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Managing Squash Vine Borer in Arkansas

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Squash vine borer, *Melittia cucurbitae*, is an insect pest of winter squash, summer squash, pumpkins and other cucurbit crops in Arkansas. Infestations often go unnoticed until signs of insect boring or wilted plants are noticed in midsummer. Nothing can be done once squash vine borer inhabit plants, but many tactics can be employed to prevent damage by this pest.

Biology

Squash vine borer (SVB) is a day-flying clearwing moth species from the family Sessiidae, similar to many other "boring" pests like raspberry crown borer or peachtree borer (Figure 1). SVB overwinter as pupae or larvae just a few inches below the soil surface. They finish pupation in the spring as it begins to warm up and then have an extended emergence as adult moths that may last a few weeks. In Arkansas, we have two generations per year of SVB, which means that growers face risk of infestations from May-September. Soon after emergence, SVB females mate and quickly begin laying eggs on the underside of cucurbit stems, leaf stalks, and near flowers (Figure 2). SVB eggs are shaped like flat disks, are copper colored, laid singly and shouldn't be confused with squash bug eggs which will be more upright and laid in groups. SVB eggs hatch in 6-11 days and larvae will then immediately begin to bore into the stem[1]. Larvae will then feed for 14-30 days before exiting the stem and pupating in the soil (Figure 3).

Figure 1. Squash vine borer adult moth. Photo by Ansel Oommen, Bugwood.org.

Figure 2. Squash vine borer eggs laid on the stems of a squash plant. Also pictured is a new entrance hole with frass around the entrance, which is often the first sign after finding eggs of a new infestation. Photo by Aaron Cato.

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Figure 3. Squash vine borer larvae observed feeding in a squash stem. Photo by Aaron Cato.

Figure 4. Wilting in cucurbit caused by squash vine borer feeding of multiple larvae. Identification of squash vine borer damage can only be confirmed if bore holes or frass are observed on wilting plants. Photo by Aaron Cato.

Figure 5. Feeding damage by squash vine borer larvae. Frass from larval feeding can be seen here around an exit hole present on a pumpkin runner. Photo by Aaron Cato.

Damage

Squash vine borer (SVB) larvae burrow into the stem or crown of cucurbit plants where they feed on the surrounding plant tissue and hollow out a small section of the plant and destroy xylem and phloem structures. This feeding will present as wilting in the region of the vine that has lost its water and nutrient resources and can eventually progress to complete collapse in those plants (Figure 4). Frass can generally be found around greenish holes near the base of wilting plants and will often appear as a mushy tan/green substance (Figures 2 and 5). These holes will eventually rot. It's possible that multiple larvae can attack a single plant, contributing to its collapse.

Cucurbit Crops at Risk

Squash vine borer (SVB) is a native pest that co-evolved with cucurbit plants native to North and South America that we now grow as crops[2]. SVB prefer crops within the genus *Cucurbita* and prefer cultivars from the species of *Cucurbita pepo* (winter squash, summer squash, pumpkins, and zucchini) and *Cucurbita maxima* (buttercup squash, banana squash, hubbard squash, and others). Common cucurbit crops that are generally unaffected by SVB are watermelon (*Citrullus lanatus*), cucumber (*Cucumis sativus*), and cantaloupes (*Cucumis melo*). Cucurbit crops that are more vining in nature and have runners that are smaller in diameter are generally less affected, as they are less hospitable for larvae.

Monitoring

Squash vine borer (SVB) management can only be successful if larvae are controlled before entering the plant. Adult monitoring is one of the easiest ways to determine when plants are at risk. Adults begin to emerge at 750-1000 degree days (base 50F degree day model with a January 1st biofix) which is usually in May in Arkansas[3]. Pheromone traps utilizing SVB lures should be set up near susceptible cucurbit crops to determine when adults are emerging and when egg-lay is beginning. A *Heliothis* trap is usually the most cost-effective solution for trapping SVB (Figure 6)[4]. See FSA7090 "Using Pheromone Traps to Monitor Pests in Tomatoes and Cucurbits" for

Figure 6. Pheromone trap set up for squash vine borer using a *Heliothis* trap. Photo by Ryan Keiffer.

information about trapping for SVB. Squash vine borer eggs are also a useful monitoring tool and should be scouted for after reaching 750-1000 degree days. These eggs are often found on the underside of stems, leaf stalks and near flowers. Additionally, growers should look for the first signs of frass, which indicate early infestation of vines before the majority of larvae enter plants (Figure 2).

