

Blueberry[®] Monitoring Course

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Based on BBNZ IPM Manual developed Dr. Rob Silberbauer
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Introduction

Mechanics:

- Housekeeping and health and safety
- Questions at any time
- Sign the attendance sheet

The course is to inform you of:

- What monitoring Blueberries involves
- The pests and diseases are found in Blueberries
- Methods of control

The Blueberry IPM Programme

The Blueberry IPM Programme has been developed by Blueberries NZ.

The aim is to:

- * Support growers to produce Blueberries in an environmentally and economically sustainable way.
- * Produce a safe and healthy food.
- * Targeting pests and diseases using the most effective controls.

Integrated Pest Management IPM

IPM – divided into 3 categories:

- Prevention – understanding potential problems
- Crop Monitoring – identification of problem
- Intervention – decide best method of control

Prevention

Use of resistant or tolerant cultivars

Orchard hygiene

Plant spacing and pruning

Weed control

Preservation of habitats for beneficial insects

Use weather, environment and historical knowledge to decide action

Scouting - Intent

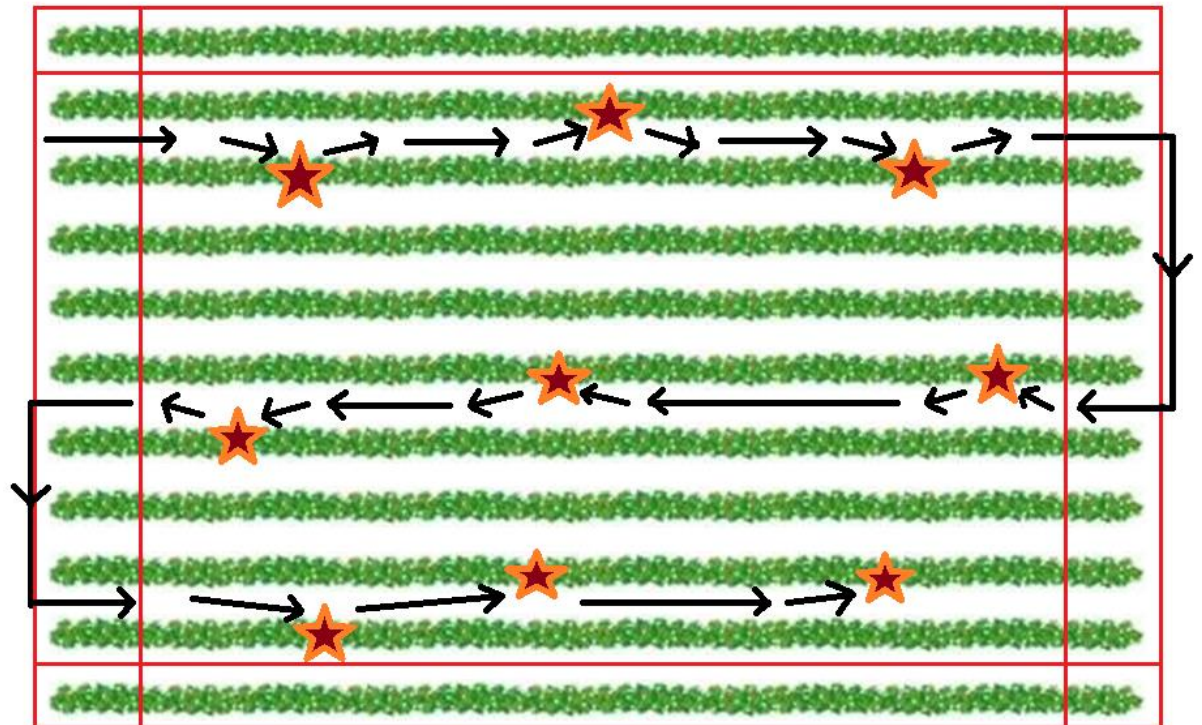
Intent of Scouting:

- **To identify all Pests and Diseases present**
- **Report findings to grower**
- **Action must be justified**
- **Weather and environment**

Scouting - Method

Avoiding the areas in red, monitor plants by zigzagging along the rows

Select rows and plants randomly to avoid visiting the same plant.



