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# Control of Root-feeding Larvae: Kiss Black Vine Weevil, Japanese Beetle and Oriental Beetle "Goodbye"

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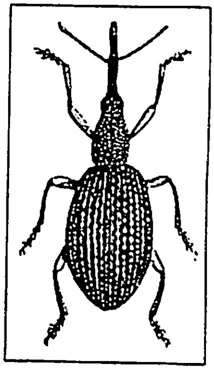
Soil-dwelling insect pests can affect any container-grown nursery crop. Economic losses can include poor vigor or death of plants, rejection of plant shipments by customers, and loss of markets due to quarantines. Root-feeding species include fungus gnat larvae, white grubs and root weevils. Recent test of bifenthrin, a pyrethroid, as a preplanting potting mix ingredient demonstrate that infestation by all three of these root feeding complexes can be prevented in containerized nurseries.

Fungus gnats are delicate, mosquito-like flies commonly found in enclosed propagation areas. The larvae are nearly clear with a slimy surface and a small, jet black head capsule. When moisture and potting mix conditions favor their growth, the numbers of larvae can be great enough to cause significant injury to plant roots, and the larval feeding sites can allow entry of root diseases. Outbreaks can be so severe that workers require dust masks to avoid inhaling the flying adults.

White grubs, larvae of scarab beetle, include Asiatic garden beetle, European chafer, Japanese beetles, oriental beetles and green June beetle. Scarab larvae are C-shaped, have a brown head capsule, and are easily distinguished from the other root-feeding species by having six legs. Green June beetles are occasionally encountered in potting mix containing composted organic material, especially if it includes manure. Their larvae are easily recognized when removed from soil because they crawl on their backs. Though the largest of all these grubs, root feeding by green June beetles is minimal; they get most of their nutrition by digesting microorganisms in compost. The remaining scarab species also feed on potting media and microbes, but grow much better when feeding directly on roots. Among these species, oriental beetles are the most commonly found in nursery pots. Female oriental beetles seem to favor highly organic, moist soils to lay eggs, meaning that any container nursery stock is jeopardized. Oriental beetles are a special concern when nurseries are located next to turf; damage can be particularly severe during droughts. Japanese beetles and Asiatic garden beetles are much more selective in their egg-laying. Japanese beetle adults eat many different kings of plants, but the females lay eggs near grasses and sedges. Asiatic garden beetles feed on Astible, strawberry, rhododendron and various plants in the carrot family, and seem to lay eggs near where they feed. European chafer can be found in containers, but is much less prevalent than oriental beetles or Japanese beetles. Adults of all these species lay eggs in groups. Thus, one pot can have 30 larvae and a dead plant, while an adjacent pot may have no larvae. Japanese beetles are easily detected through their conspicuous adult feeding habits and through use of floral/sex attractant baited traps. Oriental beetles are more difficult to detect because they fly briefly during the day, mate, and burrow into soil to lay eggs. Recently developed Oriental beetle pheromone traps can detect adult activity, but this information may not be useful for planning control measures.



The only root weevil currently significant in container-grown nurseries is the black vine weevil. The adult is 12mm, jet black, with a beaded appearance on the thorax. Of the species mentioned in this article, black vine weevil has the greatest potential to cause substantial losses in container-grown perennials. With the exception of grasses, black vine weevil reproduces very well on perennials, and since the larvae develop completely on consumed root tissues, a single root weevil larva typically causes more injury than one white grub. Adults can live more than one year, often laying 200-400 eggs the first year, 400+ eggs the next. Adults cannot fly, but often invade heated structures to overwinter, crawl into a nursery from surrounding vegetation, or are inadvertently brought in with plant material. Since the larvae feed in the soil and adults are active at night, infestations often go unnoticed until significant damage has occurred. The C-shaped larvae are easily distinguished by their brown head capsule and the absence of legs.

The standard treatment for disinfecting pots of white grubs and weevils has been a pot dip with Dursban 4E. This procedure has been unpopular because of the large quantity of insecticide required, risk of worker exposure to organophosphates, environmental concerns (toxicity to fish), and phytotoxicity to non-woody plants. Furthermore, such treatments are curative, meaning that the larval damage to plants would already have occurred.

Controlling adults would prevent infestation and damage caused by larvae. However, attempts to control fungus gnats, scarabs, or black vine weevil adults with foliar sprays disrupts IPM programs and is inefficient. In some cases adults make poor targets because their above-ground activity is limited (oriental beetle, European chafer) or because they have developed insecticide resistance (fungus gnats, black vine weevil). Tim Abbey and I have determined that the chemical standard for black vine weevil adult control, bifenthrin, is selectively toxic to predatory mites and its use causes outbreaks of two spotted spider mites. The same results could also be expected of another adulticide, bendiocarb.

One treatment option is a preventive potdrench with imidacloprid. A mid-July Marathon 60W drench using the lower labeled rate of one packet (20g) per 240 one-gallon pots is 100% effective in controlling white grubs, and will kill approximately 85% of black vine weevil larvae. At $55.77 per packet, this costs 23 cents per pot. An additional benefit from this treatment is season-long control of aphids, whiteflies, spittlebugs, lace bugs and rhododendron leaf miner through imidacloprid's systemic action.

A recent spin-off from fire ant quarantine research provides long-term quarantine-level preventive control for all three groups of root-feeding larvae. Bifenthrin (Talstar F or Talstar 0.2G) is thoroughly mixed into potting media before planting at a 5- 10-, or 20-part-per-million (ppm) concentration. This active ingredient seems unique among pyrethroids in having a long half-life in soil (approximately 12 months, Homer Collins, USDA Fire Ant laboratory, Gulfport, MA, personal comm.) Fungus gnats seem to be the most sensitive to this product; the labeled rate is 5 ppm for its control. Field data (CT and RI) suggests that the 5 ppm rate may also be completely effective for one year against back vine weevils, but 10 ppm may be required for complete prevention of infestation by European chafers. The strategy is to identify the target pest and the duration of control desired (one, two or three years) and to adjust the potting medium dosage accordingly. For example, for one year of black vine weevil control, 5 ppm should be sufficient. For two years 10 ppm would be required and for three years 20 ppm is needed. At a cost of $60.00 per 50 lb page of Talstar 0.2G, a pot volume of two quarts, and a bulk density of 750 lb per cubic yard, the cost is 1.9 cents per pot. Talstar F can be substituted for the granular formulation: To use the flowable product, spray a diluted volume containing the required amount of active ingredient onto media while mixing.

**Example for calculating the amount of Talstar 0.2G to treat potting media:**

- Weight of potting soil (oven dried): 83.4 g
- Volume of potting soil: 325 ml
- Bulk density: 83.4 g ÷325 ml = 0.256 g/ml
  = 256 kg/m3 x 1.68 = 430 lb per cu. yard
- Target concentration = 10 ppm (10 pounds active ingredient per million pounds mix)
- Amount per cubic yard, active ingredient = 430 lb x 0.00001
  = 0.0043 lb (a.i.)
- Amount per cubic yard, Talstar 0.2G = 0.0043 lb (a.i.)÷ 0.002
  = 2.15 lb. formulated

A quick way to do these calculations is by using proportions. For Talstar 0.2G and a 10 ppm potting mix, you would need 1 lb of formulated product to treat 200 lb (dry weight) of media. If the bulk density of your medium is 500 lb per cubic yard, then it will require 2.5 lb formulated Talstar 0.2G to obtain 10 ppm in a cubic yard. A 750 lb per cubic yard medium would require 2.5 x (750/500)=3.75 lb of Talstar 0.2G.