6. Occasional Pests

Ants

Ants are easily recognized by their elbowed antennae (bent in the shape of an elbow) and narrow waists. They range from 1.5–6 mm long.

Ants are attracted to sweet substances and therefore may be a problem in greenhouses where insect feeding has produced honeydew or where flowers have nectaries. They can also jeopardize biocontrol programs against aphids by protecting the aphids against attacks from natural enemies. Treat all ant trails or nests located in or near the greenhouse. Flooding nests with insecticidal soap and using household boric acid baits can provide some control.

Beetles

Beetles comprise the largest order of insects, but very few are pests of greenhouse ornamental crops. There are two, however, that are important to note.

The Japanese beetle (JB) is a quarantine insect pest found in parts of Ontario. The adult beetle is brown with a metallic green sheen and measures about 1 cm long. It has a number of distinctive white tufts at the edge of its wing covers, along each side of its body. The beetle larvae live in the soil and are C-shaped with brown heads and three pairs of legs. The mature larvae are about 2.5 cm in length. The quarantine status of this beetle means that its movement and that of infested plants, soil and related matter are regulated to help prevent further spread into uninfested areas. While not a major pest of greenhouse crops in Ontario, in some situations it can have an impact on both domestic and export movement of plant material, depending on the crops being grown and the facility in which they are grown. Some crops such as grasses and sedges are of particular concern, but growers of any greenhouse crops who ship to regions without JB (or that have a lower infestation ranking than Ontario) must be certified by the Canadian Food Inspection Agency (CFIA). Contact your local CFIA office (see Appendix D. *Other Contacts* on page 155) for more information.

The second beetle of importance is the black vine weevil (BVW). Weevils (or snout beetles) have a hard body with a snout and elbowed antennae. Adult BVW do not fly. They are dull brown to black, about 9 mm long with fine ridges along the back. The larvae are legless grubs, white with reddish-brown heads, and are found among roots of various bedding plants.

Adults actively lay eggs in June, and the larvae feed on the roots for the rest of the season. The larvae will attack a wide range of plants including rose, geranium, fern, gardenia, kalanchoe and rhododendron. Although the adult does not fly, it can move to new plantings easily.

Use control measures in late May and June. Inspecting the roots of all material introduced to the greenhouse may prevent an infestation.

Caterpillars/Moths

Several different insects have caterpillar stages that damage greenhouse crops. These include leafrollers, armyworms, cutworms, loopers, fruitworms, hornworms and leaf tier and stalk borers. The adult moths of these caterpillars are often attracted to greenhouse lights in the summer and will lay eggs that hatch into the caterpillar pest.

Duponchelia fovealis is a small, nondescript, greyish-brown moth with a wide host range that includes many greenhouse ornamental crops. It is Mediterranean in origin but has become established in greenhouse production in many northern European countries. Between 2005 and 2008, a number of Ontario greenhouses experienced outbreaks of this moth. While at one time it was regulated by CFIA as a quarantine pest, that status has changed and it is now simply considered an economic pest (the same status as other common greenhouse pests). In 2011, it was also discovered in a number of U.S. states, with especially large numbers in California and Florida. Host crops include rose, begonia, cyclamen, gerbera, kalanchoe, anthurium and poinsettia. Infestations and damage can be minimized using a combination of biological control and chemical control.

Armyworms and cutworms feed directly on plant foliage and may cause considerable damage. Both insects are dark brown or grey with longitudinal stripes. Cutworms burrow into the soil during the day and come out to feed at night. Use insecticides registered for caterpillars to bring armyworm and cutworm infestations under control.

Cabbage loopers commonly attack certain greenhouse crops, such as alstroemeria, between July and September. Cabbage loopers are green with faint white longitudinal body stripes.

Stalk borers bore into plant stems, making them more difficult to control.

Another damaging borer, the European corn borer, can be a serious pest of greenhouse vegetables and a potential pest of some greenhouse ornamental crops, infesting many fruits before being detected. They normally begin infestations in spring around May to early June. There are two generations of this borer in southwestern Ontario and one generation elsewhere in Ontario.

Pheromone traps can be used to detect certain moth species, and light traps can be used to monitor many species.