Scouting - Logistics

Number of plants:

- * 10 plants per hectare with minimum of 20 for blocks under 2ha.
- * 5 branches per plant – inspect from base to tip
- * Check all leaves, fruit, flowers and stem
- * Tap at least 1 branch of the 5 onto a white tray or paper (A4+ size)
- * Pick 2 ripe, but firm fruit from each plant inspected and place in container for microscope inspection
- * Record everything found

Size of scouted area	# of plants to be inspected
Up to 2 ha	20
Up to 3 ha	30
Up to 4 ha	40
Up to 5 ha	50

Scouting - Magnification

Hand lens of x10-x30 is mandatory when inspecting in the field

Microscope capable of at least x60 magnification. Digital is ideal as photos and videos can be recorded and shared with BBNZ or advisors for positive ID of insects.



Scouting – Additional Equipment

In the field you will need:

- 1. 10 - 30x Lens**
- 2. Recording sheet**
- 3. Clipboard**
- 4. Camera (cellphone camera)**
- 5. Jars, Vials, Ampules, small bag (to collect insects)**
- 6. Pest identification manual**
- 7. White board to tap onto (A4+)**

Scouting - Frequency

Frequency changes depending on growth stage

Plant Movement	Scouting Frequency
Dormancy to bloom	6 Weekly
Bloom to fruit set	Fortnightly*
Fruit Set to Harvest	Fortnightly*
Postharvest to Dormancy	6 Weekly

Increase frequency if mite eggs are found

Orchard Map

- Property boundaries
- Boundaries of blocks, and block name or number
- Access routes
- Buildings and other physical landmarks. Toilets, taps for washing and drinking.
- Hectares
- Any hazards – drains
- Contact details
- Date of map

Intervention Thresholds

These change according to the stage of growth and whether the fruit is being exported or going to local market.

Thresholds have not yet been set on Aphids or Mites though there is **nil tolerance** for Mites or Mite eggs on export fruit.

INTERVENTION THRESHOLDS				
Pest	Dormancy to bloom	Bloom to fruit set	Fruit Set to Harvest	Postharvest to Dormancy
Aphids	?	?	?	?
Leaf rollers (field)	?	10%	10%	?
Mealy bug	10%	5%	5%	10%
Mites	?	?	?	?
Scale	10%	5%	5%	10%
Thrips	?	5%	5%	10%

Main Pests



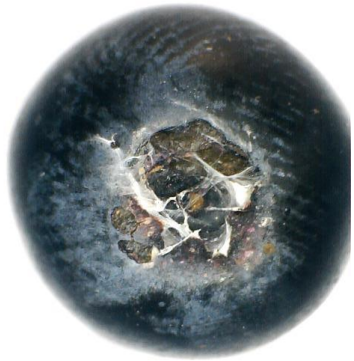
Individual Pests

Aphids



- **Peach Aphid** (*Myzus persicae*) are the most damaging. Look for signs of curling leaves. Aphid will be found on the tips of new growth, under new leaves or in flowerheads or fruit clusters.
- There is no threshold. Intervention is warranted as this insect can kill the plant.
- Control – chemical spray or
Introduce biological insect.





Individual Pests

Leafroller - Introduction



- * Several species of Leafroller
 - Light Brown Apple Moth
 - Greenheaded
 - Brownheaded

- * Light Brown Apple Moth (LBAM) is most common in Blueberries in Waikato.

- * Overwinter on young tips in Rabbiteye outdoors. Move onto new shoots or flower heads in Spring.

- * Look for rolled shoot tips or fruitlet clusters with webbing.

Leafroller - Lifecycle

Lifecycle

Egg → In rafts or masses of 20 - 80

Caterpillar → 5 – 6 instars or growth phases

Pupa → Non-feeding, allows change

Moth spreads to new host

All stages of the Leafroller are a quarantine issue for export.

