

## IPM\* Series: Peppers

Symptoms	Possible Causes	Notes
<b>FOLIAGE</b>		
Leaf yellowing	Older leaf drop	Normal for bottom leaves to yellow and drop as plant ages
	Root knot nematode	Plant becomes yellow and stunted; small nodules cover roots-
Leaf spots and blotches	Verticillium	Leaves yellow, wilt and curl upward
	Fusarium wilt	Slow yellowing of foliage; wilting of upper leaves
	Aphids	Chlorosis and leaf drop from severe infestations
	Whitefly	Small, transparent oval insects on leaf undersides. Tiny, white insects fly up when plant is disturbed
	Spider mites	Yellow stippling; leaves may appear dirty on undersides
	Nitrogen deficiency	Lower leaves yellow
	Magnesium deficiency	Interveinal chlorosis of lower leaves
	Bacterial spot	Small, brown, water-soaked lesions with yellow halos; enlarge to blotches
	Cercospora	Circular spots with gray centers and dark brown borders
	Phytophthora blight	Dark green, water-soaked areas
Powdery mildew	Yellow spots or blotches; powdery growth may be seen on upper sides	
Leaf and stem distortion	Viruses	Variable mottling with leaf distortion
	Chemical injury	Round or irregular dead spot
	Chilling injury	Brown or black, water-soaked blotches
	Herbicide damage	New leaves become narrow with wavy edges
Leaf curling	Mosaic viruses	Crinkled and puckered leaves; usually accompanied by mottling-
	Thrips or cyclamen mites	Leaves curl upward; silvery to bronze sheen on undersides
	Aphids	See above
Leaf scorching	Thrips or cyclamen mites	See above
	Viruses	See above
	Drought stress	Leaf margin burn
Leaf and stem browning	Chemical burn	Random, irregular spots up to entire leaf burned
	Fertilizer burn	Leaf margin burn from roots contacting excessive salts
	Bacterial spot	Leaves die and eventually drop; may progress to stems appearing as long, brown streaks
	Phytophthora blight	Black lesions on stems at plant base or on upper branches
	Southern blight	Initial sudden wilting followed by browning from plant base up

\*Integrated Pest Management (IPM):  
The balance approach to pest problems

Educating People To Help Themselves

Local Governments - U.S. Department of Agriculture Cooperating

Entire plant wilts	Fusarium wilt Verticillium wilt Bacterial wilt Southern blight  Phytophthora blight Moisture extremes European corn borer in stem	Begins with slight yellowing and wilting of <b>upper</b> leaves Begins with slight yellowing and wilting of <b>lower</b> leaves Wilting without leaf yellowing Sudden wilt, lower stem with tan lesion, white strands of fungal growth and mustard seed-sized, tan sclerotia present (fungal survival structures) Black lesion at base of plant and occasionally on stem Too much or too little water Hole in stem with sawdust-like excrement
Leaves with holes	Flea beetles  Colorado potato beetle Caterpillars	Tiny holes in shotgun pattern. Small, dark shiny insects that jump when disturbed Rare feeder on peppers Armyworms and other occasional feeders
Leaves chewed	Colorado potato beetle	See above
Slow growth	Inadequate sunlight Poor soil conditions Low temperatures Varietal characteristic	See above Tight clay soil; low soil fertility; poor drainage  Some chiles, like habanero, require up to 120 days to ripen from transplanting
Plants fall over (lodging)	Lack of plant support Poorly developed roots Waterlogged soil	
Brittle branches	Drought stress Harvesting techniques Varietal characteristic	Remove pods by cutting
<b>FRUIT</b>		
Failure to fruit or flower	Temperature extremes Moisture extremes Low or high soil pH Low fertility soil Planted too late Inadequate sunlight Tarnished plant bug	Temperatures over 90° F. and below 50° F. Too much or too little water  Plants need a minimum of 6 hrs. of sun May feed on blooms during dry weather
Blossom drop	Temperature extremes Moisture extremes Tarnished plant bug	See above See above See above
Large holes chewed in fruit	Various caterpillars (see text)	
Small holes in fruits	Pepper maggot European corn borer	Very small holes or dimples Hole near stem end; fruit soon collapses
Spots on fruits	Bacterial spot Anthracnose Stink bugs Blossom-end rot Gray mold (botrytis) Alternaria	Raised, wart-like brown lesions Water-soaked sunken lesions that expand Cloudy, yellow blotches directly below skin Dark leathery spot on blossom-end Small pale halos- “ghost spots” Small, brown, leathery lesions with concentric circles
Large discolored areas on pods (cont'd next pg.)	Blossom-end rot Gray mold (botrytis)	See above; lesion can enlarge and may extend to sides Light-colored, soft rot

