

CHAPTER FOURTEEN

Squash and Pumpkins

Gerald Brust, John Palumbo, Al York, & Richard L. Wilson

Squash and pumpkins traditionally have been treated as low-input commodities. Relatively high yields and low return have caused growers to be less likely to invest money for insect control than they would in other vegetable crops. But growers are discovering that insect control is essential to realizing a greater profit from these crops and higher value miniature pumpkins and ornamental gourds. Yield reducing pests are present each year, but they must be controlled at the proper time. One of the main goals of this chapter is to provide growers with useful information to determine when insects should be controlled. Fungal diseases, such as *Phytophthora* blight and powdery mildew, are usually more serious on squash and pumpkins than are insects.

Pest	Status	Action Threshold
Squash bug	Annual	1 egg mass/plant
Cucumber beetle	Annual	5 beetles/plant
Squash vine borer	Sporadic/annual	Larval feeding detected
Aphids	Occasional	Plant deformation
Mites	Sporadic	Buildup on field borders

Table 1.
Status and economic thresholds of insect pests on squash and pumpkins.

Monitoring

The proper times to look for the various pests of squash and pumpkins are shown in Figure 1. Weekly visual inspection of plants is the proper sampling method. Many pests appear first on the edges of a field, and infestations may be localized, so all portions of a field should be scouted. Sample enough plants to determine the insect situation in the entire field.

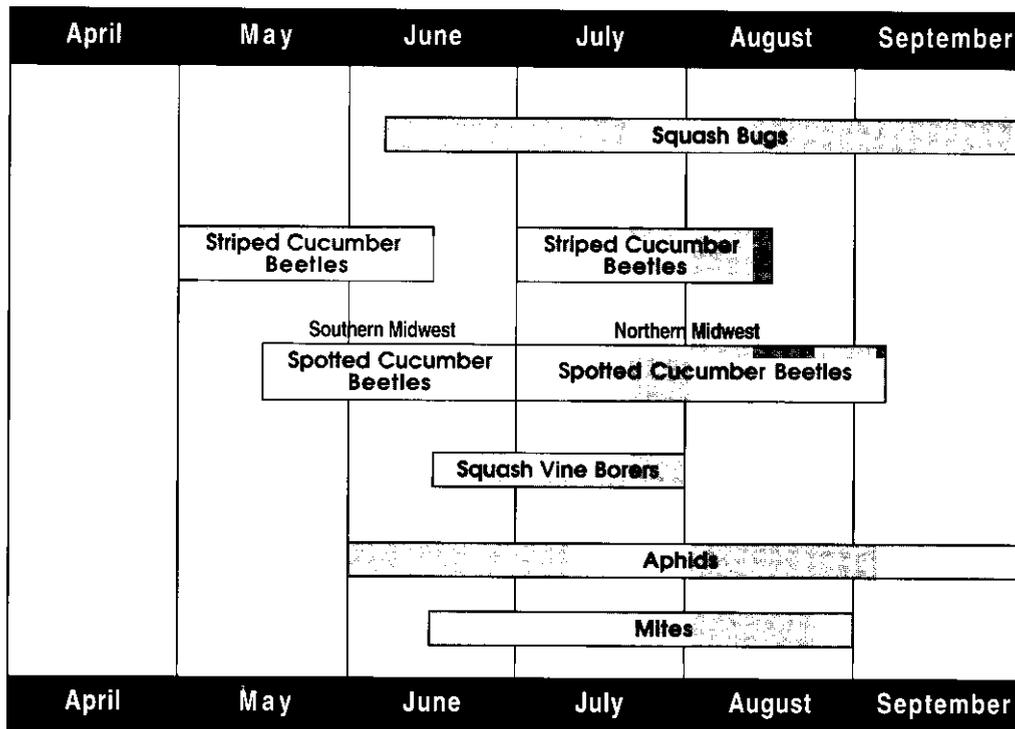
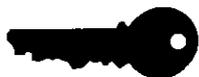


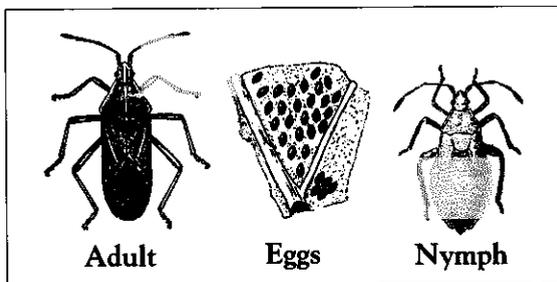
Figure 1.
Calendar for scouting squash and pumpkins.