If you detect these pests early, begin control before the small caterpillars start feeding. Screened vents help prevent the entry of moths and a good inside/outside weed control program will reduce potential infestation sites. Apply a bacterial insecticide containing *Bacillus thuringiensis kurstaki* (Btk) for control of loopers and most leaf-eating caterpillars that are not miners.

Grasshoppers

Grasshoppers are easily recognizable and occasionally invade greenhouses. They will feed on almost any vegetation and, in large numbers, can destroy plants. Grass and weeds near greenhouses may allow a grasshopper infestation to occur, usually in late summer and fall.

Mealybugs

Two distinct groups of mealybugs are found in greenhouses. The more common foliage-feeding mealybugs are white, wax-covered, scale-like insects with piercing mouthparts that remove plant sap.

Mealybugs produce large amounts of honeydew. The females (1–3 mm long) lay large numbers of eggs in masses of wax. Active immature mealybugs called crawlers hatch from these eggs in 5–10 days. The nymphs mature into reproductive adults in 6–8 weeks.

Damage is caused in a variety of ways: the removal of plant sap, the growth of black, sooty mould fungus on the honeydew, and the unsightly appearance of the waxy secretions.

Mealybugs are serious greenhouse pests because the crawlers spread rapidly and exist under bud scales and within leaf axils. Males, present in low numbers, are small, winged insects.

The second group is the root-feeding or subterranean mealybugs, which are found within masses of wax, on the roots of wilting or yellowing plants. These insects are very similar to those described above, but secrete less wax over their bodies.

Carefully inspect all plant materials entering the greenhouse for the presence of mealybugs. The crawler stage of all mealybugs may spread to other plants through contaminated equipment or via water leaching through pots. Most infestations result from introduced contaminated material.

Biological control agents for this pest include the Australian lady beetle, *Cryptolaemus montrouzieri,* the common lady beetle, *Hippodamia convergens,* and a parasitic wasp, *Leptomastix dactylopii.*

Midges

These small (1 mm), delicate flies lay eggs in the stems, leaves or flower buds of ornamental plants. The larvae burrow into plant tissue, causing swellings of stems, galls on leaves or collapse of buds.

Swede midge affects Brassica crops. It is primarily a pest of field vegetables, but Brassica bedding plants (cabbages, broccoli, etc.) and ornamental cabbages and kale are also affected. The adult is a small fly (1.5–2 mm long) that lays its eggs in the growing point of the plant. The larvae feed on the developing leaves, resulting in distortion of the growing point and providing an entry point for disease. Swede midge was first found in southern Ontario in 2000. It is now present in most areas of Ontario and Quebec and has also been found in Nova Scotia and Saskatchewan. Originally a quarantine pest in both Canada and the USA, it was deregulated in 2009 and is now treated in the same way as other economic pests.

The rose midge is an occasional problem for Ontario rose growers as it can quickly cause serious losses, but it is an infrequent pest in greenhouses. Flower buds bend or become distorted, then turn brown and die. The rose midge is most abundant during the hot summer months, when it enters greenhouses from infestations on outdoor roses. Eggs hatch in approximately two days; larvae mature in 5–7 days and drop to the soil to pupate in another 5–6 days. The adult midge then emerges and lives for only a couple of days. Pesticide sprays for the adult stage are ineffective. For rose midge, use a foliar spray of the systemic insecticide Orthene to control larvae in the base of the buds.

Mites

Cyclamen mite/broad mite

Cyclamen mites and broad mites are microscopic in size. They are no larger than 0.25 mm long and cannot be seen without magnification. The female's hind pair of legs is thread-like, while those of the male are pincer-like.

The pale brown female mite deposits approximately 100 eggs, 80% of them female, around the crown of the plant or along the midrib of unfolded leaves. The mites develop through the six-legged larval stage and quiescent nymphal stage with eight legs, similar to the two-spotted spider mite. The life cycle from egg to adult is about two weeks but varies depending on the temperature.

Distorted leaf tissue and/or small blasted or twisted flower buds and flowers are usually the first damage symptoms. Foliage will often show purplish areas. The cyclamen mites feed around the crowns of plants or in the flower buds. Cyclamen is usually the most seriously injured, but many foliage and bedding plants, as well as other potted crops, can be attacked.