Large discolored areas on pods (continued)	Phytophthora blight	Water-soaked, dull green spots covered with cream-colored mold growth
	Sunscald	Sunken, light-colored lesions on exposed fruits
	Thrips or cyclomen mite feeding	Brown russetting in streaks or patches
	Varietal characteristic	Green, immature pods may develop black streaks prior to ripening
Distorted fruits	Thrips or cyclomen mite feeding	See above
	Poor pollination	
	Viruses	Malformed, rough or spotted
Soft rots	Bacterial soft rot	Pods soften and quickly collapse
	Gray mold	See above
	Chilling injury	May be observed after frost or freeze
Failure to ripen	Insufficient ripening time	
Uneven ripening	Viruses	Yellow spots or concentric rings
	Cold temperatures	
	Varietal characteristic	

## TRANSPLANTS AND SEEDLINGS

Symptoms	Possible Causes	Notes
White-tipped leaves	Frost damage	Peppers insufficiently hardened; planted too early
Purple leaves	Cold damage Phosphorous deficiency	See above Low temperatures prevent phosphorous uptake
Wilted	Wind burn Water stress	Leaves may become pale and dry Lack of adequate water; related to wind burn
Plants fall over and die	Damping-off Cutworms	Tap root and lower stem shrivel and darken Night feeders; plants cut off at soil line
Leaves and stems chewed	Slugs and snails	Night feeders; slimy trails may be seen
Plants cut off at soil line	Cutworm	Plants sometimes “disappear”; dragged into underground burrow by cutworm
	Slugs and snails	See above
Small holes in leaves	Flea beetles	Small, dark, shiny beetles that jump when disturbed; “shotgun” feeding pattern
Pale green leaves	Lack of nitrogen	Cool soils contribute to poor nutrient uptake
	Lack of sunlight	Pepper plants require a minimum of 6 hours of direct sunlight
Leaf yellowing	Spider mites Whitefly	Fine stippling, especially in hot, dry weather Tiny, white insects fly up when plant is disturbed; usually from greenhouse where plants were grown

The **integrated pest management** (IPM) approach to preventing or managing pepper problems is recommended and can be summarized as follows:

1. Correctly identify the problem; if insect or disease, learn the life cycle and habits.
2. Learn to anticipate and prevent problems; reduce plant stress.
3. Monitor the problem for worsening symptoms.
4. If the level of damage becomes unacceptable, choose the least toxic control.

## Cultural/Environmental Problems

Pepper plants are frost-sensitive perennials grown as annuals in temperate climates. Plant stems become semi-woody when mature and the growth habit may be compact, erect or prostrate. For best results, pepper plants should each be given 3-5 sq. ft. of growing area and a minimum of 6 hrs. of direct sunlight. The soil should be well-drained and amended with organic matter and have a pH in the 6.0-7.0 range. All bell pepper and most chile pepper plants are members of *Capsicum annum*. Some chile types (e.g. habanero, aji, roccoto) belong to other species. Pepper plants are largely self-fertile but insects may be responsible for considerable crossing within and between species. Therefore, saving seed from year to year can lead to unpredictable results unless plants are screened from insects or separated by 500 ft.

## Nutritional

**Slow, early season growth** can usually be attributed to growing plants under cool conditions or purchasing overgrown, stressed transplants. Planting before soil temperature reaches 65°F will cause plants to “just sit there.” It is better to pot plants up into a larger container and grow them indoors until the ground has warmed. Fertilizing with a high phosphorous, soluble fertilizer, setting plants through a black plastic mulch and covering plants with a floating row cover can help encourage early growth. Pinching off early buds and flowers will accelerate root development and improve yields.

