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 pre-planting 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

2. Eradication: keep debris, dead leaves removed.
3. In greenhouses decrease humidity through air flow, air exchange and proper watering.
4. In outdoor production use proper spacing and fungicides (see below and references).
5. In landscapes thin stems and increase spacing for more air movement; water early in when leaves will dry quickly.
6. Begin scouting early in season (Memorial Day); begin application of sprays at onset of disease; continue through season if weather is conducive for disease.

Phlox Cultivar Resistance
- Ratings in 1986 (White Flower Farm, CT), 1996 (Chicago Botanic Garden – Richard Hawke).
- Cultivars with least or no mildew in at least 2 of the 3 ratings:
  ✓David (white).
  ✓Orange Perfection (dark salmon).
  ✓Prime Minister (white, red eye).
  ✓Starfire (red).

Monarda Cultivar Resistance
- Rating in 1996 (Chicago Botanic Garden – all 19 cultivars with no mildew, as in Vermont in 1995).
- Replicated 1994-97 (Vermont).
- Cultivars with least or no disease in Vermont ratings:
  ✓Blue Stocking (purple).
  ✓Marshall’s Delight (pink).
  ✓Violet Queen (purple).
- Cultivars with high disease in Vermont ratings:
  ▼Adam (red).
  ▼Cambridge Scarlet (red).
  ▼Croftway Pink (pink).
  ▼Souris (pink).

Organic Control Research (Vermont)
- Best control (no differences among treatments):
  ✓Baking soda, 0.5% (1.5 Tbsp/gal water, weekly).
  ✓Sunspray Horticultural Oil (3Tbsp/gal water, every two weeks).
  ✓Both combined (every two weeks).
The following article was reprinted from the 1998 University of Connecticut Perennial Plant Conference.

**Powdery Mildew on Phlox and Monarda**

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**The Problem**
- One of the main diseases of important genera such as phlox and monarda.
- White powdery growth covering leaves, severe cases cause leaf drop, affects vigor and resistance to stress over time, less attractive for sales.

**Cause**
- *Erysiphe cichoracearum* fungus generally; strains vary with location, climate.
- White fungal threads produce spores early in season, which germinate, penetrate leaves and absorb nutrients causing leaves to turn yellow and eventually die.
- Overwintering “pepper appearing” structures form late in season, overwinter in buds and debris, release spores following spring to continue disease.

**Conditions affecting mildew**
- Wind triggers spore release and aids distribution, but also keeps leaves dry so spores don’t germinate as easily.
- *Leaf wetness* for short periods promotes the diseases; *forceful water* (70 psi) or continual wetness prevents it.
- *High relative humidity* promotes spore germination, some also germinate in dry
- *Temperatures* above 86°F kill spores except under high humidity; moderate temperatures promote the disease
- *Light: plants in shade* usually have more disease from lower temperatures and more dampness.
- *Nutrition: plants with luxuriant growth* from excess nitrogen have more disease.

**Management Options**
1. Host resistance: select resistant cultivars (see below).
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 potclrench 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 chafer. 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.
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.

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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
  - 0.256 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

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