

# Black Vine Weevil

## Controlling a Major Nursery and Landscape Pest

The black vine weevil (BVW), *Otiorhynchus sulcatus* (Fabricius), is a flightless insect in the family Curculionidae. In the United States, black vine weevils were first noted in 1835 in Massachusetts.

With more open markets and trade worldwide, the black vine weevil has been shipped to nurseries and moved into landscapes throughout the continental United States, Europe, and Asia. It is occasionally a pest of some food crops such as strawberries, raspberries, and grapes. Sometimes it is a problem in greenhouses. BVW does not seem to thrive in southern states, tropical areas, or arid climates.

The black vine weevil is a widespread, entrenched pest in many nurseries in Maryland. Once it is introduced into a production nursery, BVW is extremely difficult to eliminate. While foliar damage caused by adult weevils is a cosmetic concern, larvae of the black vine weevil cause serious root injury and girdling of azaleas, rhododendrons, yews, and many conifers.

In addition, the black vine weevil has a major impact on herbaceous perennial nurseries. Larvae damage the root systems and crowns of several species of herbaceous perennial plants. Some states prohibit importation of plant material infested with BVW.

### **Black Vine Weevil Feeds on Herbaceous Annuals, Perennials, and Woody Plants**

Some of the host plants are listed below according to type of plant and its susceptibility to black vine weevil damage.

#### Highly susceptible herbaceous perennials and annuals

*Astilbe x arendsii* (astilbe)  
*Bergenia cordifolia* (heart-shaped bergenia)  
*Begonia* (tuberous begonia)  
*Convallaria* spp. (lily of the valley)  
*Cyclamen* spp. (cyclamen)  
*Epimedium x rubrum* (epimedium, barrenwort)  
*Filices* spp. (maidenhair fern)  
*Heuchera sanguinea* (alumroot, coral bells)  
*x Heucherella* (cross between *Tiarella cordifolia* and *Heuchera* hybrid)  
*Tiarella* (foamflower)  
*Hosta* spp. (hosta)  
*Impatiens* spp. (garden impatiens)  
*Paeonia* hybrids (peony)  
*Physostegia virginiana* (obedient plant)  
*Rodgersia* sp. (rogersia)  
*Sedum* spp. (sedum)  
*Waldsteinia fragarioides* (barren strawberry)

Low to moderately susceptible herbaceous perennials and annuals

*Calluna* spp. (heather)  
*Impatiens balsamina* (garden balsam)  
*Lysimachia nummularia* 'Aurea' (creeping Jenny)  
*Tricyrtis hirta* (toad lily)

Highly susceptible woody plants

*Rhododendron* spp. (rhododendron)  
*Taxus* spp. (yews)

Low to moderately susceptible woody plants

*Euonymus* spp. (euonymus)  
*Gardenia* spp. (gardenia)  
*Liquidambar styraciflua* (sweet gum)  
*Rhododendron* spp. (azalea)  
*Tsuga* spp. (hemlock)  
*Wisteria floribunda* (wisteria)

## The Biology of the Black Vine Weevil

### Generations per Year

Outdoors in Maryland, the BVW produces one generation per year. In the greenhouse, the weevil may produce several generations a year, depending on temperature and environmental conditions.

### Egg Stage

In Maryland, adults lay eggs starting around 3 weeks after emergence (late June to the end of October). The female weevil lays between 500 and 600 eggs over 2 to 3 months, averaging seven eggs per day. Newly laid eggs are white and turn pale brown after a few days. The eggs are spherical and less than 1 millimeter (mm) in diameter. They are typically laid on the substrate or soil surface, close to the stem of the plant. Within 10 to 12 days, the eggs hatch into grubs that burrow down into the soil or substrate and begin feeding on roots and

dead plant material. In greenhouses, eggs are laid over an extended time, and all stages of the weevil may occur at the same time across the population.

### Larval Stage

Black vine weevil larvae are legless white grubs with brown heads and are typically "C"-shaped (figure 1). Rows of gold-colored setae (hairs) are visible on the body. The larval stage can last from 2 to 12 months.