Leafroller

Leafroller Caterpillar,
Leafroller moth,
Leafroller on shoot tips,
Leafroller eggraft



Individual Pests

Leafroller Thresholds & Control

- Use of Pheromone traps gives indication of presence along with visual monitoring of plants if Mating Disruption is present.
 - *Threshold = 10% if LR present on plants (Bloom/Harvest)*
- If not using Mating Disruption
 - *Threshold = 10 moths per trap per week (Bloom/Harvest)*
- If monitoring plants only
 - *Record as present if 1 or more LR seen on a plant (Bloom/Harvest)*

Control – Mating Disruption or Chemical sprays.



Individual Pests

Mealy bug - Introduction

- * Not often found on Blueberries.
- * Overwinter in crevices beneath loose bark.
- * Emerge in Spring.
- * Lifecycle takes about 8 weeks in mid-season.
- * 3 generations per year.
- * Quarantine issue – hide in calyx of fruit.
- * Suck sap and excrete honey dew = sooty mould.
- * Can cause stunted growth.

Individual Pests

Mealy bug – Signs and Symptoms

- * Heavy infestation = stunting, chlorosis, defoliation, wilting
- * Honey due
- * Sooty Mould
- * Powdery white wax in axil of leaf or sheltered place on plant
- * Ants



Individual Pests

Mealy bug – Thresholds & Control

- * Cultural – if small numbers present – squash them
- * Biological – No commercial biological controls in NZ
- * Chemical – sprays are available, can cause reduction in natural predators.

Time of year	Threshold
Dormancy to bloom	10% or more of branches inspected have mealy bug present
Bloom to fruit set	5% or more of branches inspected have mealy bug present
Fruit set to harvest	5% or more of branches inspected have mealy bug present
Postharvest to dormancy	10% or more of branches inspected have mealy bug present

Individual Pests

Scale - Introduction

- * Several species of scale:
 - * Greedy scale
 - * Black/Olive
 - * Chinese wax
- * Scale are a sucking insect
- * Easily overlooked as can look like part of the plant

Individual Pests

Scale - Lifecycle

Lifecycle

Egg → hatches as laid

Crawler → mobile stage, short-lived

Settled 1st and 2nd instars →

Adult

- Parthenogenetic with no males - all are females - at least in New Zealand.
- **Populations only increase slowly – c. 2 generations per season.**
- **Limited mobility - only crawler is not fixed to one spot.**
- Abundance one year is a good indication of abundance the next.
- Cosmopolitan. Very wide host range, including some shelter trees.

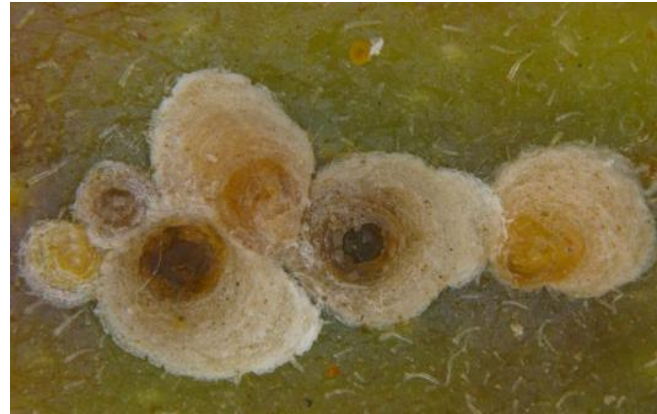


Individual Pests

Scale – Signs & Symptoms



- * Crawlers can be very hard to detect as only present up to 7 days
- * Honey Dew
- * Sooty mould
- * If Ants are present – look closely for Scale or Mealy Bug



Individual Pests

Scale – Threshold & Control

Checking for crawlers using double-sided tape on infected plants – check weekly.