Tomato russet mites

The adult mite is 0.2 mm long and 0.05 mm wide. Because of its small size, the mite is not noticed on plants until it reaches damaging levels. At that time the stems, leaves and fruit appear beige or bronze as a result of the high mite population density.

Russet mites appear to thrive under dry conditions. The life cycle from egg to adult takes about six days at 27°C and 30% relative humidity (RH). Females can lay approximately 16 eggs during their lifetime, which extends for about three weeks after the immatures become adults. Russet mites feed first on stems, then on leaves.

Damage symptoms include yellowing, curling, and wilting of leaves, flower abortion, and bronzed, cracked fruit. If uncontrolled, the tomato russet mite will eventually kill the plant.

Alternative hosts for this pest include nightshade, petunia and several other species of the tomato family.

No early detection techniques exist for this mite. Once established in a crop, they easily spread by hands, equipment and clothing.

There are no current options for biological control. Work to date indicates that two predatory mites, *Amblyseius fallacis* and *Typhlodromus occidentalis,* are potential biocontrol agents.

For more information on mites, see OMAFRA Factsheet *Mite Pests in Greenhouse Crops: Description, Biology and Management.*

Scale Insects

Scales are minute, wingless insects up to 3 mm long. They have piercing/sucking mouthparts and an oval or hemispherical body shape. Scales secrete a characteristic waxy or scale-like covering over their bodies. Males, which are rare, have wings.

Most scales are females that lay hundreds of eggs under their immobile scale. When these eggs hatch, the small crawlers migrate to new feeding sites. Damage is caused by the removal of sap from plants, which results in yellowing, wilting, stunting and distortion of plants.

Several species have been identified on greenhouse ornamentals in recent years, mainly due to the increased quantities of foliar stock being imported from tropical areas. Many newer introductions of fern, palm and ivy plants are susceptible to scale infestations.

To help control scale, quarantine, check and treat or destroy infested material.

Biological control agents for soft and armoured scales include two small lady beetles, *Chilocorus nigritus* and *Lindorus lophanthae*. A small parasitic wasp, *Metaphycus helvolus,* has been reported to help manage several species of soft scales. Another wasp, *Aphytis melinus,* can be used for several species of armoured scales.

Ivy scale and greedy scale

These scales are similar in appearance, pale and circular with a prominent yellowish nipple in the centre. Both attack a wide variety of greenhouse plants such as ivy, palm, ficus and fuchsia.

Fern scale

The shield of this scale resembles an oyster shell. It is brown with a lighter terminal nipple and is usually found on ferns and other foliage.

Brown soft scale

Female scales are flat, brown and pliable. They have a wide host range and produce large amounts of honeydew that promote the development of black, sooty mould fungus.

Hemispherical scale

The scale covering on this species is very convex, brown and shiny. Ferns are a favourite host.

Slugs and Snails

Slugs are dark grey, soft-bodied creatures, 1.3–10 cm long. They glide over plants leaving a shiny trail. Slugs eat the foliage of many greenhouse plants, shredding the leaves and sometimes completely destroying a plant.

Snails are similar in colour and appearance to slugs, except that a snail bears a noticeable shell. The shell varies in colour and markings, and may be 1.3–5 cm in diameter. Snails are particularly injurious to seedlings. They eat holes in the flowers and leaves of many plants, leaving them shiny and tattered.

Individual snails may lay up to 100 eggs, depending on the species. Slugs lay fewer eggs that may remain unhatched for long periods under dry conditions. They hatch upon return of moist conditions.

Both slugs and snails need a damp environment and fairly humid air to survive. They avoid the sun and emerge primarily at night or on cloudy days. During the day, slugs hide under boards and rocks or in other damp, shady places. If the air or substrate is dry, a snail can pull its entire body into its shell and remain dormant for up to four years.

Indirect control strategies for these organisms should focus on reducing their favoured habitat.

Remove boards, bricks, etc. that are in contact with the ground, or arrange them to permit proper air circulation around and under them.

