MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

Fact Sheet

Fact Sheet 805

Controlling a Major Nursery Pest

Black Vine Weevil, *Otiorhynchus sulcatus* (Fabricius)

Significance to the Nursery and Landscape Industry

The black vine weevil (BVW), *Otiorhynchus sulcatus* (Fabricius), is a flightless insect in the family Curculionidae. In the United States, black vine weevil was first noted in 1835 in Massachusetts. As a result of open worldwide markets, this pest 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 strawberry, raspberry, and grape. Sometimes it is a problem in greenhouses. BVW doesn't seem to thrive in southern states, tropical areas, or arid climates.

The black vine weevil has established itself as a widespread, entrenched pest in many nurseries in Maryland. Once it is introduced into a production nursery, this pest is extremely difficult to eliminate. While foliar damage caused by adult weevils is of cosmetic concern, larvae of the black vine weevil cause serious root injury and girdling of rhododendron, azalea, taxus, 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 including *Astilbe* spp., *Aster* spp., balsalm, *Bergenia* spp. (pigsqueak), *Convallaria* (lilies of the valley), *Epimedium grandiflorum* (barrenwort), ferns, *Geranium* spp. (cranesbill), *Heuchera* spp. (coral bells), *Calluna* (heather), *Hosta* spp. (hosta), *Liriope* (liriope), *Lythrum*, *Paeonia* spp. (peony), *Phlox* spp. (phlox), *Polyanthus*, *Tricyrtis formosana* (toad lily), and *Sedum* spp. (stonecrop). Some states prohibit the importation of plant material infested with BVW.

Biology of the Black Vine Weevil

Generations per Year

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

Larval Stage

Black vine weevil larvae are legless white grubs with brown heads and are typically "C"-shaped. 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.

Black vine weevil larvae.

Black vine weevil larvae in root system.

Pupal Stage

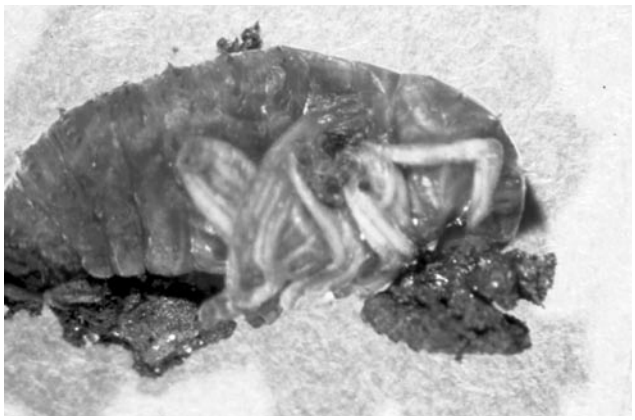
Larvae of black vine weevil pupate in an earthen cell they form below the surface of the soil. Pupation lasts between 20 and 40 days; cool temperatures in spring slow pupation. Adults remain in the pupal cell as the body hardens and darkens before emerging.

Adult Stage

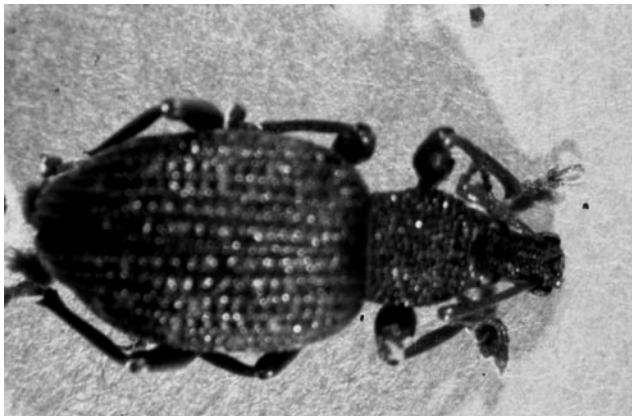
Emergence of adults starts in June in most years and can extend over a 20- to 40-day period. Adult females live from 5 to12 months. Adults are 7 to 9 mm long (~ 1/2 in.) and dark black with patches of yellowish hairs on the wing covers (elytra). Males have not been observed in the United States. Adults cannot fly because their elytra (hardened forewings) are fused together.