Squash Bug



The squash bug is probably the most consistent pest of pumpkins and squash in the Midwest, and its control is usually difficult. **The key to management is early detection and control of nymphs.**

Adults are 1/2 to 3/4 inch long and dark to grayish brown. Adults are somewhat flattened, or flat-backed, with wings not covering the orange and brown striped edges of the abdomen. Newly laid eggs are 1/16 inch long and orange to yellow, but turn metallic bronze in a few days. Eggs usually are deposited in clusters of 7 to 20 in rows on the leaf undersides in the angle formed by two veins. Egg laying usually begins in mid-June, and eggs hatch in 7 to 10 days under early summer conditions.



Newly hatched squash bugs are wingless and pale-green to white, with reddish-brown heads and legs. Larger nymphs are grayish-white, with black legs.

In the Midwest, squash bugs have five nymphal stages and take 5 to 6 weeks to reach maturity. Young nymphs feed in close groups on the underside of leaves. New adult females mate and begin to lay eggs immediately. Females appearing in late July or later in the season do not mate or lay eggs but enter diapause, an inactive stage. As fall approaches, adults may seek shelter in field debris or move out of fields into nearby woods or field borders to overwinter. Nymphs present in late fall will freeze, and only the unmated adults overwinter. These adults initiate the following spring's infestation. Squash bug adults are very mobile and can move easily from plant to plant or field to field. They spend most of their life within the plant canopy around stems or on the underside of leaves.

Damage

Squash bugs prefer squash and pumpkins over other cucurbits. The adults and nymphs feed by sucking sap from the plant. Fortunately, they **do not** inject a plant toxin. As squash bugs feed on leaves, small, yellow specks develop that later turn brown. If feeding is severe, the damaged leaf turns brown and dies. When vines are fed upon, they wilt from the point of attack to the end of the vine; leaves first turn brown, then black, and eventually dry up. Large numbers of overwintering adults can cause severe damage and stand loss to newly transplanted or emerged seedlings. Young nymphs tend to feed in groups near where they hatched, but older nymphs spread out over the entire plant. Squash bugs will not kill or cause plants to wilt rapidly. Large populations can cause plants to wilt under hot, dry conditions. The plant will recover if squash bugs are controlled soon enough. Squash bug nymphs and adults feed on squash and pumpkin fruit. When populations are high, they can cause fruit to collapse or be unmarketable.

Management

Squash bugs must be controlled when plants are seedlings and during the early flowering stage.

Squash bug is difficult to control because it feeds on the underside of leaves in a plant canopy that is very dense at flowering. There are two critical times when plants need to be protected from squash bugs. The first is when the plants are seedlings. Root systems on these plants have not developed, and feeding by moderate to large numbers of

overwintered adults can kill the plants. In the Midwest, the occurrence of large, damaging squash bug populations in the early part of the season is unusual. Growers, however, should watch closely newly transplanted or germinated squash and pumpkin fields for any wilting. If wilting is observed, the underside of leaves should be checked for the presence of squash bug adults or their feeding. One or two applications of a pyrethroid insecticide at this time provides excellent control of the adults.

The second critical period for squash bug control is at early flowering. Squash bug populations must not be allowed to increase at this stage or they will damage plants, reduce yield, and become too numerous to control. Foliar insecticide applications are needed for control of squash bug nymphs if the average number of egg masses per plant, before or at flowering, exceeds 1 per plant. Small nymphs are much easier to control with insecticides than large nymphs or adults, so sprays should be timed to kill the small nymphs. When checking for egg masses, the underside of the lower leaves of a plant should be examined. Do not scout for squash bug nymphs or adults as a primary way to make spray decisions. Look for nymphs and adults only to assess the level of control achieved with insecticides. When plants are examined for adults, both the plant and the soil surface around the plant should be checked.



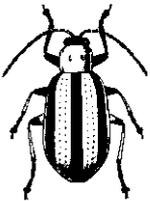
Squash Bug Action Thresholds

Early season: Wilting observed and squash bugs present

Early flowering: Average more than one egg mass per plant

Cucumber Beetles

The striped cucumber beetle is one of the first insects to attack cucurbits as the plants emerge or are transplanted into the field. The spotted cucumber beetle usually appears later in the spring (mid-May) in southern region of the Midwest or in early summer (early to mid-July) in the northern sections of the Midwest. Although both striped and spotted cucumber beetles attack pumpkin and squash, the striped cucumber beetle is a more important problem in the Midwest.

