Managing True Bugs in Production Nurseries

SUMMARY

The true bugs are a specific group within one insect order (Hemiptera: Heteroptera), the most widely recognised being stink bugs and mirids. There are around 40,000 species worldwide and about 6,000 in Australia, many of which are considered minor sucking pests in production nurseries. Some of the common species include the green stink bug, green vegetable bug, red banded shield bug, harlequin bug, Rutherglen bug, azalea lace bug, and the green and brown mirid bugs. These pest species are plant-feeders, with adults and nymphs using their sap-sucking mouthparts to pierce the plant tissue and suck up sap (xylem or phloem depending on the species). Perhaps more important is the damage caused when they inject saliva into the plant that can cause dieback of growing tips. True bugs can feed and damage leaves, seeds (causing non-viability), fruit and growing tips of a range of vegetables, ornamentals and tree crops. Not all true bugs are pests, there are many species that are predators, and some may feed on nectar.

Harlequin bug, *Dindymus versicolor*, infestation on a weeds. Photo by Lesley Ingram, Bugwood.org

BIOLOGY

The lifecycle of true bugs is quite varied, particularly under different climates. For instance, some tropical species may reproduce continuously, with many generations every year. Other species, particularly in cooler climates, may have only one or two generations per year and some species, like the green vegetable bug, have three to four generations during the warmer months when the temperature is ›25°C in Queensland. When it is cool many true bugs become inactive and the adults shelter in leaf litter, wild hosts, under bark and on weeds.

True bugs usually lay eggs on the underside of the plant foliage in clusters or egg masses. Some species, such as the Rutherglen bug will lay eggs in flowers, soil and seed. Mirid bugs lay individual eggs in the leaf and petiole of the plant. In general, eggs hatch between 4–10 days.

True bugs go through five nymphal stages before becoming an adult. First instar nymphs hatch from the eggs and look like small, wingless adults. The nymphs go from one stage to the next by moulting (changing their skin). With each moult

they get bigger and their body changes colour. First instars do not feed and remain clustered together around the egg mass. Second instars begin to feed and by the third stage they are slightly larger in size. When they reach the fourth and fifth stage, feeding on plants can result in as much economic damage as from adults. The development time can vary for each species. For instance, each nymphal stage of a mirid can take 2–3 days and the adults can live for 3–4 weeks. Green vegetable bug takes about 30 days to become an adult. Adults and feeding instars feed on foliage, pods, fruit and seeds of plants.

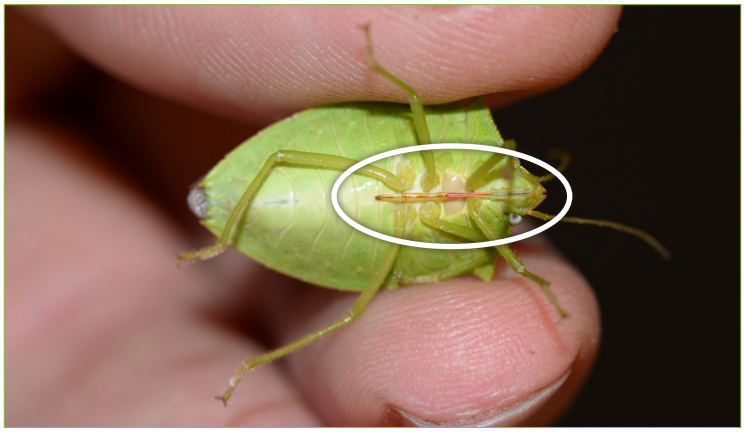
Because there are many true bug species and because feeding nymphs can also cause damage it is often helpful to identify the species, at least when it is a regular or significant pest. This will help gather information on when a species is likely to be active, the number of generations per year and the overwintering hosts, such as weeds, old crops or even non-cropping areas that may be present around your nursery. This information can help break the lifecycle and assist in proactive management of the pest.

