Vermont Vegetable and Berry News – March 26, 2008

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ORGANIC GREENHOUSE TOMATO PRODUCTION TWILIGHT MEETING

Old Athens Farm, Westminster VT. Wednesday April 16, 2008, 4:00-7:00 PM

Mike Collins and Rebecca Nixon own and operate Old Athens Farm in Westminster, Vermont. They sell produce wholesale to food co-ops and natural food supermarkets, and at farmers' markets. Mike manages 3 acres of mixed vegetables, berries and herbs, but his main product is organic greenhouse tomatoes, for which he is widely known. He has 10,000 sq. feet in production, and he utilizes production techniques such as grafted transplants, carbon dioxide enrichment, zoned bottom heat, and biological pest control. Mike will explain his approach to soil fertility, show us grafted plants at various stages of growth, and talk about his experience with different furnaces and fuels for heat. The greenhouses are heated primarily with waste vegetable oil from local restaurants. There are also a variety of back up heating systems including oil, propane, and wood.

Directions from the South: Take Exit 4 off I-91, turn left off the ramp, back over the interstate to the intersection with route 5. Turn right, go straight through Putney village, staying on Route 5 north for about 3 miles. Take the left before Harlow's Sugar House (Pine Banks Rd.). At 2.8 miles turn left on Daigel Rd. You will see the greenhouses in the second driveway on the left, number 463.

Directions from the North: Take Exit 5 off I-91, turn left off the ramp, go under I-91, then take the first right, Kurn Hattin Rd. You will crossover I-91, then after the Kurn Hattin school campus take the first left, Piggery Rd. At the Y, just before you would go back under I-91, bear right onto Pine Banks Rd. Your first right is Daigel Rd. You will see the greenhouses in the second driveway on the left, number 463.

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GREENHOUSE APHID IDENTIFICATION AND BIOCONTROL

(adapted from Ontario Ministry of Agriculture fact sheet 06-081
www.omafra.gov.on.ca/english/crops/facts/06-081.htm)

Several species of aphids can cause problems in vegetable and ornamental greenhouses. Most common are the green peach aphid, the cotton or melon aphid, the potato aphid, and the foxglove aphid. Proper identification is critical to biological control, and in some cases chemical control. The green peach aphid and the melon aphid used to be the most common species found in Ontario greenhouses. However, since the late 1990s, the potato aphid and the foxglove aphid have become much more common.

Cornicles can be found on all aphids. They are a pair of tube-like structures projecting from their posteriors. Cornicles can be used to identify different species, if you have a 10x hand lens. On green peach aphid, cornicles are the same color as the body, slightly flared and darker at the tip. In melon aphid, cornicles are shorter, and dark throughout their length, regardless of body color. In potato aphid, cornicles are long and thin and may be curved outward at the tips. They are the same color as the body. The foxglove aphid has cornicles of medium length, darkened at the tips.

Green peach or tobacco aphid

Cotton or melon aphid

Potato aphid

Foxglove aphid

Body color alone is not an accurate way to identify aphids, though it may be useful with other features. The green peach aphid is commonly light green-yellow, but can be darker green or sometimes pink/rose. Melon aphids are smaller, often dark green, almost black, but can be green, yellow or mottled. The potato aphid is a large, active aphid, usually green, but variable in color, often with a darker stripe down its back. The foxglove aphid is green, often quite shiny, with two darker patches on its abdomen at the base of the cornicles. The less common chrysanthemum aphid is shiny and dark brown.

The life cycle of aphids outdoors is quite complicated, at times involving sexual reproduction and egg-laying. In the greenhouse however, the life cycle is usually very simple. All individuals are female. They give birth to live young, which in turn can reproduce within 7-10 days. Individual aphids can give birth to 60-100 young depending on host plants and nutritional status over a 20-day period. Obviously, aphids can rapidly build up very large populations. Aphids are usually wingless, although adults may develop wings if the population density is high, allowing rapid dispersal.