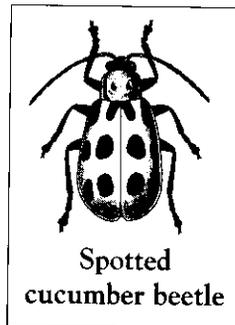


Striped cucumber beetle

Cucumber beetles are about 1/5 inch long and yellow-green. The striped cucumber beetle has three black stripes along the length of its forewings, while the spotted cucumber beetle has 12 black spots. Striped cucumber beetles resemble western corn rootworm beetles that may also be in squash and pumpkin fields. One easy way to tell them apart is to turn them over and look at their undersides. Striped cucumber beetles have black abdomens, and western corn rootworms have yellow abdomens. The western corn rootworm will not damage squash or pumpkin plants.

Striped cucumber beetles overwinter as unmated adults in protected areas near buildings, along fence rows, or in woodlots. They become active in mid-spring, when temperatures begin to increase. Currently, there is no method for predicting when the beetles will appear in large numbers. The adults feed and mate, and females begin depositing eggs in the soil at the base of cucurbit plants. The eggs hatch and the larvae feed on the roots for 2 to 3 weeks before they pupate. A second generation occurs each year, with adults emerging in July and August. These adults serve as the overwintering generation in southern areas of the Midwest.

The spotted cucumber beetle, sometimes called the “southern corn rootworm,” feeds on a wide variety of crops, including corn, beans, peas, and tomatoes, as well as vine crops. This insect most likely overwinters only in southern states and must migrate north each year.



Spotted cucumber beetle

Damage

Heavy feeding by striped and spotted cucumber beetles can kill small plants within 1 to 2 days. This type of injury usually occurs only early in the season, when plants are transplanted or are seedlings. Pumpkins or squash, which are often planted relatively late (late May or early June), may be particularly vulnerable because beetles are active when the plants first emerge. The beetles prefer to feed on the thick, fleshy cotyledon leaves.

Striped cucumber beetles feed on stems, foliage, and fruit, while spotted cucumber beetles feed mostly on the leaves. Larvae of the striped cucumber beetle can cause damage by feeding on the roots of squash and pumpkin plants, causing stunted plants and delayed maturity and fruit development.

Jack-o-lantern pumpkins and most varieties of squash are rarely susceptible to bacterial wilt.

Hubbard and butternut squash and processing pumpkins are susceptible to wilt.

Cucumber beetles carry the bacteria that cause bacterial wilt of cucurbits (see Chapter 13). Jack-o-lantern pumpkins and most varieties of squash are **rarely** susceptible to this disease. Hubbard and Butternut squash are susceptible to bacterial wilt. Some processing pumpkins are a cross between jack-o-lantern pumpkins and butternut squash and are susceptible to bacterial wilt.

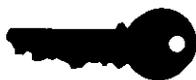
Management

The striped cucumber beetle first appears in squash fields in large numbers some time in late April or early May (mid- to late May in the northern Midwest). The timing of the invasion differs from year to year and area to area. Growers need to watch their fields for the first flush of beetles in the spring. Beetles will often be found first on the edge of the field near a grassy fence row or wooded area. **Therefore, field edges should be checked two to three times per week early in the season for the presence of beetles or their feeding.**

Systemic soil insecticides (such as Furadan 4F®), where legal to use, usually provide adequate control of the early season outbreak of beetles north of Interstate 70. Growers should still monitor their fields regularly. Systemic soil insecticides have not provided consistent control in southern parts of the Midwest but can still be used where labeled.

Foliar insecticides, such as pyrethroids and Sevin XLR®, provide the best control of the beetles, because they have 5 to 7 days of residual activity. New products such as Adios®, which combines a small amount of insecticide with attractants, are also promising management tools (see Chapter 13). Once the initial outbreak of beetles subsides (after 2 or 3 weeks), there is little benefit to continuing to apply insecticides unless the threshold is exceeded.

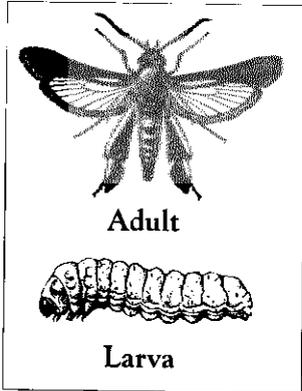
Second generation striped cucumber beetles and spotted cucumber beetles usually pose more of a threat north of I-70. If squash plants within a row have grown together, there is little danger of serious injury. **If the plants are not touching within the row, treatment is justified if the field averages more than five beetles per plant.** Insecticides for jack-o-lantern pumpkins are justified only to stop beetles from defoliating plants or feeding on the fruit.