Maintain a plant density that permits sunshine to penetrate to the ground level, provides good air circulation, and allows the plant media to dry.

Where a low plant density is inappropriate, use a ground cover unattractive to snails (e.g., rough-cut cedar chips or crushed eggshells). Sawdust and diatomaceous earth are effective barriers if kept dry.

Various devices can trap or attract slugs and snails for subsequent destruction. Set traps using beer or a mixture of water and commercial yeast as an attractant. Crush snails or slugs and cover with an inverted flower pot, or invert grapefruit halves to attract slugs and snails.

Chemical controls involve pesticides formulated as baits. Metaldehyde is toxic and must be inaccessible to children and pets. Prolonged use of baits is likely to produce a local bait-resistant population.

Sowbugs/Pillbugs

Sowbugs and pillbugs have grey, flattened, oval bodies up to 13 mm long with seven pairs of legs. Sowbugs have two small, tail-like structures that the pillbugs lack.

They are both small decomposers but occasionally feed on roots and tender plant parts, causing seedling damage. They feed at night and hide during the day, preferring dark, moist areas with abundant organic matter.

Sterilizing soil and eliminating decaying plant material and moist areas will help prevent a build-up of these pests. Many strategies used for snail and slug control also suppress sowbug/pillbug populations.

Springtails

Springtails are tiny, wingless insects 2–6 mm long. They range in colour from white, grey or yellow to red, orange, purple, brown or mottled hues.

They are usually found on the surface of moist soil, in pots or within the soil, and have a spring-like apparatus at the end of the abdomen that allows them to spring into the air.

Most springtails are scavengers, feeding on decaying organic matter, algae or fungi. Because they do not usually feed on living plant material, chemical controls are rarely necessary.

Striped Cucumber Beetle

Striped cucumber beetles are yellow-green beetles, approximately 6 mm long, with three longitudinal stripes. These beetles and their relative, the spotted cucumber beetle, carry the bacteria *Erwinia tracheiphila,* which causes bacterial wilt in cucumbers and related species such as melons and squash, which could be an issue for bedding plant growers with vegetable transplants.

Striped adult cucumber beetles overwinter outdoors under old leaves, old logs or garbage. They emerge the following spring, mate, feed for several weeks, and then lay orange-yellow eggs in the soil at the base of plants.

Larvae usually hatch in 10 days, then feed on the roots of plants for 2–6 weeks. Fully grown larvae are about 9 mm long. Pupation takes place in the soil and adults emerge after approximately one week. There is only one generation per year in Ontario.

The adult beetles damage plants by chewing on leaves, stems and fruits. However, the greatest damage comes from the wilt-causing bacteria they often carry, which can survive the winter in their gut. In the spring, the beetles inoculate plants with the disease as they feed on the plant tissue.

There is no control for the wilt once a plant is infected. Inoculated leaves generally wilt within 5–6 days, and the plant dies within two weeks. Striped cucumber beetles can also transmit cucumber mosaic virus.

The best control comes from insect barriers installed over all greenhouse openings to exclude the adult beetles.

Symphylans

Symphylans are found under stones, in rotting wood and in moist soil high in decaying organic matter. They are small white creatures resembling centipedes, with long, slender, white bodies (1–5 mm long), long antennae and 10–12 pairs of legs (centipedes have 15 pairs of legs).

While centipedes are beneficial predators that prey on many insects, symphylans can feed on the roots of plants. On many crops, damage appears as tiny black marks on the roots where a hemispherical piece of tissue has been scooped out. Injured roots become stubby and the plant becomes stunted. Damage caused by symphylans to roots and root hairs provides entry points for root-rotting diseases.

Steam sterilization of soil or heating of soil by solarization can help to reduce populations.

Tarnished Plant Bug *(Lygus)*

These bugs are about 6 mm long, yellow-brown, with piercing mouthparts. The adults and their green nymphs feed on many crop and weed species. They can be serious pests to greenhouse crops such as chrysanthemum, gerbera, cucumber and pepper.

Eggs are inserted into plant tissue and the small nymphs complete their life cycle in about four weeks. They damage new growth by causing foliage distortion and dead or distorted flower buds. They are most active during the summer and fall, and may gain access to the greenhouses from surrounding weedy areas.