Pepper plants require a supply of nutrients throughout the growing season, particularly during fruiting. **Small peppers** may result from inadequate fertilization. Feed plants lightly with a balanced fertilizer every 2-3 weeks after fruiting begins.

**Blossom-end rot** is a physiological disorder that results from a lack of calcium in enlarging fruits. The fruit tissue disintegrates on the blossom or bottom end of the fruit producing a sunken, leathery, dark brown lesion. Symptoms appear when there is insufficient calcium in the soil or when plants can't move calcium to the enlarging fruit due to a lack of water. Affected fruits should be pulled immediately and discarded because they will continue to use up valuable water and nutrients.

Plants tend to “grow out of the problem”. Calcium chloride may be sprayed on affected plants but this will not reverse existing damage. **You can reduce blossom-end rot by:**

- Adding calcitic or dolomitic lime in the fall to maintain proper pH.
- Mixing in a handful of ground limestone with your garden soil from each hole when transplanting.
- Mulching your plants to conserve soil moisture.
- Watering deeply and regularly.
- Avoiding high nitrogen fertilizers.

## Fruit Set

Growth, blossom set and fruiting can be quite variable through the season and are particularly affected by temperature. **Night temperatures below 60°F and above 75°F cause blossoms and small fruits to drop.** Day temperatures above 95°F can also lead to blossom drop. Keep in mind that some blossom drop is to be expected on healthy plants growing under near-ideal conditions. Planting peppers so they receive afternoon shade, cooling plants off with a water spray and covering plants with a shade cloth or floating row cover can help to combat problems associated with high temperatures.

## Fruit Ripening / Pungency

Almost all pepper varieties produce green pods that change color as they ripen. Some varieties may go through 2 or 3 color changes (e.g. jalapeno goes from green to black to red.) Bell peppers may reach a mature green stage 70-80 days after transplanting and require an additional 2-3 weeks to fully ripen. Some types of chiles take 110-125 days to fully mature. Late-maturing varieties may not produce ripe pods if planted too late. Furthermore, pods are more vulnerable to diseases, insect pests and environmental disorders as they approach full ripeness. Longitudinal and concentric growth cracking, or “**rain checking**”, is a common but not very serious condition resulting from soil moisture fluctuations, rainy weather and heavy dew. **Sunscald** of pods occurs when pods are exposed to direct sunlight. Sunscald often results from defoliation and appears as light tan or white areas that feel soft or papery.

Pungency seems to increase with ambient temperatures, length of time growing and thinness of the pod wall. Typically, one finds genetic variability in pungency between plants grown from the same seed packet and even between different pods from the same plant. This is especially true for less domesticated, non-hybridized types of chiles (e.g. ancho, mulatto, pasilla and numex types). **Always wear rubber gloves when processing chiles or cleaning seeds.**

Pepper branches tend to become brittle and may break under a heavy fruit load or in a strong wind. Support your pepper plants with cages or trellises and consider cutting pods with a knife or scissors rather than twisting them off the plant.

## Diseases Affecting Foliage, Stems and Roots

### Bacterial Spot (*Xanthomonas campestris* pv. *vesicatoria*)

The symptoms of bacterial spot disease begin as small circular pimples on leaf undersides and as small water-soaked lesions on the upper leaf surface. Spots enlarge during warm, wet and humid weather and turn brown. Leaves will drop with severe infections, resulting in sunscald. The bacteria over-winter on crop residue and are seed-borne. The disease is spread by splashing rain and working with wet, infected plants. Hot, dry weather will slow the spread of this disease. This is one of the most common diseases of peppers in Maryland.

**Control:** Select resistant cultivars. Jalapeno and serrano chiles seem to be less susceptible to bacterial spot than other types. Treat seeds prior to planting by soaking them for 2 minutes in a 10% chlorine bleach solution (one part chlorine bleach to 9 parts water). Rinse with water for 5 minutes and thoroughly dry seeds. Cover the soil around pepper plants with a mulch and don't crowd plants together. Avoid overhead watering and working with plants when foliage is wet. Fertilize plants to support new growth. Spray with a labeled copper fungicide\*, when symptoms are first observed. Remove and hot compost all crop residues. Where bacterial spot is a perennial problem consider covering the soil with black plastic or landscape fabric.

