APHID ABC's

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Damage. Aphids are commonly encountered on many floral crops. They can be found on all plant parts. A few species can even infest roots. Their presence can decrease the aesthetic value of a plant. Aphids feed by inserting their stylet mouthparts through plant tissue directly into the phloem and sucking plant sap. Their feeding can cause plant stunting and deformities in leaves, especially by foxglove aphid.

Large numbers of aphids can remove enough nutrients from a plant that its vigor is affected. Their excrement coats leaves with a sweet, sticky substance called "honeydew," which in turn promotes the growth of unsightly grey sooty mold. Aphids can reduce the saleability of a plant by the accumulation of the white cast skins that they leave behind as they molt from one stage to another (Photo 1). The combination of honeydew and cast skins created by an aphid infestation can be ugly. Finally, aphids are responsible for the transmission of about 60% of all plant viruses on agricultural crops world-wide.

Biology. Under greenhouse conditions, aphids reproduce parthenogenetically, i.e., all the insects present are females, and each female gives birth to more females without the need to mate. In the greenhouse, aphids are viviparous, wherein females give birth to living nymphs rather than lay eggs. In fact, in some species, an unborn aphid already contains a complement of developing nymphs, a phenomenon known as "paedogenesis." Their ability to reproduce without mating or egg production causes their populations to increase almost explosively, especially because individuals can mature and begin to reproduce very rapidly (less than a week at 70-75F). As an aphid colony increases in age and size on individual plants, the proportion of winged forms may increase.

An aphid infestation can spread rapidly throughout a crop. Green peach aphid can spread 120 sq.ft. per day from a single infested plant.

Aphids can vary in their preference for plant species. They often also prefer certain cultivars over others. Careful record keeping of aphid infestations by crop cultivar may reveal these differences and allow a grower to avoid certain cultivars.

Aphids have a well-known capability to develop insecticide resistance. Strains of some species have documented resistance to carbamate, organophosphate, and pyrethroid insecticides. In green peach aphid, resistance can be conferred by increased production of a non-specific esterase that provides immunity to insecticides from several chemical classes.

Monitoring.

Inspect a greenhouse thoroughly for sources of aphids, before a new crop arrives. Then carefully inspect plant material brought into your growing areas. If possible, quarantine newly-arrived plants, and inspect thoroughly before moving them into production areas. Avoid planting aphid-susceptible cultivars near doorways or vents where they could be infested from an outside source.

Aphid control is much more successful when an infestation is detected and controlled early in a crop production cycle. Train workers to recognize signs of an aphid infestation, and incorporate

their observations in your regular scouting effort.

Stems and lower surfaces of leaves of various ages on each plant should be examined. The presence of white cast skins and/or honeydew on leaves may indicate an aphid colony on a plant.

Ants are attracted to the honeydew that aphids produce, and can signal an infestation. Pay close attention to those varieties on which aphids seem to occur most frequently. Group aphid-susceptible plants/cultivars together to make intensive scouting and control efforts more efficient and minimize the spread of aphids throughout the production area. Aphids can be spread on clothing, so plants located near walkways and doors should be examined.

The use of yellow sticky traps may provide an early indication of an aphid migration into the greenhouse, particularly in the spring, summer, and early fall. (Photo 2) Winged aphids that are active outdoors during these times may invade the greenhouse. Yellow sticky cards may alert you to their presence. However, it is even more important to inspect plant foliage on at least a weekly basis for early detection and monitoring of aphid infestations.

To aid in evaluating insecticide efficacy, several plants infested with aphids can be marked with flags or flagging tape, and an estimate of the number of aphids on each should be recorded. A few days after insecticides are applied, the number of surviving aphids should again be recorded. Examine plants carefully and frequently, looking for killed or missing aphids, to determine if repeat applications will be required.

Identification. Knowing the species of aphid present in a greenhouse can be important to achieving control. Susceptibility to certain insecticides can change with species, and more importantly, some natural enemies are much more effective against some aphids than others.

Aphids are among the most common pests of greenhouse crops. There are more than 4,400 known species of aphids worldwide, and as a group they attack an enormous range of plant species. Though many aphids infest a limited number of plant species, the most common and problematic aphids found on greenhouse crops attack a very large number of plant species. On greenhouse flower crops in general, a recent survey shows that the two most common species in the Northeastern U.S. are the green peach aphid, *Myzus persicae*, and the foxglove aphid, *Aulacorthum solani*.

