Aphids in apple orchards
Kathryn Carter, Apple IPM Specialist, and Hannah Fraser, Entomologist – Hort Crops

With the weather being a little on the cool side for the last week, it is hard to imagine the hot humid summer to come. However, this year meteorologists are calling for unseasonably high temperatures again—so undoubtedly aphid populations will be thriving. There are several aphid species of economic importance to apple; they need to be correctly identified, as they have different biologies and action thresholds.

Rosy apple aphid

Some growers are already seeing high levels of rosy apple aphids in their orchards. Rosy apple aphid (RAA) or *Dysaphis plantaginea* (Passerini) is the most destructive aphid species that feeds on apple. It is often one of the first aphids to appear in orchards in the spring time. RAA overwinters in the egg stage in crevices in the bark of larger branches. The eggs hatch and nymphs begin to feed on expanding fruit buds and leaves. These aphids remain on apples during May, but most move to alternate hosts in June and July. They feed and reproduce on the weed plantain until fall, when the females move back into orchards to lay their eggs.

Similar to other aphids, RAA nymphs are small soft-bodied insects with piercing and sucking mouthparts and have two distinct cornicles (or tailpipes) projecting from the back of their abdomen. The nymphs are yellow or pink when first hatched, and eventually turn purple in colour. Rosy apple aphids can be distinguished from other species by their colour as well as their long antennae and cornicles. As nymphs develop to adulthood, they form a powdery-white covering.

RAA nymphs and adults have toxins in their saliva which causes the leaves to curl and turn red in colour. Leaf feeding around fruit can cause stunting and malformation of developing fruit. RAA saliva also prevents fruit from abscising naturally at harvest.

RAA should be monitored from tight cluster through late June by sampling five clusters from 20 trees. A cluster is considered infested if more than 20 aphids are present. Chemical control is only recommended if more than 10% of the fruit clusters are infested.

Green apple aphid

Green apple aphids (*Aphis pomi*) are one of the most common aphids found in apple orchards. Fortunately for most growers apple trees can usually withstand higher populations of green apple aphid than other aphids, and there are often an abundance of natural predators around to manage these pests.

Green apple aphids overwinter as eggs on suckers at the base of buds on terminal shoots. Nymphs begin to emerge out as the first leaves are unfolding and begin feeding on terminal...
shoots. Green apple aphids are most numerous during July and early August, and their colonies can double in a week if conditions are favourable. Unlike RAA, GAA populations can remain on apples for the entire growing season. Immature GAA can be distinguished from immature RAA by shorter antennae and less well-developed cornicles. Their colour varies from yellow-green to light green and they have black cornicles.

Green apple aphids suck sap from the leaves reducing the vigour and growth of shoots, and causing leaf curling. They also produce a sugary substance called honeydew which may drip onto the fruit allowing fungi to grow. This fungus blemishes the fruit and lowers the market value.

Monitoring for GAA should begin in early to mid June. Check 10 terminals from 10 trees. The action threshold for GAA is 400-600 aphids per terminal on more than 10 of the terminals. Beneficial insects often play an important role in managing GAA and if present in high enough numbers can delay or eliminate the need for insecticide sprays to control these pests. Lacewings, ladybugs, Orius spp. and syrphid fly larvae are all effective predators of aphids. Although there are no thresholds for biological control of aphids in Ontario, Pennsylvania recommends that pesticide applications may be delayed or eliminated if 20 percent of the aphid colonies have predators.

**Woolly apple aphid**

Wooly apple aphids (WAA) (*Eriosoma lanigerum*) have become more prevalent in orchards over the past few years. They are often difficult to control since they produce a thick waxy coating that helps to protect them from insecticides, weather and natural enemies.

Most WAA found in apple orchards overwinter as first instar nymphs on the roots of trees. The first instar nymphs or crawlers are the dispersal stage; they initiate aerial colonies in the spring from overwintering root infestations. WAA can feed on wounds on the trunk and branches of the tree, or they can feed in colonies on the roots of the tree. Nymphs are red to purple in colour and are covered with a white cottony wax which becomes more extensive as the insect matures. Nymphs can be spread throughout an orchard in a variety of ways including crawling, transport by birds and insects, or wind. These nymphs can find their way into the roots and begin infesting them early in the season.