Larvae, which can grow up to 10 to 12 mm (0.4 to 0.5 in.) in length, have six stages, or instars. Young larvae feed on fine roots; mature larvae feed on stems, crowns, and larger roots, sometimes boring inside larger roots. In some herbaceous perennial plants, such as astilbe, the larvae bore into the base of plants. Before pupation, larvae become quiescent (immobile). The weevil overwinters as larvae. Overwintering larvae often migrate to the bottom of container-grown plants. Feeding usually ceases as soil temperature decreases. In the spring, larvae feed before pupating.

**Figure 1. Black vine weevil larva showing "C" shape**



### **Pupal Stage**

Larvae of black vine weevil pupate in an earthen cell they form below the surface of the soil. Pupation lasts 20 to 40 days; cool temperatures in spring slow pupation (figure 2). Adults remain in the pupal cell as the body hardens and darkens before emerging.

**Figure 2. Black Vine Weevil Pupation Lasts 20 to 40 Days**



Photo: Mike Reding and Betsy Anderson. USDA, Agricultural Research Service. Bugwood.org

### **Adult Stage**

In Maryland, adult BVW start emerging in June in most years and can extend over a 20- to 40-day period (figure 3). Adult females live from 5 to 12 months. Adults are 7 to 9 mm long (~ 1/2 in.) and dark black with patches of yellowish hairs on the wing covers (elytra). Males have not been observed in the United States. Adults cannot fly because their elytra (hardened forewings) are fused together.

Adults are generally active at night. During the day, they tend to hide beneath plant debris and pots and

in cracks and crevices. However, some limited daytime activity may occur when skies are overcast.

**Figure 3. In Maryland, adult BVWs begin emerging in June**



Joseph Berger, Bugwood.org

The newly emerged adult weevil undergoes a pre-oviposition period of approximately 3 weeks during which it feeds on plant foliage. After this period, adult females start laying eggs. Adults and eggs can be found throughout most of the summer. Larval feeding extends over several months.

### **Adult Weevils Feed on Leaves, Larvae Attack Roots**

Adults cause notching damage to the foliage of herbaceous and woody plants (figure 4). Larvae feed on the roots and girdle the crowns. Plant species vary in how susceptible and/or tolerant they are to both larval and adult feeding. In addition, host plants with foliage notching by adults may show no larval feeding and vice versa. Sedum, for example, can have larvae feeding on the roots but no noticeable notching of foliage.

Notching damage to foliage by adult BVW may only become significant where high populations of black vine weevil exist; damage may go completely unobserved on plants such as *Taxus*. Commonly, notching of foliage is noticeable on green leaf

cultivars of *Heuchera* but not on dark-leafed varieties.

With some plant species, black vine weevil larvae may severely reduce root systems and kill entire plants. Certain species such as toad lily, however, tend to be very tolerant of large numbers of larvae, with little noticeable injury to the parts of the plant above ground. On the other hand, comparatively fewer black vine weevil larvae may cause other plants such as bergenia, coral bells, impatiens, and astilbe to suddenly wilt and die from severe injury to their roots and crown. On many plant species, stems are girdled just below the soil level, resulting in plant death. Because females cannot fly away, large populations usually build up on a preferred site after several years.



**Figure 4. Black vine weevil caused foliage notching on this rhododendron**

### **Monitoring Can Help Reduce Weevil Infestation**

#### **Adults**

Monitor for adults in greenhouses by placing horizontal sticky boards on benches to trap walking adults. In the field, adults often hide during the day under leaf litter or loose soil beneath the plants; they can be detected by sifting through soil. Since

adults are active at night, place corrugated cardboard or pitfall traps below or around canopies of susceptible crops and check traps regularly. During late spring and summer, check new foliage for the characteristic notching of the leaf margin caused by adult feeding.

Place burlap collars around the trunks of susceptible plants to trap the adults that seek daytime hiding places. Shake out the burlap every day over a small bucket of soapy water. For evergreens such as yew, arborvitae, or spruce, shake or lightly beat branches over a cloth on the ground to dislodge weevils, which hide in dense canopies during the day.

#### **Larvae**

Knock a plant out of its container or uproot a suffering plant. Examine roots and crowns of plants for signs of larval feeding. Larvae may be found around the outside of the roots or inside the root ball or possibly inside fleshy crowns or rhizomes.

### **Non-chemical or Biological Measures Can Be Used to Manage BVWs**

#### **Non-chemical Controls**

In container nurseries, segregate older, infested plant material from plants that will be used for propagation next year. Do not grow host plants around greenhouses where susceptible plants are grown. In landscapes, use less susceptible plant varieties. Inspect plants for larvae before planting.