### Viruses (Cucumber Mosaic, Potato Y and X, Tobacco Mosaic and Tobacco Etch)

Specific virus diseases are difficult to distinguish and produce a wide range of symptoms including stunted, slow growing plants, twisted, crinkled, cupped or deformed leaves, and leaf discoloration (yellow mottling and mosaic patterns, ringspots and dark-green banding). Aphid, thrips and leafhopper feeding transmit most viruses common in Maryland. Tobacco mosaic virus (TMV) is mechanically transmitted by tools and handling plants. Viral diseases are systemic and symptoms tend to progress and worsen through the season.

**Control:** Remove and discard plants that display severe viral symptoms. Control weeds around the garden and insect pests that suck plant sap. Grow or purchase transplants resistant to TMV.

### Blights and Wilts

**Phytophthora blight, Fusarium wilt and southern blight** are soil-borne diseases that produce cankers on plant stems near the soil line and cause plants to wilt. Phytophthora also causes water-soaked leaf lesions, black stem lesions at branches and root rot. Fusarium causes a browning of internal stem tissue.

**Control:** Select resistant cultivars. When symptoms are widespread it is best to remove and discard plants. These diseases are long-lived in the soil and resistant varieties are not available. Avoid poorly drained soils. Plant peppers on ridges or beds and irrigate when necessary around the base of the plants. Rotate peppers to a different area next year.

## Fruit Diseases

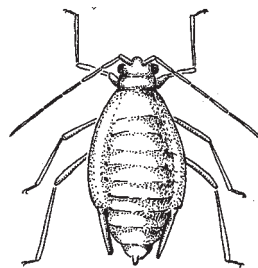
In addition to blossom-end rot and sunscald, several fungal and bacterial diseases attack pepper pods. **Anthraxnose** appears on mature green and ripening pods as small, shrunken lesions. Dark-colored concentric rings may be observed with masses of salmon-colored spores. **Alternaria rot** produces small brown lesions that also contain concentric rings and is associated with sunscald. **Bacterial soft rot** causes pods to become soft and watery and usually appears after harvest. **Botrytis**, or gray mold causes light-colored soft spots to form which can quickly enlarge. **Phytophthora** will cause large, water-soaked spots covered with a cream colored mold. **Virus diseases** may cause fruits to be small, deformed, spotted or discolored.

**Control:** Keep plants supported and mulched. Provide adequate spacing. Remove affected pods immediately. Control diseases that may defoliate plants.

## Pests

### Aphids

Aphids are small, soft-bodied insects, usually green or pink, with long, slender mouthparts which they use to suck out plant fluids. This feeding causes curling and wilting of the leaves. They excrete honeydew, which makes the leaves sticky and supports the growth of sooty mold. Two species of aphids attack peppers in Maryland, the green peach aphid (most common) and the potato aphid.



aphids turn brown and remain on the leaves. If necessary, aphids may be controlled with an application of insecticidal soap.

**Control:** Aphids are generally more of a problem May through June and again in the fall. Control is often not necessary because predator and parasite activity. Common predators are green lacewing larvae, lady beetles, hover fly larvae and predatory bugs. Several small wasps also parasitize aphids. Parasitized

### Greenhouse Whitefly, (*Trialeurodes vaporariorum*)

Whiteflies infest many vegetables during the summer. Adults are small, white, moth-like insects that may fly from the plants when disturbed. The immature whiteflies are tiny, scale-like

\* Denotes an organic fungicide

insects that feed on the undersides of leaves. Both the adults and nymphs (immatures) suck the sap from leaves. Heavy infestations cause leaves to turn yellow or appear dry. Whiteflies secrete honeydew, which causes the leaves to become sticky and supports the growth of black sooty mold.

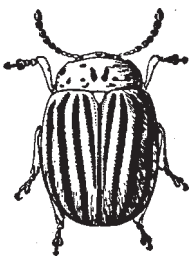
**Control:** Whiteflies are attacked by parasites and predators which normally keep them under control. If additional measures are needed, insecticidal soap, pyrethrum or a commercial blend of both is effective for control. They must be sprayed on the undersides of the leaves to contact the whiteflies and only sprayed when temperatures are cool. Insecticidal soaps and other insecticides can burn plants when temperatures are above the low 80's°F. Check container labels for precautions.