Tarnished plant bugs tend to appear in crops where pesticide use is minimal. Eliminating weeds that may serve as spring/summer hosts or overwintering sites will lower overall populations. Screening vents will help control this pest.

For more information on *Lygus* bug, see OMAFRA Factsheet *Managing the Lygus Bug in Greenhouse Crops.*

Tomato Pinworm

The tomato pinworm (TPW) is a semi-tropical pest that can infest tomato crops in Ontario, and as such could be an issue for bedding plant growers producing vegetable transplants. It inflicts damage by feeding on tomato leaves and fruit. Other suitable hosts for TPW are potatoes and eggplant. Weeds such as nightshade and its relatives may also serve as hosts.

The adult is a small, light-brown moth about 6 mm long. It is generally more active at night, laying most of its eggs on younger leaves during the first few nights of activity. Newly hatched larvae walk on the leaf surface for a very short time before entering the leaf to start mining.

There are four larval stages, with the first two spent in the leaf. The third and fourth stages may be found between two leaves knitted together, in a leaf that has been folded over or inside fruits. Larvae characteristically enter fruits just beneath the calyx.

Mature larvae may either remain on the plant or drop to the ground to pupate. On the ground, pupation usually occurs within the top 15 cm of soil. Tomato pinworms do not diapause. Their development continues year-round, slowing during cold weather periods. Development time from egg to adult usually ranges between 28–70 days, depending on temperature. The life cycle is completed in 28 days at 24°C, and can be as short as 19 days at 30°C.

For control:

- Inspect all seedlings for larval feeding damage.
- Destroy all old infested plants and any debris from infested crops.
- Monitor for the presence of tomato pinworm with pheromone or light traps and by inspecting crops regularly. Note that pheromone traps attract only male tomato pinworm, whereas light traps attract both sexes of tomato pinworm and many other insect species.
- Hand-pick damaged leaves and destroy larvae within the mines.
- Destroy weeds and stray tomato seedlings inside and around the greenhouse.
- Install insect barriers over vents.

Vertebrate Pests

Rats and mice may be very destructive in the greenhouse. They feed on almost any food source and can cause damage by gnawing and burrowing.

Norway rats and field mice are the most common vertebrate inhabitants of greenhouses. Baits containing rodenticides such as chlorophacinone, diphacinone, warfarin and zinc phosphide can offer some control. The first three chemicals are anticoagulants and multiple doses are usually required. Zinc phosphide is not an anticoagulant and is more acutely toxic. A single dose can kill. Ensure that the toxic baits are placed in covered stations where they cannot be accessed by pets and children.

To minimize the development of rodenticide resistance, particularly to the anticoagulants, always use a variety of control measures. For example:

- Store all potential food material in tight-fitting containers.
- Use many traps where there are signs of activity, placing one trap every 2–3 m along walls.
- Set traps at right angles to the wall, with the bait and trigger facing the wall.
- Handle traps with gloves to avoid contaminating them with human smells.
- Try different baits. Suggested baits include peanut butter mixed with oats, raisins, gumdrops, any other sticky food material and cotton that provides nesting material.
- Maintain several female cats, which tend to be more predacious than males, as biological control agents.

Root Nematodes

Plant parasitic nematodes are small (less than 1 mm long), worm-like organisms that live in the root media. They are broadly divided into two groups: ectoparasites, which attack plants externally, and endoparasites, which spend at least part of their life cycle within the plant tissue.

All parasitic nematodes have stylets through which they inject saliva into plant tissue. The saliva causes most of the damage, causing necrosis or the proliferation of giant cells that produce galls.

Nematodes cause damage mainly by reducing the ability of plants to absorb water and nutrients. Above-ground symptoms of nematode damage include weakened plants that wilt in the sun, yellow or pale green leaves and stunted fruit or flowers.

Where nematicides are used between crops, nematode infestations often recur because of insufficient penetration of the chemicals into the lower soil levels. Soils treated in this manner should always be properly aerated to avoid subsequent plant damage.

