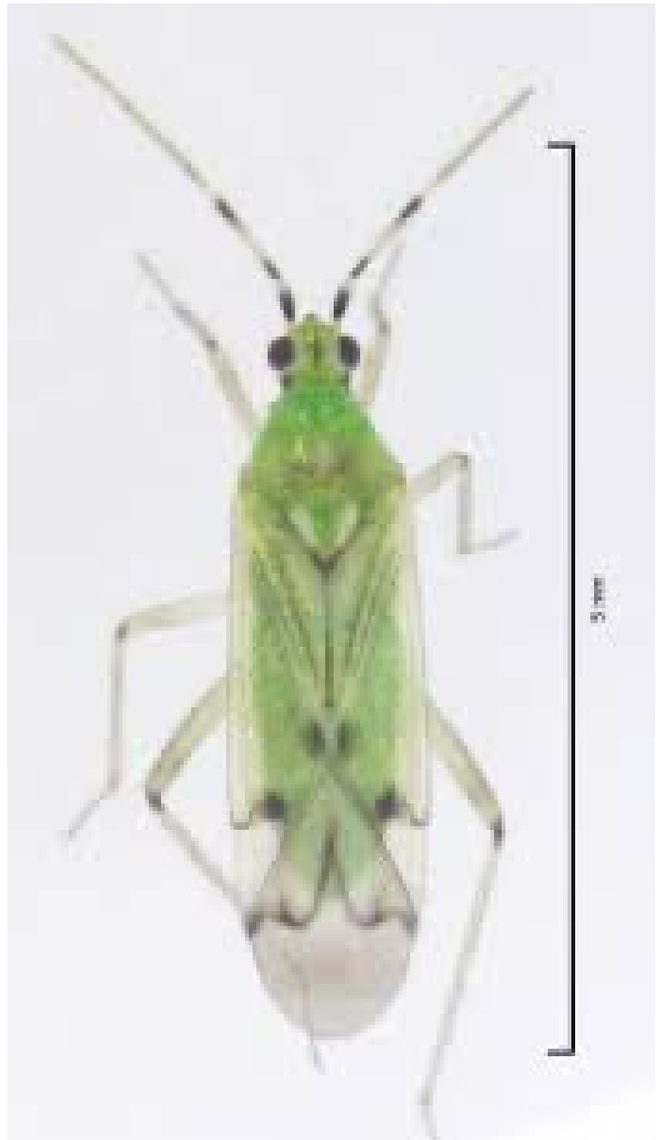
- More whitefly predators.
- A predator to keep Psyllid under control.
- A generalist predator that eats several pests.
- Preferably a NZ native species so no issues importing and well adapted to our climate.

We have new Predators.

- Proven in the lab.
- Survive and breed in the glasshouse.
- Polyphagous and preferentially feed on the right targets.
- Do not interfere with *Encarsia.*
- Early glasshouse trials show promise, some of the new predators are available already.

Engytatus nicotinae

A generalist predator, shown in the laboratory to preferentially feed on psyllid, but also consume complete lifecycle on whitefly.



Two Trial sites.

Site 1: Stand alone greenhouse.

Site 2: Consists of 2 near identical glasshouses side by side so one was used as a control.

Method:

Banker plants were used at row ends. *Engytatus* were observed to only be hunting in a 4-5m radius so banker leaves were broken off and spread down the rows once there was a residual whitefly population. The E*ngytatus* was topped up about 1bug per 5m2/month.

Observations: Site 1.

Engytatus and *Encarsia* have totally controlled the whitefly population for the season.

The E*ngytatus* is visible everywhere as you walk down the rows.

There have been <u>no spray</u> applications for whitefly.

There have been no psyllid observed in the crop at all.

This is unusual. Greenhouse is in a high psyllid pressure area.

Possibly no infestation, possibly killed by large population of E*ngytatus*.

Not proof, but promising.

Observations site 2.

Same method as site 1.

IPM area much better whitefly than control section by mid season. Trial area 1-2

Whitefly per head.

Control (chemical) 10+ per head with areas of 20+ per head. Psyllid fly in infestation of trial area.

Observations showing *Engytatus* preferentially eating juvenile

Psyllid

Test area one spray soft spray treatment for Psyllid,

then continued BCA programme

Summary:

Engytatus:

1. Established in the greenhouse.

2. Co-existed with *Encarsia* and helped control whitefly.

3. Definitely attacked juvenile Psyllid.

4. Potentially excluded/slowed psyllid from establishing in crops.

5. Next step will be to try to boost Engytatus population through a fed a fed population approach in the hope that a higher population will prevent psyllid establishment.

Buchananelia whitei

Trial Site Observation.

Glasshouse had an established IPM whitefly control program.

No Spray application.

Psyllid pressure from a neighbouring outdoor crop.

Observed established lifecycle in localised (1-2 plant) spots.

Released *Buchananelia* directly into observed spots.

Total juvenile psyllid population eradicated. Only leaf scarring to indicate scale were present.

Micromus tasmaniae (brown lacewing)

This is a generalist predator observed to preferentially feed on Psyllid, Greenhouse whitefly and two spotted mites.

Added to the *Buchananiella whitei* Trial site to apply further pressure on adult psyllid population.

Juveniles are small “crocodile like” larvae that predate on almost anything they can (including each other).

Adults are highly mobile, and hunt mostly at night.

At the trial site a combination of these two predators (*B. whiteii and M. tasmaniae*) initially appear to have totally suppressed the ability of the psyllid population to establish.

Unfortunately, due to constant fly in pressure, the effect on the adult population was difficult to determine. Late season spray control due to ongoing psyllid, but whitefly control based on BCAs for most of the season.

IPM Approach looks Promising.

- We have Knowledge and understanding of our pest.
- We understand the value of physical/cultural control (Hygiene, weeds, traps)
- We understand how to scout our crop.
- We have a plan, We know how, when and how many predators to introduce.
- We understand how and when to help our predators with physical mode of action sprays and soft chemistry.

What else would you like to know?

Questions?