



Some Aphids Go Deep, Others High

A new study in root aphid control shows that certain rootball drenches are the most effective eradicator of this hidden pest.

By
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Most growers are familiar with aphids, but did you know there are aphids that attack the roots of plants? Yes, the roots. You may be used to looking for aphids on foliage and stems, but with these aphids, you need to pull off the pot and look closely at the root system.

Root aphids in the genus *Pemigus* are being found with increasing frequency feeding on the root systems of herbaceous perennials. The first thing growers will notice is the white wax that looks like snow-flocking covering the root system. Root aphids tend to build up populations at the edge of rootballs. Female aphids give live birth to nymphs, and a clustering of aphids builds up on concentrated areas of the root system. Small populations are not a problem; however, when populations become high, the plants are reduced in vigor, and customers will definitely see the white wax.

There are several species of *Pemigus* (root aphids), and



Root aphid infestation shows itself as a white, waxy buildup that looks like snow-flocking covering the root system. (All photos courtesy of Stanton Gill)

unfortunately, when they are feeding in the soil in the spring and summer, there are few, if any, winged adults around. Winged adults are necessary for species identification, and are produced in the fall. Samples can be collected and placed in small vials of alcohol and sent to the extension entomology specialist in your state for identification.

A CASE STUDY

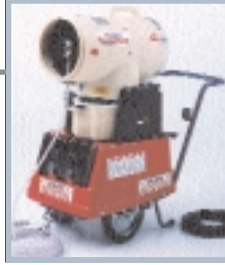
This spring, the University of Maryland Cooperative Extension worked closely with two greenhouse/nursery operations that were experiencing problems with *Pemigus* root aphids on galleria, aster and boltonia. The operations had tried applications of Talstar (bifenthrin) and Marathon (imidacloprid) applied as a soil drench with poor results controlling root aphids.

Often, the problem with Marathon applications is that the grower overwaters after an application and washes the pesticide out of the root zone. But in these two cases, the growers applied the Marathon with just

enough water to wet the rootball and tried not to overwater for seven days after the application to avoid washing the chemical out of the rootball zone. Both growers said they followed the directions for proper soil drench applications using the 60 WP formulation.

Talstar drenches also gave poor control. For these applications, the pots were watered prior to application. The Talstar drench was applied with enough water to soak the rootball and for runoff to just start coming out of the drainage holes.

We decided to investigate other pesticides for control of this pest. Ray Cloyd, entomology specialist at the University of Illinois, suggested trying Orthene (acephate) or Dycarb (bendiocarb) as soil drenches. We set up a trial to evaluate soil applications of Orthene and Dycarb, plus we added in a treatment of the entomopathogenic fungus *Beauveria bassiana* (*BotaniGard*). These treatments were applied as soil drenches on 1-quart containers of the herbaceous perennial



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Boltonia 'Pink Beauty'. We also had the grower remove several plants from containers and dip the rootball for 30, 60, 90 and 120 seconds in M-Pede insecticidal soap. We took pretreatment counts by a set time rootball examination and recorded aphid populations before the treatments. Post-treatment counts were taken in a similar manner one week after the treatments were made.

Besides these insecticide treatments, we tried another method. We received input from a Florida IPM scout who suggested trying copper-coated pots as a method to deal with root aphids. Plants were removed from regular plastic pots and placed in 1-quart copper-coated pots. One week after the plants were transplanted, we could not detect any reduction in the population of root aphids on the copper-coated pots. One month after switching to copper-coated pots, there was a reduction in root aphids, but the population was not completely controlled. We also asked the grower to try placing new plugs in the copper-coated pots to see if these plants are less likely to develop problems with root aphids. This is still being evaluated.

RESULTS

All of the treatments applied as soil drenches gave good control levels. Orthene applications provided the best control, with close to 100 percent mortality of root aphids. Dycarb applications gave a fair level of control, with death occurring in 85 percent of the root aphids. BotaniGard gave close to 96 percent control.

Submerging the rootballs in insecticidal soap for a 30-second duration delivered very poor control, less than 30 percent. Submerging them in insecticidal soap for a 60-second duration gave control of close to 70 percent. Submersion of the rootball

for 90-120 seconds gave a 95 percent control level. It is interesting that the white wax was dissolved by the insecticidal soap submersion method; the white wax is what customers are going to notice when they remove the pot to transplant. With the Orthene, Dycarb and BotaniGard applications, the white wax was still present two weeks after application, even after the aphids were killed.