### Flea Beetles, *Epitrix* sp.

Flea beetles are small beetles with enlarged back legs that enable them to jump. The most common species on peppers is the potato flea beetle, which is 2 mm long, black, and has yellow rear legs. The adult beetles chew small, round holes or pitted areas in leaves. The larvae feed on roots, but cause no damage.

**Control:** To manage flea beetle problems, protect young plants with floating row cover. Older plants can usually tolerate heavy feeding. Flea beetles overwinter in plant debris and weeds. Remove these refuges by removing or rototilling the weeds and debris in the fall.

### Colorado Potato Beetle *Leptinotarsa decimlineata*



The Colorado potato beetle prefers potato and eggplant but will attack peppers if preferred hosts are not available. The adult beetle is stout, about 3/8 of an inch long, and has yellow wing covers with black stripes. The larvae are red to orange, stout, with 2 rows of black spots along their

sides. Both adults and larvae feed on the leaves, leaving only veins and stems.

**Control:** If only a few are present, hand pick and destroy them. A B.t. product called "M-Trak" may be used to control young larvae in heavy infestations. There are up to 3 generations of this beetle in Maryland each growing season.

### Stink Bugs

#### Southern Green Stink Bug, (*Nezara viridula*) Brown Stink Bug, (*Euschistus servus*)

Stink bugs are shield shaped insects with long, sucking mouth parts and long jointed antennae. Their name comes from the fact that they give off an offensive odor when

disturbed. The most common species that cause damage to peppers in Maryland are the brown and southern green stink bugs. On pepper fruit, damage appears as dark pinpricks surrounded by light discolored areas that may be as large as 1/2 inch in diameter. The spots become white and pithy, but remain firm as the fruit ripens.

**Control:** Stink bugs are attacked by parasitic wasps and flies and several predatory beetles and bugs. In the vegetable garden look for stink bug egg masses and removes them. The eggs are barrel or keg shaped with distinct circular lids and laid in groups of 10 or more on leaf surfaces. Remove or rototill crop debris at the end of the season and control weeds to help reduce hibernating sites of adults.

### Tarnished Plant Bug, *Lygus lineolaris*

The tarnished plant bug is an occasional pest on peppers. Adults are about 1/4 inch long, mottled brown, with long, segmented antennae. They are mainly a problem during hot weather. They feed on blossoms and buds causing them to drop. This damage may be confused with drop from high temperatures.

### Spider Mites

Spider mites can be a very serious problem on pepper plants during hot, dry weather. Spider mites are very tiny with 8 legs. They vary in color from light green with two dark spots to red. To the naked eye they look like tiny moving dots. The mites feed on the undersides of leaves and damage appears as fine stippling on the upper surfaces. Lower leaf surfaces appear dirty and may or may not have webbing. Heavy mite infestations cause leaves to turn yellow and eventually brown. To monitor for spider mites, examine the leaves closely with a hand lens, if necessary. If damage is seen, but no mites are found, check leaves higher up on the plant. A simple technique for sampling is to tap a few terminal leaves over a piece of white paper. Wait a few seconds and watch for movement.

**Control:** Because spider mites feed on lower leaf surfaces, they are difficult to control by spraying. All lower leaf surfaces must be contacted with the spray to kill the mites. Insecticide sprays also easily damage plants that have had heavy mite feeding. This is especially true of insecticidal soap during hot, dry weather. Predatory mites are an excellent option. They will hunt down and kill the spider mites and provide long-term control. They are available through mail-order sources.

### Caterpillars

#### Hornworms (*Manduca* spp).



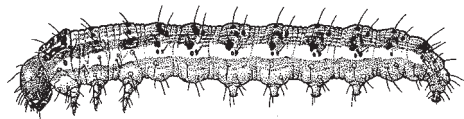
Hornworms grow up to 4 inches long, are green with diagonal stripes and have a horn at the rear end. They may strip

individual branches of a pepper plant. To find the hornworms look in areas of the plant that are being defoliated and on the ground for the presence of large, black droppings. Remove the caterpillars by handpicking. It is not necessary to spray for them.