Aphids that are fairly common to greenhouse crops in the Northeast are covered below. The species descriptions that follow are intended to provide some characters that can be used for "field" identification by people who are not professional entomologists. However, aphid taxonomy is complex and is best left for experts.

General identification information. Aphid species can differ in size, coloration, location on a plant, and crop preferences. They are all generally small (1-4 mm), slow-moving, soft bodied, and pear-shaped without obvious segmentation into head, thorax, and abdomen. Their legs and antennae are typically long and slender. Aphid nymphs resemble small wingless adults. All aphids have a pair of unique structures, called cornicles, that resemble "tailpipes" on either side of their body near the end of their abdomen. Adult aphids may or may not have wings. The unwinged form

of an aphid is usually more common on greenhouse plants than the winged form; though winged forms, which can fly, may be found on yellow sticky traps.

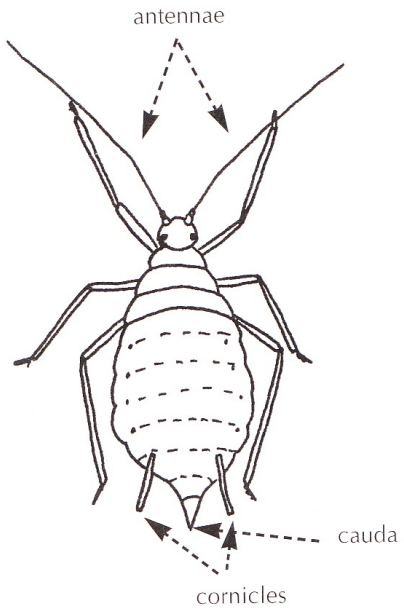

Fig. 1

Several characteristics of an aphid can be used to tell species apart. (See Fig. 1) These include the plant on which it is found, where it occurs on the plant, the body coloration, length of the antennae, and color and length of the cornicles. The shape of the cauda is also important. The cauda is a structure at the extreme tip of the abdomen that may be thought of as a "tail". Some species have a pronounced cauda; in others it is very reduced. The cauda can be long, short, tapered, triangular, parallel-sided, or vary in other ways. The number of tiny hairs on the cauda can be important in identification, but require a great deal of magnification to see them. In some species the presence and form of antennal tubercles (bumps) is important. If present, these tubercles are located on the inside of each antenna near the base and produce an apparent "indentation" in the aphid head. (See Fig. 2 below) Their size and shape of the tubercles varies among certain species and gives this indentation a different shape.

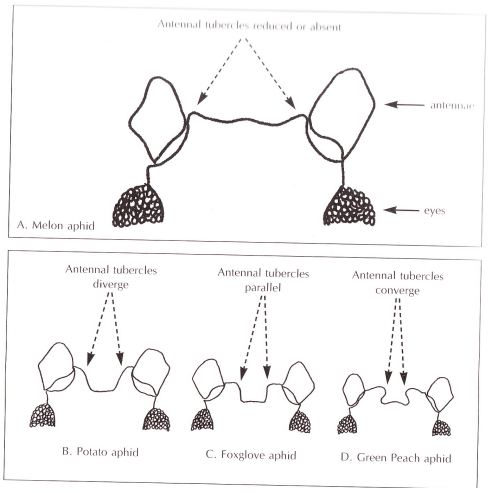

Fig. 2

The following descriptions all refer to the unwinged adult forms (called “apterae”) rather than the winged forms (called “alatae”), because the unwinged forms are the most likely to be encountered on greenhouse crops. Winged forms may be found on yellow sticky traps, but entrapment usually obscures the characters needed for identification.

With experience, many aphids can be identified in the greenhouse, but the use of a 10x handlens, or preferably, a dissecting microscope, will be necessary.

Green peach aphid, *Myzus persicae* Sulzer

The green peach aphid is the most common greenhouse aphid pest. It can infest a wide range of floral crops and also can transmit over 100 plant viruses among at least 30 plant families. The color of green peach aphids can range from light green, light yellow, green, grey-green, to pink or reddish (Photo 3). It is usually a moderately large aphid. It can be winged or unwinged.

Green peach aphids have a pronounced indentation between the bases of their antennae on the front of their head, and the sides of this indentation converge, getting closer away from the head (see Fig. 2 and Photo 5).