APPEARANCE

Adults are small to medium sized insects, often between 5–20mm in length (though some species are larger or smaller). Their eyes are large and well separated and they have sucking piercing mouth parts that come out from the front of the head. The mouthparts are relatively long, extending between their legs when at rest (this is easily seen without magnification, particularly for larger species). The antennae are thread like and never exceed five segments. Adults have two pairs of wings, with the forewing hard at the base and membranous at the tip, which can appear triangular. The forewings sit flat over the abdomen, are relatively hard and may appear superficially similar to beetle wings. They are generally widest across the shoulders where the wings attach. Behind their head there is usually a prominent shaped triangular shield (called the scutellum). This shield sometimes meets the membranous portion of the forewings, giving the appearance of two triangles, or diamonds, meeting at their tips.

Their body shape is variable, but often dome, stick, shield or spindle shaped. Stink, green vegetable, red banded shield and harlequin bugs are usually shield shaped. Mirids are oval or elongated with a triangle shaped segment at the base of their wings and Rutherglen bugs have a pear-shaped body.

Eggs vary in number, colour and shape depending on the species. Eggs can be laid in rows, masses (egg rafts) or



Stink bug showing long and obvious sucking mouthparts extending between its legs, photo by Joseph LaForest, University of Georgia, Bugwood.org.

Various stages of green vegetable bug, *Nezara viridula*. Adult with parasitic fly eggs just behind its head (left: photo by CSIRO Archive, Bugwood.org). Different sized nymphs (centre: photo by Russ Ottens, University of Georgia, Bugwood.org). Egg raft (right: photo by Herb Pilcher, USDA Agricultural Research Service, Bugwood.org)

individually. For instance, green stink bugs can lay between 5–15 eggs in a mass, while green vegetable bugs can lay between 5–100 eggs.

Nymphs resemble wingless adults although their colour and markings may be very different. Sometimes the nymphal stages will have projections on their body that adults do not have, or may be a slightly different body shape. True bugs go through five nymphal stages in their development cycle and often live and feed in the same habitat as the adults.

DAMAGE

Because of their specialised piercing and sucking mouthparts true bugs do not bite chunks out of a plant like caterpillars and beetles. Instead, feeding nymphs and adults use their mouthpart to puncture the plant tissue and suck the contents. In small numbers, they are rarely problematic in nursery crops. However, if larger numbers occur significant damage is possible, particularly if feeding causes the growing tips to dieback or wilt. They can also cause seed damage and abortion, which can be an issue for nurseries reliant on seed collection.

Stink bugs mainly feed on buds, leaves, fruit, stems and seed pods. Leaf feeding causes them to become yellow and dry, whilst on the pod, pale rings (halo spots) can form which sometimes cause the pod to abort, be deformed or marked by dark depressions (pits). Feeding on the fruit can leave slight depressions, causing the flesh underneath to become brown (fruit spotting) and allow for secondary pathogens to infect fruit (which may infect seed). Mirid bugs can cause fruit distortion and flower marking, the damaged tissue can blacken, and the growing tip can die. Rutherglen bugs also cause shoot wilting and large numbers will suck the leaves and terminals sometimes causing the entire plant to wilt. Azalea lace bugs suck the juices from ornamental crops, causing white or yellow spotting, which eventually gives a silvery mottled appearance to the whole leaf. As they feed, they also leave behind tiny black, hard shiny droppings.

True bugs are considered poor vectors of plant pathogens. Bacteria are the most likely pathogen to be vectored by this group of insects and is not particularly widespread. Phytoplasmas are not known to be vectored by mirids or Rutherglen bugs. Refer to further reading for more information on this group as pathogen vectors.