Squash Vine Borer

Squash vine borer occurs in low numbers in most large, commercial fields of squash or pumpkin, but it can be important in some fields. The presence of the borer is often not noticed by growers until after the damage is done. The squash vine borer moth looks remarkably like a wasp and often is not recognized as a potential pest.

The adult squash vine borer is a “clear wing” moth that is slightly more than 1/2 inch long. Its wings (1 1/4 to 1 1/2 inch wing span) are a cloudy greenish-brown. The hind wings are transparent, with a fringe of reddish-brown hairs. The body is generally reddish-white, with bands of black on the abdomen. Squash vine borers overwinter as pupae in the soil and appear in mid-June through July. The moth is a daytime flier that lays eggs singly at the base of the plant, or on petioles or stems, when cucurbits begin to bloom.



The small, brown eggs (1/20 inch) hatch in 7 to 10 days, and the larva immediately bore into the stem of the plant. As they bore, larvae leave behind a tell-tale sign of sawdust-like frass at the entrance hole. Frass may also be found along the stem near additional holes. Larvae spend 14 to 30 days feeding inside the stem. Once they are full-sized, larvae leave the vine, burrow into the ground, and create a silken cocoon in which they overwinter. In the southern areas of the Midwest, larvae may pupate immediately, and a second generation of moths appears in late summer or early fall.

Damage

Squash vine borer larvae tunnel in vines and destroy the water- and food-conducting tubes, causing the vines to wilt and eventually die. Once inside the vine, little can be done to control the pest. Squash vine borers tend to cause the most damage in winter squash, especially Hubbard.

Winter squash, especially Hubbard, are most susceptible to squash vine borer damage.

Management

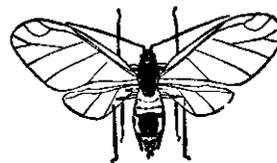
From mid-June through August, growers should watch for the borers' frass at entrance holes in the stems. Once frass is found, stems should be split to check for the presence of young borers. Very early signs of larval feeding indicate eggs have been deposited and many probably will hatch within a few days. **Two insecticide applications spaced 5 to 7 days apart will control the majority of the newly hatching larvae before they enter vines.** Weekly scheduled sprays, however, should not be used because most fields will not have an economic problem with this pest. The poor timing of scheduled sprays usually results in inadequate squash vine borer control. Currently, there are no thresholds set for the number of plants with borer frass to indicate the need for chemical control. Fields that have been severely attacked in the past are more likely to have economic damage during the current growing season.



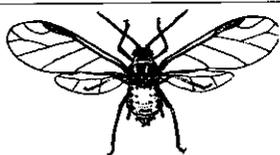
Aphids

There are many species of aphids that feed on squash or pumpkin, but they all cause the same type of damage. The direct feeding injury is usually insignificant: All the aphids can transmit viruses to the plants. There is no control for viruses after infection occurs. The disease may reduce yields considerably on late-planted squash and pumpkin (early to mid-July).

Aphids overwinter as eggs on various host plants. In spring, they hatch and feed on their hosts until mature. They then give birth to live young. These aphids usually become winged adults that leave their overwintering sites to feed on crop plants. The winged adults are 1/25 to 1/18 inch long, with clear wings. Aphids vary in color, but many are green, with black antennae and legs. Once in a squash or pumpkin field, adult female aphids will "taste-test" many plants until they find one they "like." They crawl to the underside of the leaf and lose their wings. An aphid feeds by inserting its mouth parts, which resembles a hypodermic needle, into the plant and sucking out the sugary sap. Within 24 to 48 hours, aphids begin to give birth to duplicates of themselves without mating. These smaller, immature versions of the mother grow and mature rapidly and are able to reproduce in 5 to 7 days. In fall, males and females with wings leave the field to mate and lay eggs on their overwintering hosts.



Winged green
peach aphid adult



Winged melon
aphid adult

Damage

Leaves damaged by aphids have a distorted, cupped appearance. The leaf tends to curl downward around the aphid colony. Aphids excrete a great deal of sap as "honeydew." This sticky substance may cover fruit and is difficult to remove. In addition, a sooty, black mold grows on the honeydew, causing further cosmetic injury. Aphids also transmit several viruses that can infect squash and pumpkin. As the winged adult taste-tests plants, she can potentially transmit the virus to each plant she visits. Virus infected plants have a mottled or mosaic appearance of dark and light green. Leaves are either strap-like (early infection) or puckered (later infection).