The "indentation" is created by the presence of two large tubercles on the inside base of each antenna. The cornicles are long, thin, and slightly swollen in the middle. The color of the cornicles matches that of the rest of the aphid, except the extreme tips of the cornicles typically are darkened and slightly flared. The cauda is fairly long, tapered, and has three hairs on each side.

Foxglove aphid, *Aulacorthum solani* Kalt.

This aphid can infest Anemone, arum, calceolaria, carnation, cineraria, dahlia, geranium, gloxinia, lettuce, nasturtium, salvia, and many other plants. It is another aphid with a very wide host range, and can infest nearly every plant that is attacked by melon aphid or green peach aphid. It is reported to transmit about 40 plant viruses. It is slightly larger than green peach aphid (1.8-3.0mm). Color is usually shiny, light green or yellow, and the head, thorax, and the part of the abdomen around the bases of the cornicles is often slightly darker than the rest of the abdomen.

The area of the head at the base of the antennae is also often a darker green than the rest of the body. The legs and antennae are pale but have dark joints. The pronounced indentation in the head between the bases of the antennae is similar to the green peach aphid, but the sides are slightly more straight and parallel to each other (see Photo 7 and Fig. 2).

The tips of the cornicles are flared and nearly black. The cauda is fairly long, tapered, with 3 to 4 hairs on each side and one tiny hair near the tip.

Melon aphid, Cotton aphid, *Aphis gossypii* Glover

The melon aphid is a cosmopolitan pest, attacking a wide range of plants, and is capable of transmitting over 50 plant viruses. It is generally a small aphid (0.9 - 2.0 mm). Its color often depends on food source and temperature, and may vary from light yellow to very dark green, nearly black.

Antennae are shorter than the length of the body, and there is no pronounced indentation between the bases of the antennae (see Fig. 2). The cauda is tapered and has 2 to 3 hairs on each side. To distinguish them from green peach aphid, the melon aphid is smaller, has no pronounced indentation between the base of their antennae, and the entire length of the cornicles is always very dark, regardless of body color.

Potato aphid, *Macrosiphum euphorbiae* (Thomas)

The potato aphid has been recorded from many greenhouse crops, including abutilon, carnation, cineraria, lettuce, rose, tomato, and tulip. It can infest almost every crop as can melon aphid or green peach aphid; including over 200 plant species in more than 20 families. It also can transmit over 45 viruses.

It is a very large aphid (1.7-3.6 mm). Color can be yellow, pink, or green. Antennae are about as long as the body, and are dark near the ends. The sides of the indentation in the head between the bases of the antennae diverge, getting wider away from the head (see Fig. 2). Legs are the same color as the body. Cornicles are long and very slender, and the same color as the body except darkened and reticulate at the tip. The

cauda is very long and prominent, gradually tapering, with 4 to 5 hairs on each side and one or two tiny hairs on the top side near the tip. Nymphs are paler than adults and can have a dark stripe down the length of the body. It is a very restless, active aphid that readily drops off the plant when disturbed.

Crescentmarked lily aphid, *Aulacorthum* (*Neomyzus*) *circumflexum* (Buckton))

This aphid is most common on arums and cyclamen, and is also recorded from amaryllis, anthurium, azalea, begonia, calceolaria, chrysanthemum, cineraria, cyclamen, fuchsia, freesia, iris, lettuce, *Lilium* sp., rose, *Schizanthus* sp., and tulip. This aphid has a very wide host range. It can transmit over 30 plant viruses, but in colder climates it does not live outdoors so it doesn't acquire viruses as easily. The wingless form of this aphid is the most common.

It is 1.2-2.6 mm long, and is shiny, pale white, pale yellow, or bright green, with a characteristic large blackish patch on the top of the abdomen of adults. The mark may be obscure or absent on younger nymphs. The antennae, legs, cornicles, and cauda are pale.

Rose aphid, *Macrosiphum rosae* (L.)

Primary host plants of this species are typically in the Rosaceae. Can transmit at least 12 plant viruses, but does not transmit rose mosaic or rose streak viruses. This is a fairly large aphid (2.5-3.5 mm).