Mirid damage on daisies, photo by Whitney Cranshaw, Colorado state University, Bugwood.org

HOST RANGE

Each species has a range of plants that they may feed on, some more than others. Green vegetable bugs feed on vegetables and fruits including silver beet, beetroot, citrus, carrots, beans, macadamia, passionfruit, stone fruit, corn and many Solanaceae crops, including weeds (where adults overwinter). Green stink bugs feed on stone fruit, mulberries, grapes, beans, tomatoes, capsicum, legumes and seeds. Mirid bugs are a serious pests of many legume crops and will also feed on wild turnip, verbena and thistles. Harlequin bugs are pests of apples, stone fruit, pears, figs, apples, grapes, berries and many vegetables such as asparagus, tomato, cabbage, squash and beans. Rutherglen bugs are pests of carrots, beans and Solanaceous crops, whilst the azalea lace bug feeds on a range of ornamental crops such as azaleas, rhododendrons and flowering quinces. Some species may only feed on a small number of species or genera, e.g. the bronze orange bug only feeds on *Citrus*.

PREDATORY TRUE BUGS

There are many different predatory true bugs that suck out juices from pest insects. Most of them are not host-specific and will feed on many different pest insects in the nursery. Some of these are:

Assassin bugs are easy to spot because of their narrow neck, sturdy build and curved proboscis (mouthpart). They inject a lethal saliva that liquifies the inside of their prey, which they then suck out. Take care if handling these insects as their bite can be very painful.

Damsel bugs have long slender light brown bodies that taper towards the head. They have large eyes, long antennae and feed on moth eggs and small larvae, aphids, leafhoppers, mites and mirid bugs.

Glossy shield bugs are shiny and brown and have a shield shaped body with patterned dark brown and small yellow markings. Their eggs are black with short white spines around the rim, similar to predatory shield bugs, laid in masses of around 50 eggs. They feed on various caterpillars including *Helicoverpa* and loopers.

Predatory shield bugs are small grey-brown, shield shaped bugs with bulging spines on their shoulders. Their eggs are black with long white spines around the rim that are laid in irregular shaped masses. They also feed on caterpillars.

Pirate bugs are small black bugs with white banded markings on their wings. They feed on thrips, small larvae and moth eggs.

PREDATOR OR PEST?

Predatory shield bug (Photo by Frank E French, Georgia Southern University, Bugwood.org)

Plant feeding, redbanded stink bug (not present in Australia) (Photo by Russ Ottens, University of Georgia, Bugwood.org)

Distinguishing between pests and predators can be difficult, therefore the best option is to research information available online (refer to further reading) and collect specimens to help identify the bug if necessary.

- **Collect** specimens into a container with some leaf material that may contain other insects. This can be as simple as a soft drink container placed over a small plant. Put holes in the container and glue screen to it (Selleys All Clear is very good for this purpose), or purchase insect cages online, e.g. from Australian Entomological Supplies.
- **Observe** the insects. Pop them on the desk of an interested colleague that has the opportunity to glance up at them periodically (e.g. office staff). Do they eat the plant, each other or pests that may be present?
- **Contact** your local Department of Agriculture or diagnostic laboratory, e.g. Grow Help Australia. If possible, send pictures (that are in focus) of the insect via email in the first instance.

MANAGEMENT

A small number of pest species are unlikely to cause major problems, but relatively high numbers may require some control to stop serious damage, particularly if the crop is susceptible. The most important tactic is to know what is happening in the nursery. Monitor plants during critical seasons when populations are likely to increase (typically spring, summer and autumn). Look for eggs under the leaves and check the plant for nymphs and adults on a regular basis to determine if populations are increasing. This will enable you to determine if significant damage is likely to occur and identify the control options you may need to use. Learn to recognise the eggs of predatory species versus those known to be pests in your region; egg rafts are easily removed if necessary.

Depending on the species, certain areas of the nursery may be frequented more than others, and this may vary with the time of year. For serious pests, learn where they are likely to originate and where they may frequent in and outside of the nursery. For instance, harlequin bugs can swarm in large numbers from native tree trunks, trellis and hail net posts and sheds. Rutherglen bug can breed on various weeds and reach plague numbers in spring and summer, then move to other areas and damage many crop lines.