### Armyworms (*Spodoptera* species)

Armyworms have distinct lengthwise stripes, are smooth, and can reach up to 1 1/2 inches long. They primarily damage the fruit and are best controlled by hand picking and removing damaged fruit.

### Tomato Fruitworm (*Heliothis zea*)



Tomato fruitworms usually only damage the pepper pods. The caterpillars vary in color from greenish-yellow, reddish or brown, have yellowish heads, distinct stripes along the sides, and short, whisker-like spines over the body. They may reach 1 5/8 inches when mature. Fruitworms normally begin feeding near the stem end and eventually enter the fruit. To control handpick the caterpillars and remove infested fruit.

### Cutworms

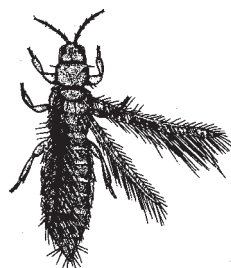
#### Black cutworm (*Agrotis ipsilon*)

The primary cutworm that causes damage to pepper plants is the black cutworm. The caterpillar is gray to black, with a lighter stripe down the middle of its back. Other species are a dull brownish color. Mature caterpillars can reach 1 3/4 inches in length and curl up into a C-shape when disturbed. Cutworms are generally a problem during May and June. The caterpillars clip off pepper transplants at or just below the soil level and are active at night. Look for cutoff seedlings and dig around the base of the plant for the caterpillars.

**Control:** To protect seedlings and transplants from cutworm damage, wrap them with cardboard collars. A simple collar can be made from a paper cup with the bottom removed. Push the cup into the soil to hold it in place. Cardboard tubes from paper towels or toilet tissue can be cut to size for collars.

### Thrips

Thrips are very tiny insects, 1-2mm long. They are slender with narrow wings fringed with hairs. They may be white, yellow, brown or black. The immatures are smaller and usually white or yellow. There are several generations. Some species overwinter in the soil; others die in winter are replaced in



the spring by populations migrating in from the south. Some thrips may feed on only one plant species, while others are general feeders on the flowers and leaves of tree, shrubs and perennials.

Some thrips species feed only on pollen and cause no damage. Others suck plant juices in a linear pattern that looks like irregular white streaks and give a silvery appearance to damaged leaves. Some species may deposit minute black fecal spots on leaves.

Thrips can cause damage to peppers in the garden. Feeding on leaves results in thickened, distorted leaves. Damage on the fruit appears as brown or silver colored areas near the cap. This damage closely resembles that caused by cyclamen mites. Thrips can also vector tomato spotted wilt virus and impatiens necrotic spot virus.

**Control:** Thrips generally do not require control in the home garden. They often become pests in June when weeds dry down and come in to well-watered, flower borders. Thrips are usually controlled by predatory insects such as minute pirate bugs and predatory mites.

### Cyclamen Mites

Cyclamen mites are tiny, pests that attack a wide range of flowers, usually in spring and late summer or fall when humidity is high. Cyclamen mites can be a minor pest of pepper and tomato. The mite injects a growth regulator into foliage while feeding that causes leaves to twist and crinkle and sometimes become very large. The symptoms mimic virus injury.

Fruit feeding produces a dramatic russetting - usually at the stem end. Fruits appear to be covered with a very fine, brown netting that feels slightly rough. Cyclamen mites usually come in on greenhouse plants or migrate in from strawberry plantings and are difficult to control when conditions favor their growth.

**Control:** Remove distorted leaves and injured fruit.

### Pepper Maggot (*Zonosemata electa*)

The pepper maggot fly is yellow, 3/8 inch long, and has clear wings with brown bands. The maggot is whitish, turning yellow as it matures, pointed at the head end, and 1/2 inch long when fully grown. The adult fly emerges in July and lays eggs just under the skin of young pepper pods. The egg punctures are elliptical and become shallow depressions as the fruit enlarges. The maggots feed on the core inside of the fruit for about 16 days. They usually leave the peppers and drop to the ground to pupate before the pods are harvested. Damaged peppers turn red prematurely and rot.

**Control:** Monitor pepper pods for the egg punctures. Pick and destroy any infested pods. Remove any rotting pods as these attract fruit flies.