Management

Because of their small size and secretive habits of feeding on the underside of leaves, aphids can become numerous before they are noticed. After a large colony is discovered, they are usually difficult to control because their great numbers and the curled leaves protect them from sprays. To prevent unexpected, large buildups of aphids, the underside of leaves should be checked periodically.

 There are many natural enemies (lacewings, lady beetles and larvae, syrphid fly larvae, and parasitic wasps) that eat aphids. Limiting the number of insecticide applications to control other insects will help conserve these natural enemies. Therefore, when checking for aphids, these natural enemies should also be noted. Aphids should be controlled if they are stressing the plant during hot, dry conditions or if they are producing honeydew that is being deposited on the fruit. Unless there are high populations of aphids, their control seldom will be necessary if predators are

Viruses spread by aphids cannot be controlled effectively by killing the aphids with insecticides.

present. Spraying insecticides in attempting to control the spread of virus is not effective. Late season plantings of pumpkin and squash are at a much greater risk for virus infection than early to mid-season plantings (Table 2). Although some fruit may be harvested from virus infected plants, the younger the plant is when it is infected, the greater the yield reduction. Plants infected before fruit set may suffer yield reductions of 50-80%, as well as reduced quality. **Plant pumpkins as early as possible for your operation.**



Table 2. Effect of planting date on pumpkin yield¹ reduction caused by zucchini yellow mosaic virus in southern Indiana.

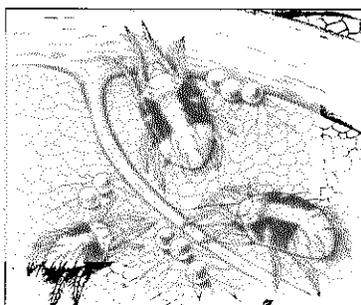
Planting Date	Weight (lbs.)	No. Fruit	Wt. (lbs.)/Pumpkin	% Culls
Early (June 10)	112	12.5	9	0
Average (June 24)	105	9.7	11	1
Late (July 10)	33	5.1	7	15
Very late (July 20)	22	3.5	6	27

¹Yields based on 60 ft. rows, 10 plants per row.

Twospotted Spider Mites

Twospotted spider mites can be major pests on just about any crop. Because of their small size and hidden feeding habits, mites can feed on squash and pumpkin and not be noticed until their populations are so large they are very difficult to control adequately.

Adult mites are 1/25 to 1/50 inch long, and yellowish-white, with two large, black spots on either side of their abdomen. Adults move long distances by "ballooning." They climb to the top of the plants, release a 3- to 5-inch silken web, and wait until the wind catches them. With this method, mites can move great distances. In the summer, adults balloon or walk into the edges of fields, where they begin to feed on the underside of leaves. Females begin to lay spherical, greenish-opaque eggs. Females can lay 70 to 200 eggs in their lifetime at a rate of five to six per day.

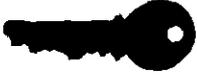


Eggs are often covered with silken webs. Eggs hatch into six-legged larvae, then develop through two additional nymphal stages before becoming adults. The life cycle (egg to adult) can be as short as 6 days at temperatures of 86°F. In the fall, spider mites overwinter where they were feeding last.

Damage

All stages of mites feed by sucking the contents out of plant cells. The first sign of feeding is the appearance of whitish-yellow dots on the top side of the leaf. On plants with large midribs or veins, the dots often appear first in long clusters along the midrib. This is because mites frequently begin feeding along or under the midrib of a leaf and then move out from there. As the mites feed, damage becomes worse, with veins remaining green and the rest of the leaf turning yellow. Whole leaves will turn bronze, then turn brown and dry-up. Leaves will often have large amounts of webbing. At this point, the mites will be difficult, if not impossible, to control adequately.

Management



Spider mite populations are worse during hot, dry weather (see Chapter 13). Therefore, starting in July (or earlier during drought), check field borders for mites. The best sites to inspect are the rows next to grassy borders or dirt or gravel roads. Many predators feed on mites, but during hot, dry weather, they often cannot control them. Mites can be monitored by examining the undersides of leaves with a 10x hand lens or by shaking a leaf over a sheet of white paper and watching for the movement of any dislodged mites. If mites are found along a field border, check the interior of the field to see how far the mites have spread. If only the border has mites, don't spray unless weather conditions favor a rapid buildup of mites. If border spraying is necessary, often only the edges of the field and 100 feet beyond the infestation need to be treated. The use of insecticides, particularly pyrethroids, can cause spider mite problems by killing natural enemies. Use insecticides only when needed.

Pollination and Honey Bees

See comments regarding pollinators in Chapter 13. Pumpkins and squash generally require one to three hives of bees per acre for maximum pollination.