Plant damage by aphids results from piercing tissue with their mouth parts and sucking out the sap, causing deformed leaves and flowers. They also excrete a sugary, sticky substance called honeydew, which promotes the development of black, sooty mould fungus on the leaf surface. Sooty mould is not pathogenic on the plant, but in severe infestations, it can interfere with photosynthesis. Aphids can transmit plant viruses (like cucumber mosaic virus). In ornamentals, the presence of the aphids themselves, their cast-off skins, honeydew and sooty mold reduces plant marketability.

Monitoring is essential to assure early detection of aphids and timely implementation of management strategies. Monitoring involves two different strategies: visual observation of the crops for wingless aphids, and yellow sticky cards for those with wings.

Inspect your greenhouse crops on a regular schedule for wingless aphids, and the small white flakes of cast-off skins produced as they molt. Initial infestations are usually at isolated within the greenhouse, but can rapidly spread. Heavier infestations can result in the presence of honeydew on leaves, making them shiny and sticky. Ants are often attracted to honeydew, so their presence suggests an infestation. Growing some varieties or crops known to be attractive to aphids can help with early detection.

Place yellow sticky cards throughout the greenhouse to monitor for winged aphids. They can move into the greenhouse from outside, typically in the spring and fall as migrating aphids begin flying. If winged individuals are produced within the greenhouse, there is an advanced infestation where adults are dispersing to find new host plants. Effective crop monitoring should identify infestations before they reach this stage.

Biological controls are readily available for aphids. These include the parasitic wasps Aphidius (various species) and Aphelinus abdominalis; the predatory midge Aphidoletes aphidimyza; and ladybeetles (Hippodamia convergens, Harmonia axyridis). Lacewings are more generalist predators available for aphid control. Aphidoletes and ladybeetles are usually used to supplement the activity of Aphidius and for reducing aphid populations in 'hot spot' areas.

Aphidius species do not enter diapause and is usually more effective during winter, early spring, and fall. During summer, other parasitic wasp species can parasitize Aphidius reducing their impact on aphid populations. Optimum conditions for Aphidius are 65-77 degrees F and 80% RH. Aphidius completes its development from egg to adult in about 10 days at 77 degrees, and 14 days at 70 degrees. Three species of Aphidius are commercially available. One is Aphidius matricariae, which can parasitize about 40 aphid species including the green peach aphid. Aphidius matricariae has been largely replaced by Aphidius colemani, which is effective against both the green peach aphid and cotton aphid. Aphidius ervi is a larger species used against potato and foxglove aphids. Aphidius wasps lay their eggs inside the aphid. As the wasp develops, the aphid changes colour and appearance, becoming swollen with a bronze colour and a papery texture. This parasitized aphid is known as a mummy. The new adult wasp emerges from the mummy.

Aphidius species are best used when aphid numbers are very low. To facilitate continuous release of low numbers of these species, many growers use "banker plants" that essentially consist of seedlings of a cereal species like rye. These seedlings are host to cereal aphid species that do not attack non-cereal crops, and the cereal aphids in turn are hosts or food for the parasitic wasps. Research indicates that for optimum results, evenly distribute banker plants throughout the greenhouse, with a distance of between each banker plant ideally not greater than 130 feet.

Aphelinus abdominalis primarily attacks potato and foxglove aphids. This wasp prefers to parasitize the 2nd and 3rd nymphal stages while the 1st and small 2nd nymphal stages are used for host-feeding (i.e. as food by adults). To feed on an aphid, the wasp first pierces the aphid with its stinger or egg-laying body part, and then feeds on the aphid's body fluid through the tiny opening(s).

In contrast to A. colemani, egg laying activity is low during the first few days of this wasp's life. And then by the 4th day after emergence, an adult female can lay 10-15 eggs per day for the rest of its life of 15-27 days. During this time, an adult female may parasitize more than 200 aphids and kill about 40 by host-feeding. Because adults prefer to walk or hop rather than fly over the crop, they tend to remain localized. Studies have shown that dispersal by this wasp is poor in the greenhouse, and that most remain close to their points of release. This means these wasps should be released as close as possible to aphid infestations for best results. Note that aphids parasitized by A. abdominalis appear black while those parasitized by Aphidius species are bronze.