The body is shiny, and color can be pinkish, red-brown, light green, or dark green. The head is shiny black. Antennae and legs have dark areas. The cornicles are long, slender, and dark. The cauda is pale, long, slender, with five hairs on either side and one or two hairs on the top side near the tip. The top of the abdomen sometimes has black patches near the sides. It can be distinguished from green peach aphid by its cornicles, which are completely black, black areas on its legs, and the lack of a very deep indentation in the head between the bases of the antennae.

Chrysanthemum aphid, *Macrosiphoniella sanborni* (Gillette)

The chrysanthemum aphid, *Macrosiphoniella sanborni*, is only found on chrysanthemum. It can transmit chrysanthemum vein mottle and chrysanthemum virus B. It is a small to moderate-sized aphid (1-2.5 mm). It is shiny, and color varies from reddish-brown to blackish-brown.

Cornicles are short, stout and black, enlarged at the base and have a reticulated pattern on 2/3 of the cornicle from the tip. The cauda is long and black.

Leaf-curling plum aphid, *Brachycaudus helichrysi* (Kaltenbach)

In the greenhouse this aphid has been found on Composite hosts, including *Achillea* sp., chrysanthemum, *Senecio* sp., and *Ageratum* sp. It is able to transmit cucumber mosaic, Dahlia mosaic, and Cineraria mosaic viruses. It is a small aphid (0.9 - 2.0 mm). Color can be shades of green, pale yellow, or almost white.

Cornicles are very short, cone-shaped, and the tip is flared.

Oleander aphid, *Aphis nerii* Boyer de Fonseclombe

Oleander aphid can infest plants in the Asclepiadaceae, Apocyanaceae (*Nerium oleander*, *Vinca*), and occasionally in the Euphorbiaceae, Compositae, and

Convolvulaceae). It is bright yellow with black cornicles and cauda, and the antennae and legs are dark.

It is a moderate-sized aphid (1.5-2.6 mm). It does not have a deep indentation in the head between the bases of the antennae. They often form dense colonies on younger stems. May be found on plants from tropical regions.

Tulip-bulb aphid, *Dysaphis tulipae* (Boyer de Fonseclombe)

Colonies of this aphid can infest the outer skins of tulip bulbs and corms of gladiolus and iris. Infested bulbs can produce distorted growth. When the bulbs or corms are forced, the aphids can spread to the leaves and flowering shoots.

They are 1.5-2.5 mm, grey, pink, or pale green, and lightly covered with wax. Cornicles are short, tapered, and dark. The cauda is short, about as long as it is wide, and tapered, with five hairs.

Aphid Control with Pesticides

Aphids on the upper canopy will be easier to contact with sprays. Systemic insecticides will be most effective against those feeding on new growth. Aphids on older growth lower in the canopy are often the most difficult to kill chemically, and may be responsible for producing new aphids that will reinfest the upper canopy.

Resistance to various insecticides is common in aphids. Strains of some species are resistant to carbamate, organophosphate, and/or pyrethroid insecticides. Some green peach aphid and melon aphid populations can be hard to kill with these traditional pesticides due to resistance. Foxglove aphids and most other species are usually not as hard to kill.

Preventative applications of Marathon or other soil insecticides can be very effective for aphid control, but it's not uncommon to miss a few pots, or for Marathon to begin to "wear off" prematurely (it's not always applied correctly). So don't assume that there is no need to monitor for aphids. Check the previous section of this bulletin on "Monitoring".

Sanitation is important for aphid management. Eliminate all weeds within or near your greenhouses. Discard old stock plants, hanging baskets that have not sold, and don't keep "pet" plants. Screen doors and vents to prevent migration into the greenhouse, especially during Fall and Spring. Avoid planting aphid-susceptible cultivars near doorways or vents where they could be infested from an outside source.

Aphid control is much more successful when an infestation is detected and controlled early in a crop. There are fewer aphids, spray coverage is better while the crop canopy is sparse, and the risk of phytotoxicity is reduced. Among the worst times to first notice an aphid infestation is when they are crawling all over nearly-open flower buds. Therefore, a regular scouting program should be implemented to detect aphids throughout the crop. Spot treatments or removal of infested plants can be used when infestations are discovered early.

Check the "Cornell Guide for the Integrated Management of Greenhouse Floral Crops" (available from your Cooperative Extension Service) for a complete list of aphid pesticides for New York State. Systemic or translaminar insecticides tend to be more effective than contact insecticides, provided that a sufficient amount of insecticide reaches the aphid feeding sites. Contact insecticides can be very effective with thorough spray coverage and good canopy penetration, especially when the plants are small. Follow all pesticide label directions. Keep careful scouting records to evaluate the effectiveness of various chemicals under your own conditions.