Cultural practices that can reduce pest pressure from true bugs (and other pests) include the following.

- Control weeds around the nursery and alternative hosts of pest species. Remove unsaleable plants from the growing area.
- Remove overwintering sites. This can include wood piles and other equipment.
- Encourage natural enemies using banker plants.
- Avoid use of broad-spectrum pesticides and treat hot spots whenever possible.
- Monitor crop health, pests and diseases regularly, giving greatest priority to high risk plants and pests.
- Modify planting times to limit high risk periods of the pest.

- Use screen houses to limit entry of the pest. Very fine screen mesh (i.e. small enough to keep thrips out) is available. The system should be designed in such a way as to allow sufficient ventilation.

There are a number of pesticides available when economic damage is expected. Control should focus at just after hatching, targeting newly emerged nymphs before they begin to feed. Pesticides should be used selectively, alternating between classes to ensure prolonged usefulness and to avoid resistance. There are several active ingredients that are registered against true bugs for use in production nurseries. Labels are often specific to particular species on ornamental or certain families of plants, but some labels are very general, e.g. bugs. Therefore, check each label carefully before applying to ensure that it applies to your situation. Products available include many broad-spectrum products, e.g. carbaryl (1A), maldison (1b), methidathion (1B), methomyl (1B – PER84953 and PER82428), omethoate (1B); alpha-cypermethrin (3A – PER81707), acetamiprid (4a) (PER86931 also acetamiprid + novaluron (15), imidacloprid (4A), dinotefuran (4A PER84742) and azadirachtin. There are also a small number of relatively low risk products available including emamectin (6 – PER81707), Flonicamid (29 – PER83964) and sulfoxaflor (4C PER85011).

Some 1B products may become unavailable following a review of this group of insecticides by the APVMA. Group 4 products are known as neonicotinoids and, if applied to plants, may preclude their sale to certain markets. Label registrations and minor use permits can be searched at the APVMA website.

BIOSECURITY

Many true bugs that are exotic to Australia are serious plant pests. One that poses a great risk to Australia is the brown marmorated stink bug (BMSB), which is known to feed on more than 300 hosts including apples, beans, citrus, corn, figs, grapes, peaches, pears, raspberries, soybean, some ornamental plants and tomatoes. BMSB is not just another stink bug, its establishment in Australia would be devastating to agricultural crops, nursery stock and ornamental plants. In addition, it would be extremely difficult and expensive to manage due to its broad host range and is a significant nuisance pest; large numbers of adults move into buildings and homes before winter. The smell produced can cause allergic reactions in some people. If you observe a pest that you suspect is an exotic species, call the **Exotic Plant Pest Hotline on 1800 084 881**.

FURTHER READING:

There are many resources available online and from your local library. A small selection

- Pest ID tool (information on many bugs)
- Key to Australian stink bugs and photographs of many stink bugs.
- Heteroptera as pathogen vectors
- BMSB identification guide
- Mirid factsheet and identification
- Rutherglenn bug factsheet
- Webinar on beneficial and pests insects

Brown marmorated stink bug (*Halymorpha halys*) adults and nymph, photo by Gary Bernon, USDA APHIS, Bugwood.org

Bronze orange bug adult (notice the shield shaped body) (left) and the tip wilt damage they caused (right).

This document was prepared by Madaline Healey (University of Sunshine Coast) and Andrew Manners (Agri-science Queensland, Department of Agriculture and Fisheries, Ecosciences Precinct, GPO Box 267, Brisbane QLD 4001). It has been produced as part of the nursery levy and Hort. Innovation funded project 'Building the resilience and on-farm biosecurity capacity of the Australian production nursery industry (NY15002)' in 2019. All photos by DAF, unless otherwise stated.