PLANTS TO EXAMINE FOR ROOT APHIDS

In Maryland, we are finding root aphids in the heaviest popu-



Root aphids on boltonia roots.

lations on plants in the aster family. If you are monitoring your crop, examine the rootballs of gallardia, aster and boltonia, especially in the spring to early summer.

Typically, there needs to be a fairly large infestation to significantly damage perennials, so early detection and treatment is your best course of action.

APHIDS THAT ATTACK ABOVE GROUND

Most growers deal with aphid attacks on above-ground plant parts. Some aphid species that feed on above-ground plant parts are easy to control, while others are really tough, with populations bouncing back rapidly after insecticide applications.

Aphid populations that are

found outdoors in the northern parts of the United States generally have males and females present in late summer to early fall. The females of most species mate with males, then oviposit the eggs, which overwinter on woody plants or weeds. In the spring, winged forms (alates) of the aphids are produced and are generally females that will start new colonies on plants in the spring.

These same species of aphids generally do not produce males and do not overwinter as eggs under greenhouse conditions. These aphids reproduce

the plant. Great plant nutrition makes healthy aphids that have high reproductive ability.

Aphids tend to be gregarious, hanging out together, and large colonies will rapidly form on a plant. As an aphid colony increases in age and size on individual plants, the proportion of winged forms usually increases. The winged forms can fly to new plants and start new colonies.

IDENTIFYING APHIDS

Certain aphids are especially nasty because of their ability to reproduce rapidly, feed on a wide range of plants and develop resistance to pesticides. Growers need to be careful with these aggressive species and deal with them before a population has a chance to really flare up.

The green peach aphid, *Myzus persicae*, feeds on the widest range of bedding plants and container-grown plants. This pest is commonly encountered throughout the United States and Europe. Growers using a 10-12 x hand lens can recognize this aphid by a couple of key features. On adults, there are three faint, dark lines running down the back. Individual aphids vary from light green to yellow to slightly pinkish. At the front, top of the head is a rectangular indentation. At the tip of the abdomen, there are a pair of tube-like structures called cornicles. The cornicles on green peach aphid are long and slender and the same color as the body, with slightly flared tips that are dark and colored. The green peach aphid is usually found feeding on tip growth but may move downward to older foliage as numbers build up.

The melon aphid, *Aphis gossypii*, is as common and widespread in distribution on greenhouse plants as the green peach aphid. This aphid is relatively small (under 1.2 mm in length). The color of melon aphids can vary from medium green, ◆

blue-green, gray-green to mottle green. The antennae are shorter than the length of the body. The cornicles are short and black for their entire length. Examine the area between the antennae at the top of the head, and you will find that they lack the indentation found on the green peach aphid. Melon aphids tend to feed on the centers of plants, moving upward to buds and new leaves as the older leaves mature.

MONITORING FOR APHIDS

Aphid control is much more successful when an infestation is detected and controlled early in a crop cycle. Use a professional scout or train your workers to recognize the signs of aphid infestations. Certain plant species grown in your greenhouse, such as salvia, petunias and pepper transplants, will tend to have aphid problems each year. Inspect the aphid-prone plant very carefully. Also, keep a list of which plant species had aphid problems so you can focus your monitoring efforts the next year.

Many aphid species prefer to feed on the undersides of foliage, so make sure the foliage is flipped over and inspected carefully. Ants are often found feeding on the honeydew of aphids. If you detect large populations of ants on your plants, check closely for the presence of aphids.

Winged forms of aphids can be monitored using sticky cards. Keep in mind that winged forms of aphids are produced in a greenhouse when the population has reached high levels on individual plants and the aphids are dispersing to establish new colonies on other plants. Finding the winged forms should alert you that you have a real problem. Place 1-2 yellow sticky cards per 1,000 sq. ft. of growing area. The yellow sticky cards should be examined at least once per week and replaced after a count is taken.

NONCHEMICAL APHID CONTROL

First, control the weeds under the bench and in areas

surrounding the greenhouse production area. Aphid populations will build up on the weeds and easily spread to the plants growing in the greenhouse. Using microscreening on intake vents will help prevent winged aphids from flying into the greenhouse. Examine new plants that are brought into the greenhouse and make sure you are not carrying in aphid-infested plants. Infested plants serve as hotspots from which aphid populations can leapfrog across your greenhouse and rapidly establish an out-of-control population. Aphids can be carried into greenhouses on clothing or infested cuttings or plugs. Plants such as salvia and verbenas, known to be preferred by aphids, should be examined very carefully before they are moved into a clean greenhouse.

Aphids, as sedentary feeders, have many naturally occurring predators and parasites, including lady beetles, lacewings and Aphelinidae wasps, just to name a few. Growers interested in using beneficial organisms should select pesticides listed as having minimal impact on the good guy bugs.