Cultural Control – no cultural controls

Biological Control – no current biological controls

Chemical Control – spray using product from Appendix 3

Time of year	Threshold
Dormancy to bloom	10% or more of branches inspected have scale present
Bloom to fruit set	5% or more of branches inspected have scale present
Fruit set to harvest	5% or more of branches inspected have scale present
Postharvest to dormancy	10% or more of branches inspected have scale present

Individual Pests

Thrip - Introduction

There are 3 species of Thrip commonly found on Blueberries:

- * Greenhouse
- * Kelly's Citrus
- * Flower

Mostly found on leaves and flowers

Damage leaves, flowers and fruit

Flower thrip feed on pollen can cause fruit abortion



Individual Pests

Thrip - Lifecycle

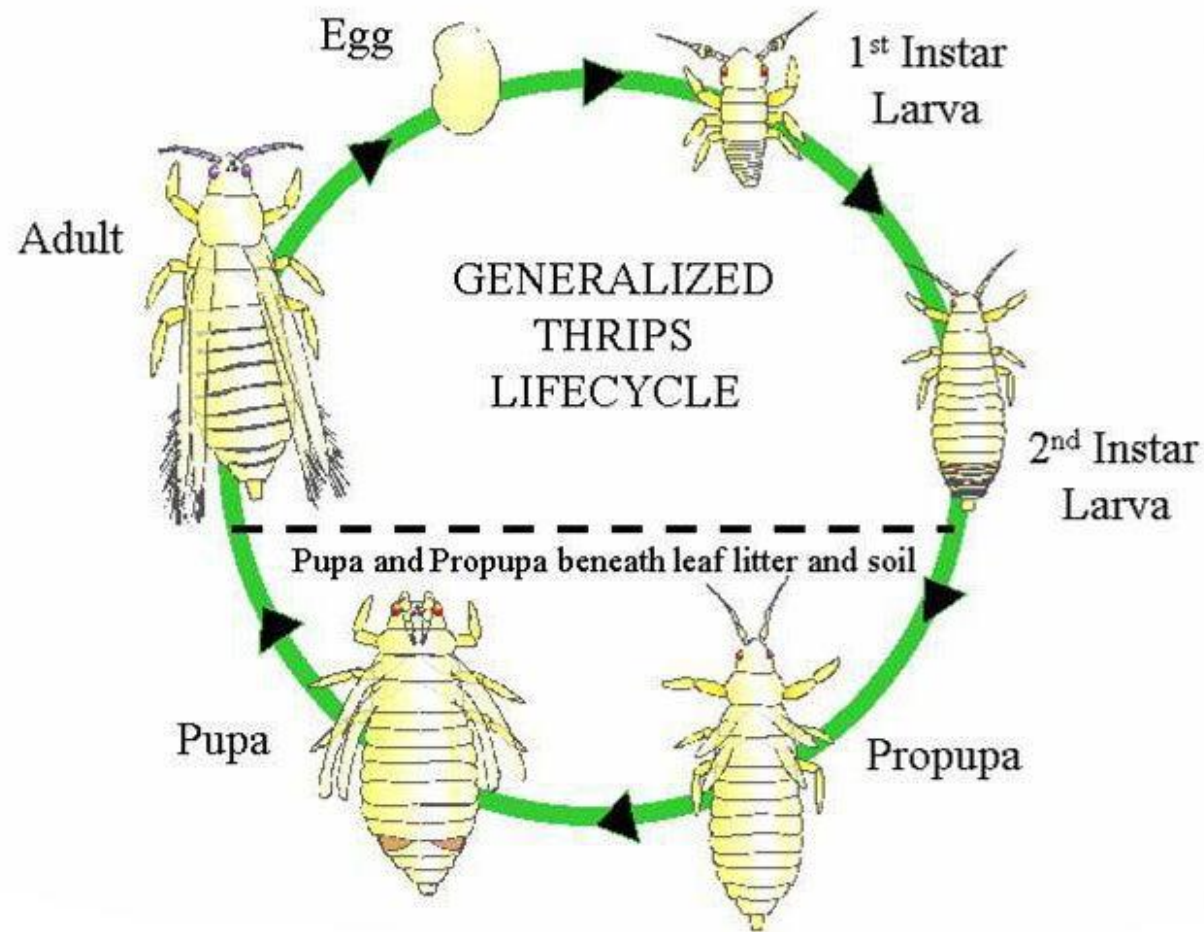


Image by Mark Hoddle, Extension Specialist and Director of Center for Invasive Species Research ©