Endeavor (pymetrozine, by Syngenta) is an effective aphicide with a novel mode of action, which stops aphids (and whiteflies) from feeding, so they die of starvation. Endeavor has some systemic activity and has low toxicity to natural enemies. Azatin XL and Ornazin are two neem-derived (azadirachtin) products that can be used for

aphids on edible crops as well as ornamentals. Marathon II, TriStar, and Aria can be applied to the foliage as a spray and all have systemic activity.

Note: Read and follow all pesticide label directions. It is a violation of Federal Law to use a pesticide in a manner inconsistent with its labeling. Test "new" pesticides or pesticide mixtures on only a few plants to check for phytotoxicity prior to widespread use.

Biological Control of Aphids

Commercial suppliers of beneficial insects sell a number of insects that attack aphids: the parasitoid wasps *Aphidius colemani*, *A. ervi*, *A. matricariae*, and *Aphelinus abdominalis*, and the predaceous midge *Aphidoletes aphidimyza*. Ladybeetles (*Hippodamia convergens*, *Harmonia axyridis*) are being sold less often but are still available. Lacewings are also available for aphid control though they will attack several other pests as well. They are best used in aphid hotspots in combination with other aphid natural enemies. Aphid biocontrol usually relies upon the use of *Aphidius* wasps and/or *Aphidoletes*.

Aphidius spp.

This parasitic wasp does 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. Plus, they do not perform well at warmer summer temperatures. Optimum conditions for *Aphidius* are 65-78F and 80% RH. *Aphidius* wasps lay their eggs inside the aphid. As the wasp develops inside the aphid, the aphid changes shape and color. It becomes swollen with a bronze color and a papery texture. This parasitized aphid is known as a mummy. After 10-14 days, depending upon temperature, the new adult wasp emerges from the mummy. Three species of *Aphidius* are commercially available. *Aphidius matricariae* can be effective against green peach aphid, but it has been largely replaced by *Aphidius colemani*, which is effective against both the green peach aphid and melon aphid. But *A. colemani* is not effective against the larger aphids such as foxglove or potato aphids. *Aphidius ervi* is a larger species used against potato and foxglove aphids.

Aphidius species are best used when aphid numbers are very low. To reduce the cost of shipping and releasing the wasps weekly, many growers use "banker plants". A banker plant consists of a container of seedlings of a cereal species (e.g. rye or barley). Cereal aphid species that do not attack non-cereal crops are infested on these seedlings, and the cereal aphids in turn are hosts or food for the *Aphidius* wasps. Thus banker plants are a less-expensive way to facilitate continuous release of low numbers of *Aphidius* 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 40 m. Banker plants must be replaced as the cereal aphid supply is exhausted or plants decline.

Aphelinus abdominalis

Aphelinus abdominalis is used against the larger aphids such as potato and foxglove aphids. This wasp prefers to lay eggs into 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). These wasps do not fly far from release points and are thus not good at dispersing throughout a greenhouse. So they should be released in close proximity to aphid infestations.

An adult female wasp 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. Aphids parasitized by *A. abdominalis* turn black compared with those parasitized by *Aphidius* species that turn bronze.

Aphidoletes aphidimyza

The larvae of *Aphidoletes aphidimyza* is the predaceous stage that attack aphids. They look like tiny bright orange-colored maggots. Adult *Aphidoletes aphidimyza* resemble

small fragile mosquitoes. They feed on honeydew and are non-predatory. Females lay eggs close to aphid colonies so that upon hatching, the 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. The larvae can kill between 10-100 aphids during their lifetime.

Unlike parasitoid wasps, the larvae of *Aphidoletes* are able to avoid detection in an aphid colony, so the aphids are less likely to escape predation, disperse, and start new colonies.

Attention to light is important for effective use of *Aphidoletes*. The larvae require at least 15.5 hours of light to prevent the pupae from diapausing. Under natural daylengths, *A. aphidimyza* enters reproductive diapause between September and March. But supplemental lighting, even at low light intensities, such as from incandescent bulbs, can be sufficient to prevent diapause. Also, 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.