Before you attempt to use biological control for aphids in a greenhouse, investigate the economics, shipping routes, availability, suitable species, release rates and timing. It also helps for you to know which species of aphid you are trying to control, since some predators and parasites are better for certain aphid species.

The predatory aphid midge, *Aphidoletes aphidimyza*, is excellent for control of over 60 aphid species, especially green peach aphid. Midges are shipped as pupae. One to two pupae are placed on each potted plant or 3-5 larvae per square yard of bench area for bedding plants. Release is continued on a bi-weekly basis until the aphids are controlled. This predator thrives under humid conditions.

For control of melon aphids, *Aphidoletes colemani* is the preferred species to use. Try 1-3 ◆

aphid midge cocoons per square foot of growing area. In Northern greenhouses, during the shorter days of fall and winter, this predator requires supplemental lighting to stay active.

Aphidius matricariae is a parasitic wasp that can be used to control potato aphid and green peach aphid. These parasitic wasps reproduce by laying eggs

in aphids, and typically produce tan or gold aphid mummies. A round hole can be observed where the adult parasite chewed its way out of the aphid mummy.

Another method for control is through the use of pathogens that are infectious to aphids. One of the most effective entomopathogenic fungi for aphid control is *Beauveria bassiana*. This insect pathogenic fungus is sold under two brand names, BotaniGard (Whitmire) and Naturalis T&O (Troy Bioscience). Conidium of the fungus are mixed with water and applied as a fine spray. Making direct contact with the aphids is important. Use a fine mist sprayer with droplet sizes of 100 microns and under to ensure the best contact. The conidia that make contact with the aphid will germinate, penetrate the body of the aphid and kill the pest. In the spring and summer, aphids shed their skins every 3-4 days; this may reduce the efficacy of the fungus. Repeated applications at 3- to 5-day intervals usually ensure that conidia are present on the skin long enough to cause infection. Some growers use *Beauveria bassiana* applications in combination with one or more chemical controls. Check the complete label for a list of pesticides that can be safely used with *Beauveria bassiana*.

European greenhouse managers have been using the entomopathogenic fungi *Verticillium lecanii* with excellent success in controlling aphids. One of the large biological control supply companies is in the process of labeling the material with the EPA.

CHEMICAL CONTROL

Aphids have a well-known capability to develop insecticide resistance. The green peach aphid, melon aphid and foxglove aphid are the most commonly found species on spring bedding plants and tend to be some of the toughest aphids to control with chemical pesticides.

The list of chemicals for control of aphids is extensive, and we apologize for the omission of any registered product.

Systemic insecticides. Imidacloprid, found in Marathon 1 G, Marathon 60 WSP and Marathon II (Olympic), works ◆

**PRODUCTS
LABELED FOR
CONTROL
OF APHIDS**

BotaniGard (Whitmire)
Naturalis-0 (Troy
BioScience)
Azatin XL (Olympic)
Marathon 1 G (Olympic)
Marathon 60 WSP
(Olympic)
Marathon II (Olympic)
Orthene 75 (Valent)
Distance (Syngenta)
Precision (Whitmire)
Preclude (Whitmire)
Endeavor (Syngenta)
Thiodan 50 WP (FMC)
DuraGuard (Whitmire)

well on aphids. The 1-G and 60 WSP applied as a soil drench will give long-term control for 8-12 weeks. Marathon II is labeled for use as a foliar spray and gives control for approximately 14 days. Acephate (Orthene) works well on some aphid species. Syngenta has plans to label the systemic insecticide Flagship for aphid control in greenhouses; EPA registration might come sometime in 2002.

Insect Growth Regulators. Insect growth regulators (IGRs) work best if applied to young colonies of aphids. This means applying the material when aphid populations are first detected. Distance (Syngenta) gives very good, long-term con-

trol of aphids. Precision and Preclude IGRs (Whitmire) also give good control of young aphid populations.

Novel modes of action. Endeavor (Syngenta) has a novel mode of action in killing aphids. The chemicals block the stylet of the feeding aphid, which basically starves the aphid to death.

Old standbys. Thiodan 50 WP (FMC) has been around a while but is still effective on aphids. DuraGuard (Whitmire) is good on tougher-to-control species such as melon aphid. GPN

Editor's Note: The use of specific trade names in this publication does not constitute endorsement of these products in preference to others containing the same active ingredients. The use of trade names is solely for the purpose of providing specific information and does not signify that they are approved to the exclusion of others. Mention of a product does not constitute a guarantee or warranty of the product by the author or magazine.

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