Individual Pests

Thrip – Signs & Symptoms



- * Lifecycle can be about 5 weeks, depending on weather and temperature.
- * Usually less than 2 cm.
- * Greenhouse Thrip leaf bronzing and black excreta drops on underside of leaves.
- * Kellys Citrus Thrip leave distinct scarring seen on tops of leaves.
- * Flower Thrip leave no visible damage.
- * Easy to confuse with Springtail and Psocid or Booklouse (Psocodea)



Individual Pests

Thrip – Threshold & Control

Tap 5 flowering stems onto white surface:

Record as present if 1 or more Thrip seen on a stem

Cultural Control – no cultural controls

Biological Control – Cucumeris (Mite A), Hyper-mite, and Orius

Chemical Control – spray using product from Appendix 3

Time of year	Threshold
Bloom to fruit set	5% or more of branches inspected have thrips present
Fruit set to harvest	5% or more of branches inspected have thrips present
Postharvest to dormancy	10% or more of branches inspected have thrips present

Individual Pests

Mites - Introduction

- * Mites are found in many sizes and shapes.
- * Usually not clearly visible to naked eye – use lens or microscope to view.
- * All mites – predators, fungal feeders or pest are a quarantine issue for Australia.
- * Only 2 Spotted or 6 Spotted mite do damage – cause damage to leaves and could cause leaf-drop

Individual Pests

Mites – Signs & Symptoms

- * 2 Spotted mite – feed on leaves and will see a dusty surface under the leaves often with webbing.
- * 6 Spotted mite – feed on leaves – will see a purple staining along veins on underside of leaf. Only seen if in a block near Avocado.
- * Tydeid – most common mite – no damage seen. Is a fungal feeder.
- * Mite A (Cucumeris) – often used as a Biological control in blocks. Slightly larger than other mites.
- * Whirligig mite – a naturally occurring predator. Easily seen.
- * Snout mite – largest of predator mites. Easily seen.



Mites

From lower left:

Tydeid

Phytoseid predator

Czenspinksia

Agistemid predator

Tyrophagid mould mite

Two-spotted mite





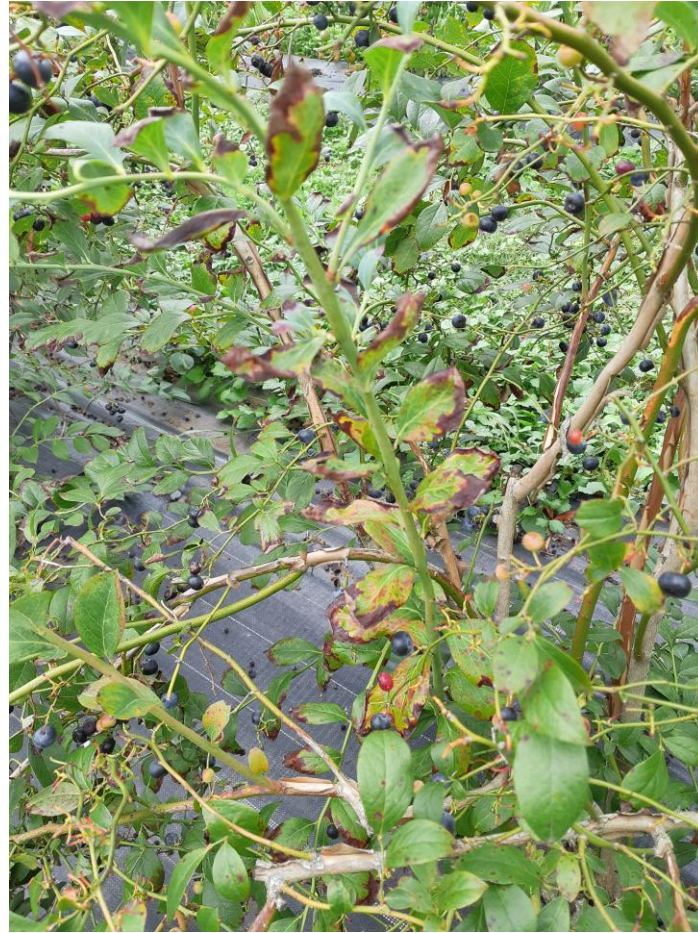
Mites

From lower left:

- Tydeid
- Two-spotted mite
- Snout mite
- Oribatid mite
- Six spotted mite



Main Diseases



Individual Diseases

Rust - Introduction

- * Blueberry rust can become an issue late season – reduce bud-set for following season through defoliation.
- * Some plants are more susceptible than others – refer to BBNZ IPM manual Appendix 1.
- * Start as reddish spots on upper surface, turn reddish-brown then develop orange-yellow spores on underside of leaf.