#### **Biological Controls**

#### **Entomopathogenic (Beneficial) Nematodes**

Entomopathogenic nematodes can be applied as a soil drench to control the larval stages (figure 5). Nematode species vary in their host-searching behavior and their activity zone in the soil profile. Research confirms that heterorhabditid species are more effective against black vine weevil larvae than

steinernematids. *Heterorhabditis* spp. have an active foraging (cruiser) strategy and move deeper into the soil searching for prey, making them ideal for pests such as black vine weevil larvae and beetle larvae. *Steinernema* spp. search to a lesser degree and tend to have a nictating (staying stationary and waving back and forth) strategy that is less effective in locating BVW larvae.

**Figure 5. Thousands of live *Heterorhabditis bacteriophora* nematodes from a wax moth cadaver. When dead, nematodes are straight as a board. Check viability with a hand lens before using the nematodes.**



Photo: Peggy Greb, USDA Agricultural Research Service. Bugwood.org

University of Maryland Extension conducted multiple trials testing the effectiveness of nematodes to control a black vine weevil infestation on container grown plants. The study provides convincing evidence that *Heterorhabditis bacteriophora* nematodes are highly effective. In all the study's trials, the application of nematodes and insecticides significantly reduced populations of weevil larvae compared with levels found in untreated containers. Levels of control were comparable to chemical control in most cases. Other research has found varying outcomes in using nematodes to control black vine weevil larvae in landscapes.

Entomopathogenic nematodes are available from commercial suppliers of biological control agents; apply to the soil as a drench for controlling soil-infesting pests such as black vine weevil larvae. Soil

temperatures must be between 10 to 30 °C (50 to 85 °F) and moist for nematode survival. The nematodes reproduce inside the infested larvae. The nematode in its infective larval stages then migrates into the soil and looks for other BVW larvae to infect.

To time applications of nematodes for optimal control, note new leaf notching in summer, then wait one month before applying *Heterorhabditis bacteriophora* nematodes to give the grubs time to hatch and enter the soil. Also, monitor the soil for larval presence. Although single, timed applications are sometimes effective, multiple applications may be required.

#### **Metarhizium anisopliae (Entomopathogenic Fungus)**

*Metarhizium anisopliae* has been reported to control larvae of black vine weevil. Apply the fungus as a soil drench to the soil surface before the eggs hatch. Met 52 is labeled for ornamentals and can be applied as a drench or foliar application.

#### **Chemical Controls**

##### **Acephate**

A systemic insecticide, acephate is one of the most widely used insecticides by nurseries and landscapers. Acephate (75S, Orthene TTO 97, Address T/O 75 S, or Address T/O WSP) is labeled for foliar (adults) or drench (larvae) application. Acephate is an organophosphate that binds to the receptor of the pest's synaptic nerve. Acephate is only labeled for soil application on container-grown arborvitae, azalea, camellia, rhododendron, roses, viburnum, and yew, and not field soil applications.

##### **Imidacloprid**

Imidacloprid is now off patent and there are many systemic formulations available that can be applied

as a drench or soil injection in nurseries and landscapes on ornamentals. Imidacloprid, which binds to the nicotinic acetylcholine receptor in the larva's postsynaptic nerve, is slowly degraded by the insect, causing lethal nervous system disorder. Because of Merit 75's unique mode of action, it is effective against pest populations resistant to other materials.

### **Bifenthrin**

Talstar Nursery Granule is a formulation of bifenthrin, a pyrethroid, labeled for incorporation into the substrate of container-grown nursery plants. This formulation can reduce populations of black vine weevil larvae to below damage thresholds. Talstar Nursery Flowable is labeled for nurseries as a container media drench for controlling larvae and as a foliar spray for adults. Talstar L and T Flowable are labeled for landscapes as a foliar spray for controlling adults on a wide variety of ornamentals.

### **Dinotefuran**

Safari and Transtect are labeled for larvae and adults. Safari can be used in greenhouses, nurseries, and landscapes. Transtect is for outdoor use only.

### **Other Insecticides**

Flagship (thiamethoxam), Astro (permethrin), Mavrik (fluvalinate), and Scimitar (lambda-cyhalothrin) are labeled for adult control in nurseries and landscapes.

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