Root-lesion nematode, *Pratylenchus penetrans* (Cobb)

This endoparasitic nematode is native to Ontario soils and can attack many floral and vegetable crops. All stages are thread-like and invisible to the naked eye.

This nematode invades the outer layers of young roots, causing small brown-to-black elliptical lesions that merge to discolour the roots and subsequently kill them.

Northern root-knot nematode, *Meloidogyne hapla* (Chitwood)

This is another endoparasitic nematode native to Ontario soils. It attacks almost all types of vegetable crops and many floral crops, particularly rose, African violet and geranium. Early larval stages are thread-like and invisible, while later stages and adults are peanut- to pearl-shaped and just visible when dissected from roots.

This nematode invades roots and causes swellings, knots or galls and excessive root proliferation. Infested roots do not necessarily become discoloured unless attacked by bacteria and fungi.

Dagger nematode, *Xiphinema diversicaudatum* (Micoletzky)

This ectoparasitic nematode is not native to Ontario and was introduced into greenhouses on plant stocks. Dagger nematodes prefer plants with woody roots and are more frequently associated with crops such as strawberry, grape and rose. The nematode survives in the root crotches of the understock.

One of the largest nematodes attacking plants, this 6 mm, thread-like roundworm can be seen on the roots if examined carefully. It feeds on young roots

in the soil, causing galls similar to root-knot galls but somewhat larger. These galls are actually curved swellings in the root tip area, accentuated with the necrosis and shrivelling of roots above the galls.

Pin nematode, *Paratylenchus projectus* (Jenkins)

This nematode is native to Ontario and can attack many floral and vegetable greenhouse crops, especially rose. All stages of pin nematode are thread-like and invisible to the naked eye. This species is active in both fine-textured (clay) and coarse-textured (sandy) soils.

The pin nematode does not enter roots, but feeds at root tips by probing root hairs and surface cells. No specific root symptoms, such as galls or lesions, appear. Plants infested with this nematode can appear stunted and unthrifty.

Southern root-knot nematode, *Meloidogyne incognita* (Kofoid and White)

This endoparasitic nematode is not native to Ontario but has become persistent in the protected greenhouse environment. It cannot survive outdoors during winter. It is a problem on tomato and cucumber, but can also attack several floral and foliage crops.

Root damage and symptoms differ from those of the northern root-knot nematode. Plants damaged by the southern root-knot nematode have larger galls and lack fine root growths from the galls. Leaves may show phosphorus deficiency (purpling) on the underside or downward curling of leaf edges.

Foliar Nematodes

There are a few nematodes that attack plant foliage. Symptoms caused by leaf-feeding nematodes are similar to those of several diseases and nutrient deficiencies.

Strawberry bud nematode, *Aphelenchoides fragariae* (Ritzema Bos)

This nematode is not native to Ontario but was introduced on plant stock. It is primarily a problem on begonia, but can also attack other greenhouse ornamentals. Invisible and thread-like, it moves in moisture films on stems and leaves.

The nematode penetrates leaves through the stomata and feeds in the inner layers of the leaf, causing small brown spots with water-soaked margins on the underside of leaves. The spots subsequently enlarge and merge, turn dark brown and become visible on the upper surface. Finally, the entire leaf is affected.

Chrysanthemum nematode, *Aphelenchoides ritzemabosi* (Schwartz)

This nematode is not native to Ontario but was introduced on plant stock. It is almost identical to the strawberry bud nematode and moves and infests plants in the same manner.

Early symptoms include dark-brown spots on the underside of leaves and vein discolouration. Infested leaves eventually turn brown or black, forming distinct wedge-shaped areas between the veins. Finally, the leaves dry, shrivel and hang down along the stems.

Cultural controls for nematodes

The following are cultural control measures for minimizing nematode problems:

- Use soil-free media or steam-sterilized media.
- Ensure that transplants are vigorous and free of root galls or lesions.
- Use nematode-resistant or nematode-tolerant cultivars, or nematode-resistant rootstocks, where applicable.
- In soil-grown vegetable crops (e.g., tomato and cucumber), mound peat or sterile soil at the plant bases to stimulate adventitious root growth and help extend the productive life of the plants.