Individual Diseases

Rust – Threshold & Control

Record each branch inspected using the following:

- 0 = No rust
- 1 = Presence of rust
- 2 = 50% of leaves have rust
- 3 = 100% of leaves have rust

Note: if blueberries are going to Australia there is nil tolerance. Therefore treatment will probably be required.

Cultural – No cultural controls

Biological – see Appendix 2

Chemical – see Appendix 3

Time of year	Threshold
Bloom to fruit set	Average score is greater than 2 (Add all scores then divide by number of branches inspected)
Fruit set to harvest	Average score is greater than 2 (Add all scores then divide by number of branches inspected)



Individual Diseases

Botrytis - Introduction



- * Common in berries.
- * Mostly seen as blossom infection.
- * Seen during flowering in wet humid conditions.
- * Attacks flowers and may spread to stems.
- * Infected flowering can develop to fruit with postharvest rot.
- * Found on blossoms, twigs, fruit.



Individual Diseases

Botrytis – Signs & Symptoms

- * Tops die back, turn brown to black.
- * Blossom appear water soaked – brown.
- * Immature fruit shrivel and turn purple
- * Mature fruit become tan
- * In damp weather plant parts covered in “gray mould”.



Individual Diseases

Botrytis – Threshold & Control

Cultural – No cultural controls

Biological – see Appendix 2

Chemical – see Appendix 3

Time of year	Threshold
Bloom to fruit set (Sept – Oct)	If more than 10% of inspected stems show botrytis and rain or extended periods of relative humidity above 90% are forecast, then take action. If more than 20% of stems show botrytis take action regardless of weather conditions.

Individual Diseases

Botryosphaeria - Introduction

- * Fungal disease
- * Damage to areas of cane, whole shoots, whole plants.
- * Some varieties more susceptible to these diseases.
- * Overwinter on dead material.
- * Enter plant via cuts, wounds, growth cracks, leaf scars, direct contact with infected plant material.



Individual Diseases

Botryosphaeria – Signs & Symptoms

- * Can infect plant through winter injury, pruning wounds, damage from hail or herbicides.
- * Slightly sunken reddish/brown spots on infected bark.
- * Enlarge to form cankers
- * Bark dies and be pulled away from plant.
- * Leaf spots may be visible – necrotic spots, leaf wrinkled.
- * Cane dieback and plant dies.



Individual Diseases

Botryosphaeria – Threshold & Control

Cultural – Prune and destroy all affected cane. Remove from block and burn.

Biological – No biological control at this stage

Chemical – Use Protectant fungicides to try and avoid serious problem.

Time of year	Threshold
Dormancy to bloom	0% - Presence = Hygiene Prune
Bloom to fruit set	0% - Presence = Hygiene Prune
Fruit set to harvest	0% - Presence = Hygiene Prune
Postharvest to dormancy	0% - Presence = Hygiene Prune



Health and Safety in Blueberries

- Tunnels:
 - Heat – wear cool clothes, stay well hydrated, avoid heat over 35 degrees.
 - Honey Bees and Bumble Bees. Be careful around hives.
 - Support wires and structure for plants and tunnels.
 - Drip feeders and irrigation pipes.
- Outdoor blocks:
 - Heat – wear cool clothes, cover from sun, wear hat and use cool clothes.
 - Stay hydrated.
 - Work in cooler parts of day if possible.
 - Support wires and structures.
 - Peat ground – uneven.
 - Prunings on ground.
 - Drains and waterways.
 - Bird netting.

ALWAYS WASH HANDS BEFORE ENTERING BLOCK.

Next Steps

- You will be working with an experienced monitor until proficient.
- Complete in written and practical tests.
- Enjoy your time learning about the insects and diseases.

Thank you

Any questions?