## European Corn Borer (*Ostrinia nubilalis*)

Corn borer larvae may damage pepper pods and stems. The larva is flesh colored with brown spots on each segment and a brown head. The mature larva is about 1 inch long. The larvae usually enter the fruit under the stem cap. The damage is difficult to see at first because the entry hole is very small. There may be sawdust-like excrement around the hole. The larva may also enter through the side of the pepper pod causing dimpling in that area. The larvae feed on the seed core. Infested pods ripen prematurely and often rot from disease organisms that entered through the feeding hole. Larvae may also bore into stems or branches of pepper plants. Sawdust-like excrement may be visible near the entry hole. The infested stems wilt and may break off at the entry point.

**Control:** Check pods for signs of borer activity and dispose of infested pods. Remove infested branches below the entry hole. It is not practical to spray for this pest.

## Slugs

Slugs feed on pepper fruit that is in contact with the ground and on the leaves of transplants. Most slug feeding is done at night and the only evidence of their presence during the day may be slime trails. Keep ripening fruit picked, especially those near the ground. Dispose of any damaged fruit. Transplants can be protected from slugs with cardboard collars as for cutworms. Keep mulch away from seedlings until they are well established. Slugs hide in cool, moist, dark areas during the day. Remove debris, boards, etc. from gardens to help eliminate shelter areas for slugs.

**Control:** Barriers of diatomaceous earth around the garden have been shown to be effective. However, these barriers are difficult to maintain because they lose effectiveness after becoming wet.

## Nematodes

### Root Knot Nematodes, (*Meloidigyne* sp.)

Nematodes are microscopic worms of which many types feed on plant roots. The root knot nematode is a common problem on peppers. This nematode causes swellings or galls on the roots of pepper plants as well as other vegetables. Nematodes reduce the plant's ability to take up water and nutrients. Symptoms include wilting, reduced vigor, smaller fruit and leaves. The only sure way to check if a plant has root knot

nematodes is to dig it up and check the root system for the galls. Root knot tends to be more of a problem in sandy soils.

**Control:** Use nematode resistant varieties of peppers in the garden. They will have an "N" on the label or seed packet indicating nematode resistance. Also, if nematodes have been a problem, move peppers or other susceptible plants to another part of the garden. Organic soil amendments such as peat, manure and compost can be added to the soil to help reduce the impact of nematodes on vegetable plants. They may contain substances that inhibit nematodes, but are most useful for their ability to increase the water-holding capacity and nutrient availability of the soil.

**Authors:** Jon H. Traunfeld and Mary Kay Malinoski, Regional Specialists, Home and Garden Information Center, Maryland Cooperative Extension, University of Maryland, College Park. 10/2002

**Artwork:** USDA.

### References:

Carr, A. 1979. Color Handbook of Garden Insects. Emmaus, Pa.: Rodale Press. 241pp.

Black, L., S. Green, G. Hartman and J. Poulos. 1991. Pepper Diseases: A Field Guide. Publication No. 91-347. Asian Vegetable Research and Development Center. P.O. Box 205, Taipei 10099. 98pp.

Flint, M.L. 1990. Pests of the Garden and Small Farm, University of California Publication 3332. 286pp. Division of Agriculture and Natural Resources, University of California, 6701 San Pablo Ave., Oakland, CA 94608-1239, (415) 642-2431. \$30.00.

Gilberg, L. ed. 1993. Garden Pests and Diseases. Menlo Park, Ca.: Sunset Publishing Corporation. 112pp.

MacNab, A.A., A.F. Sherf, and J.K. Springer. 1983. Identifying Diseases of Vegetables. Pennsylvania State University, College of Agriculture. University Park, Pa. 62pp.

Putnam, C., ed. 1991. Controlling Vegetable Pests. San Ramon, Ca.: Ortho Books. 160pp.

### Reviewed By:

Charles McClurg, Ph.D., Dept. of Horticulture, University of Maryland, College Park, MD.

Stephen A. Johnston, Ph.D., Extension Specialist, Plant Pathology, Rutgers University, Bridgeton, NJ.

**Have a home pest or garden question?  
Call the Home and Garden Information Center**

**1-800-342-2507**

[www.hgic.umd.edu](http://www.hgic.umd.edu)