Aphidoletes aphidimyza adults resemble small mosquitoes whose larvae are the predatory stage. Females lay eggs close to aphid colonies so that upon hatching, the orange-colored larvae have a readily available food source. Eggs usually hatch after 2-3 days, the larval stage lasts 5-7 days after which they drop to the floor to pupate. The pupal stage usually lasts about 8-10 days. Adult A. aphidimyza feed on honeydew and are non-predatory. The larvae can kill between 10-100 aphids in total. A particularly positive characteristic of Aphidoletes is that unlike parasitoids, it causes little disturbance in colonies. Because of its furtive behavior, it triggers little defensive reaction by aphids. This means aphids attacked by Aphidoletes are less likely to disperse, escape predation, and start new colonies. When aphids are attacked by parasitoids, they defend themselves by kicking and producing alarm pheromones (chemicals used for communication within a species), resulting in their own escape, as well as many other members of their colony.

Under natural daylengths, A. aphidimyza enters reproductive diapause between September and March because the larvae require at least 15.5 hours of light to prevent the pupae from diapausing. However, there is some evidence to suggest that regular preventative releases of Aphidoletes can be made throughout the winter to control aphids. The Aphidoletes adults lay eggs and the larvae feed on aphids, however there is no second generation of midges produced. If lighting can be supplemented, even low light intensities, such as from incandescent bulbs, are sufficient to prevent diapause.

Adults are nocturnal and require a period of darkness for mating and egg-laying. Therefore, continuous lighting from a bright source will prevent reproduction. Likewise, lighting that eliminates dusk can also interrupt mating. It is also important to note that larvae drop to the ground and use grains of sand and possibly soil debris to form cocoons. If the larvae fall on plastic or concrete that is dry and free of debris, mortality of this predator will be high. Repeated or continuous release using banker plants is necessary under such situations to achieve acceptable suppression of aphids.

Ladybeetles are also used for control of aphids. Harmonia axyridis, also known as the multi-coloured Asian ladybeetle, is an introduced species that can provide excellent control. However, it has developed a bad reputation because it has developed huge populations in the outdoor environment, become a pest on some crops such as grapes, and it has displaced native ladybird beetle populations. Some biocontrol producers have stopped supplying this species. The second species, Hippodamia convergens is a native North American species collected in the wild in California.

Both adult and larval ladybeetles feed on aphids. When daylengths are suitable, ladybeetles must feed on aphids to maintain egg production. Eggs are torpedo-shaped, orange-colored, laid in circular clusters on the underside of leaves, and hatch in 2-5 days. The larval stage lasts for about three weeks after which they pupate. Adults emerge from pupal cases after 3-5 days. To increase the percentage of ladybeetles remaining in the greenhouse, make releases late in the evening, and sprinkle a sweet liquid (diluted soda pop) over the beetles. This provides an immediate energy and water source.

Lacewings also feed on a variety of prey including aphids, thrips, spider mites, young caterpillars and moth eggs, mealybugs, scales, and whitefly larvae and pupae. However, they do have a preference for aphids over thrips, and then spider mites. Older larvae (3rd instar) are particularly voracious, and can eat unhatched eggs, other larvae, and even adults if food is scarce. A larva can consume 300-400 aphids and are usually best suited for high aphid populations. The adults feed only on honeydew, nectar and pollen.

Other Control Strategies. Remove weeds from within, and immediately outside, the greenhouse. Aphids can develop on many different species of weeds. Remove plants in isolated areas of infestation which are detected early, to prevent aphids spreading to the rest of the greenhouse. Consider the use of insect screening to eliminate the movement of aphids from outside into the greenhouse. There are a number of registered pesticides for control of aphids in both vegetables and ornamental greenhouses, and some of these are compatible with biological control.

For suppliers of biological controls, go to: www.uvm.edu/vtvegandberry click on ‘supplies and equipment.’