WAA do not feed directly on apple leaves, rather they target twigs or roots causing galls for form on the trees. Areas damaged by these aphids are more susceptible to frost and winter injury. Often aphid colonies are first observed on pruning cuts, and near wounds on limbs and trunks of trees. Their feeding activities can prevent healing of damaged tissue. Infestations can lead to honeydew deposits on fruit, resulting in sooty mold. WAA can serve as a vector for perennial apple canker (*Gloeosporium perennans)*.

When monitoring, look for the characteristic cotton, waxy covering around pruning cuts and water sprouts in the spring. Monitor for them again in the leaf axils and growing shoots in mid to late summer. There are no established thresholds for WAA. Consider management when infested twigs become swollen and galls form at feeding sites or if colonies infest near fruit clusters or on young trees and nursery stocks.

Orchard management has an impact on woolly apple aphid populations. Removal of suckers and watersprouts early in the season will discourage establishment of the pest and may improve spray coverage. Summer pruning will remove larger developed colonies and may help to suppress populations. Insecticides are most effective when nymphs are small and actively migrating up the canopy (crawler stage). High water volumes are required for good coverage.

For more information, visit the apple pest management guidelines on the OMAFRA website at [http://www.omafra.gov.on.ca/english/crops/pub360/360applecalendar.htm](http://www.omafra.gov.on.ca/english/crops/pub360/360applecalendar.htm).
Introduction:
Tarnished plant bugs are a major pest of strawberries, and are found worldwide in a variety of crops. Their ability to feed on a wide range of hosts and have multiple generations per year make them an extraordinary and resilient pest. Tarnished plant bugs can quickly migrate into a strawberry field from another crop such as an alfalfa field. Monitoring to identify nymphs is critical to reduce damage, but nymphs can be difficult to find due to their size, colour and speed. The only key symptoms of tarnished plant bug infestation are damaged fruit.

Description:
There are a few species of plant bug; the species that causes damage to strawberry fruit is *Lygus lineolaris* (Palisot de Beauvois). Most species have a stink gland that secretes allomones, a defense chemical with a foul smell that is released when the insect is disturbed to repel potential predators.

Adults:
- Tarnished colour appearance, ranging from black to dull brown colour (Figure 1)
- 6-7 mm in length and are 2.5 mm wide and oval in shape
- Able to fly; the back half of the forewings are membranous and are bent on a downward angle
- Distinct yellow triangle on the dorsal side

Nymphs:
- Small in size, range 1-5 mm in length depending on the instar
- Green in colour and darken as they mature
- Typically the third instar stage has five black dorsal spots and being to develop wing pads (Figure 5).

![Figure 1. Tarnished plant bug adult. M indicates the membranous tip of the forewing, T indicates the yellow triangle](image)

![Figure 2. First instar](image)

![Figure 3. Second instar.](image)

![Figure 4. Third instar notice the single black spot on the back](image)

![Figure 5. Fourth instar, notice the five black spot pattern](image)

![Figure 6. Fifth instar, notice the development of wing pads.](image)

![Figure 7. All life stages of tarnished plant bug.](image)
Early tarnished plant bug instars are easily confused with aphids because of their light green appearance. Tarnished plant bug nymphs lack cornicles or “tailpipes”, structures on the posterior end of the aphid; they also tend to move more quickly than aphids (Figure 8).

![Figure 8. Comparison of tarnished plant bug and aphid morphology. A) Tarnished plant bug nymph, B) Adult aphid, X indicates the “tailpipe” structure.](http://www.extension.iastate.edu/newsrel/reiman/AphidClose.jpg)

**Life History:**
Tarnished plant bug adults emerge in the spring, feeding on new buds and shoots and lay eggs on plant material once the temperature becomes 20ºC or higher. Depending on the temperature the nymphs will hatch in 7-10 days. Nymphs are usually seen on strawberries during bloom and generally emerge in mid May, feeding on the developing fruit. Adults and nymphs can both be present in a crop at the same time as a result of overlapping generations, having between three to five generations per year. From fall to winter only adults are present as they prepare to overwinter in dead weeds, leaf litter and under tree bark. Adults emerge in the spring when the temperature reaches 8ºC to start the life cycle over again.

**Damage:**
Tarnished plant bugs have a wide range of hosts, including over 350 plant species. They feed on approximately 50 commercial crops including apples, celery, raspberries, tomatoes, peaches, plums, pears, cotton, alfalfa, and beans.