Egg Stage

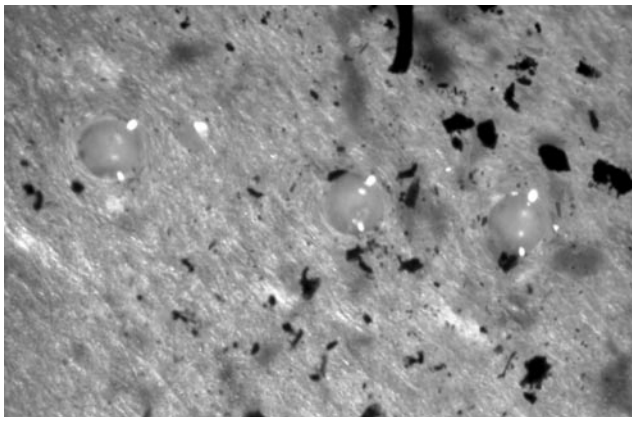
In Maryland, adults lay eggs starting around 3 weeks after emergence, from late June to the end of October. The female weevil lays



Black vine weevil pupal stage.



Adult black vine weevil.



Black vine weevil eggs.

between 500 and 600 eggs over a 2- to 3-month period, averaging seven eggs per day. Newly laid eggs, which are white and turn pale brown after a few days, are spherical and less than 1 mm in diameter. They are typically laid on the substrate (media) 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.

Life Cycle of the Black Vine Weevil

In Maryland, adult activity begins in early June. 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 the sky is overcast. 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. Females lay eggs on the soil surface or in pots in the upper inches of substrate. The larvae hatch in about 10 to 12 days and begin feeding. Larval feeding extends over several months. Black vine weevils overwinter 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. Adults emerge starting in June.

Host Plants

The black vine weevil feeds on a wide range of 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 sanginea (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. (rodgersia)
Sedum spp. (sedum)
Waldsteinia fragariodes (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)

Damage Symptoms

Adults cause notching damage to the foliage of herbaceous and woody plants; 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 notching of foliage 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 adults 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.

Larvae boring into astilbe growing point.

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.

Monitoring

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; detect them 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 on a regular basis. 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.

Notching of the foliage on variegated liriope.

For evergreens such as *Taxus*, 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.

Management

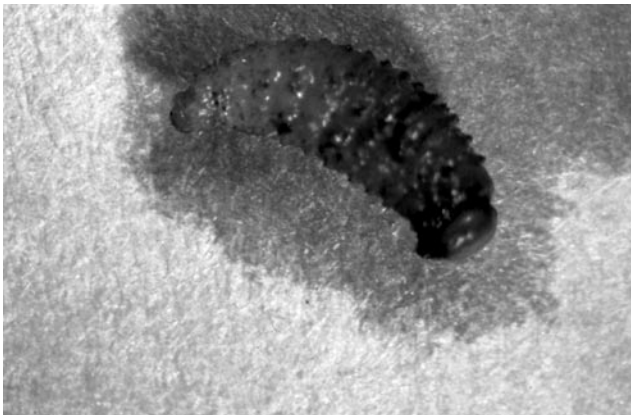
Non-chemical Control Measures

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

Biological Control

Entomopathogenic nematodes

Entomopathogenic (beneficial) nematodes can be applied as a soil drench to control larval stages of black vine weevil. 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



Larvae infested with nematodes.

(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's not as effective in locating BVW larvae.

University of Maryland Cooperative Extension conducted multiple trials testing the effectiveness of nematodes to control black vine weevil infestation of container plants grown conventionally. The study provides convincing evidence that *Heterorhabditis bacteriophora* (=*heliothidis*) nematodes are highly effective. In all the study's trials, the application of nematodes and insecticides significantly reduced populations of weevil larvae compared to levels found in untreated containers. Levels of control were comparable to chemical control in most cases. Other research has found nematode use in controlling black vine weevil larvae in landscapes to be variable.

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 degrees C (50 to 85 degrees F) and moist for nematode survival. The nematodes reproduce inside the infested larvae; the nematode in its infective larval stages then migrates out 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 aniospliae (entomopathogenic fungus)

Metarhizium aniospliae 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. Commercial formulations are not yet registered in the United States for use on nursery and greenhouse plants.

Chemical Controls

Acephate

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

Imidacloprid

As Marathon granule (1%) or wettable powder (60%), the systemic insecticide imidacloprid is labeled as a soil drench application to control larvae in nurseries and greenhouses. As Merit 75 WP, the insecticide is a formulation labeled for use in landscapes to control larvae and can be applied as a drench or soil injection. Imidacloprid, which binds to the nicotinergic acetylcholine receptor in the larvae'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 (Mullins 1993; Steward et al. 1998).

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 is labeled for landscapes as a foliar spray for controlling adults on a wide variety of ornamentals.

Other insecticides

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

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Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, University of Maryland, College Park, and local governments. Thomas A. Fretz, Director of Maryland Cooperative Extension, University of Maryland.

P2003