These pests feed on the reproductive organs of the plants, probing the tissue repeatedly causing mechanical damage. Nymphs take a test bite to determine whether the plant is a good food source, if it is suitable it will continue puncturing and release digestive enzymes into the tissue. Feeding causes a number of problems including fruit malformation, abnormal growth, cell death, abscission of fruiting structures and damage to seeds.

Both adults and nymphs feed on strawberry structures, but the nymphal stage causes the most economic damage, feeding on the achenes and tissue of the strawberry fruit.

As the fruit develops the seeds remain clustered together preventing normal development called apical seediness or cat facing (Figure 9A). Generally berries are susceptible to apical seediness before seed separation. Fruit malformation from tarnished plant bug can be confused with the symptoms of poor pollination and although they look similar, each is distinct. Tarnished plant bug damage can be identified by observing the shape of the achenes since they are of equal size while poor pollination is identified if achenes are of varying sizes in the damaged area (Figure 9).

![Figure 9. Fruit deformation. A) Full view of tarnished plant bug damage on strawberry fruit, B) Close up of apical seediness caused by plant bug, C) Full view of poor pollination, D) Close up of malformation caused by poor pollination](http://www.extension.iastate.edu/newsrel/reiman/AphidClose.jpg)
Control:
Many growers use strawberry scouts to monitor and estimate the population density of tarnished plant bugs in a crop. Monitoring is used with thresholds to coordinate sprays and spray timings. Monitoring begins in the spring at first bloom to find young developing nymphs and typically takes place once a week. Monitoring is completed by cultivar, since some varieties blossom early and will have high population numbers sooner than other varieties.

*Photographs taken by Cynthia Rougoor, copyright 2006.*

**Related Links:**

- Tarnished plant bug: a major pest on strawberries

- Tarnished plant bug and other stinging insects
  [http://www.omafra.gov.on.ca/english/crops/facts/tarbug.htm](http://www.omafra.gov.on.ca/english/crops/facts/tarbug.htm)
Necrotic Leaf Blotch of Golden Delicious and related Cultivars

John Gardner, Apple Specialist

This disorder is definitely one of the most intriguing and scary looking conditions that I know of. Without making any predictions for 2006, we can assume we’ll see some evidence of this disorder at some point as the season progresses. This specific disorder usually coincides with a dramatic change in weather. In the 2004 season it happened when we went from a pretty cool late August to a relatively warm and sunny early September. Growers have seen this disorder for years in varying degrees of severity.

Dr. David Rosenberger reports from New York State that Dr. Turner Sutton studied the disorder extensively in the early 1970’s in North Carolina. He concluded that the disorder is not caused by a fungus, bacterium or air pollution and that it is not related to foliar nutrient concentrations.

The sudden death and abscission of shoot leaves after seeing a perfectly normal looking tree can send shivers down the back of the most open minded of growers. Just after working to establish that perfect crop load and fruit growth rate, beating primary scab and several generations of various insects, you lose up to 50% of the mature foliage in the canopy more or less overnight.

Also, the defoliation occurs almost exclusively on the mature shoot leaves of the current season’s growth. These leaves do appear to finish the job of maturing their associated buds in the axil area between the leaf petiole and the woody branch on which the leaf is borne. The spur leaves and the shoot terminal leaves don’t generally appear to be affected by this disorder.

In general, the disorder does not appear to affect overall tree performance or fruit size and finish unless it is very severe. It does appear to be worse when a relatively cool growing period is followed by a period of fairly intense heat and light. Tree vigour may affect response while rootstock appears to have minimal influence on the severity of the symptoms.

The use of particle films and/or fungicides does not appear to control the disorder.

Michigan pathologist AL Jones now retired described the disorder as being related to air temperature, light intensity and soil moisture. There appears to be a relationship between certain plant hormones and the disorder. The leaf symptom is enhanced by Gibberellins and inhibited by abscisic acid.

The EBDC protectant fungicides appear to help alleviate the severity of the symptom while fungicides like Captan are not effective.

Figure 1. Necrotic Leaf Blotch in various stages of development

Figure 2. Chinook is a cultivar with Golden Delicious in its’ parentage. See the affected foliage on the right side. This photo demonstrates susceptibility by the experimental cultivar “Chinook” to the same disorder which can have striking effects on the various strains of “Golden Delicious”.

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