Cultural and Mechanical Control

There are several cultural and mechanical controls that can help to reduce the impact of squash vine borer (SVB). First, areas where cucurbit crops are planted should be rotated each year. Squash vine borer adults will emerge in the area where susceptible cucurbits were planted the year prior, so moving plantings will help create some distance from moths and susceptible crops. Additionally, field sanitation and cultivation should be maximized immediately after harvest. Vines should be removed from the planting and then discarded or plowed under immediately after harvest is completed, or when infested plants are found. The goal is to keep larvae from pupating in the top of the soil and completing their life cycle, which will reduce infestation pressure. Plowing after harvest is also very useful to disrupt the life cycle of this moth species, as late-stage larvae and pupae will either be displaced or killed when the soil is turned.

Host plant resistance is a key aspect of any integrated pest management (IPM) program and should be utilized to help avoid the impact of SVB. Resistant cultivars derived from *C. moschata* or *C. mixta* should be prioritized whenever possible. Variation within susceptible species also exists and some cultivars from *C. pepo* such as summer crookneck are known to be less susceptible than others[5]. Host plant resistance is especially important for areas that have known issues with SVB or if crop rotation is limited due to lack of space.

Perimeter trap cropping with highly attractive cucurbit crops is a useful tool to help prevent SVB infestations[5]. Blue hubbard squash is highly attractive to many pests of cucurbits (SVB, squash bugs, cucumber beetles, etc.) and can be planted around the perimeter of the field. The outside rows of plantings and the first 1-2 plants on the front and back of each row should be planted with a highly susceptible cultivar. These perimeter plants should be sprayed often to kill larvae as they emerge, and infested plants should be destroyed before larvae can exit and pupate. This strategy works best when a less attractive cucurbit crop is surrounded by a highly attractive cultivar like blue hubbard, and when the trap crop constitutes less than 10% of the planted field.

Row covers consisting of a lightweight, permeable cloth can be used to prevent SVB infestations. This is often time-consuming, expensive and tricky to implement and can affect insect pollination[6]. Squash vine borer are day-flying moths and lay eggs at the same time that many pollinators are visiting flowers. Row covers should be removed in the evening and replaced in the early morning to allow some pollination via pollinators such as squash bees. Row covers can also be placed after 50 percent of plants have flowers if SVB moths aren't active yet, which often leads to no yield loss. Row cover use is most viable for very small plantings due to the increased labor needs.

Chemical Control

Insecticides are often a necessary tool to prevent severe damage from squash vine borer (SVB) but should always be used alongside cultural controls such as sanitation, plowing and host plant resistance. A variety of thresholds exist in the literature for SVB adult moths, but it can often be very difficult to consistently capture adult moths in traps in Arkansas. Many predators and parasitoids can help to suppress SVB and calendar-based spray schedules have not been found to yield more fruit than threshold-based systems[7]. Insecticide spray schedules should be avoided to help protect beneficial insects. Instead, insecticidal control of SVB should be considered based on a combination of monitoring techniques, field history, and the cultivar being used.

Degree day modeling and pheromone traps should be used together to determine if SVB have emerged in the immediate area, and whether plants are at risk for infestation. The risk of infestation usually begins in the early season when plants begin to run but can be harder to gauge in later plantings. The attractiveness of the cultivar being grown[5] and the history of the field should also be considered. If a highly attractive cultivar is being grown in an area with past issues, an insecticide application will be necessary. Field scouting should also be used to determine if moths are actively laying eggs in plantings. The presence of eggs, or any amount of frass, is a good time to apply an insecticide in an attractive cultivar, but infestation density should be considered in non-attractive cultivars. Use these factors in combination following the first signs of adult moths, eggs or even the first signs of frass on stems or runners (depending on whichever is found first) to target insecticide applications.

All insecticide applications for SVB should be made in the late evening to avoid impact on pollinators. Cucurbits need insect pollination to set fruit and insecticide applications during peak pollination can lead to significant yield loss. Insecticide applications should target the base of plants and good plant penetration is needed to cover susceptible stems and runners. Blower sprayers will get the best penetration and coverage but may not be necessary if directed applications can be made on a smaller scale directly to where eggs are generally laid.

Insecticide application timing and frequency depend on the material that is being used. If an insecticide with a short residual, such as a pyrethroid (bifenthrin, lambda-cyhalothrin, esfenvalerate, etc.) or a spinosad-based product is being used, two insecticide applications are needed when a treatment decision is made. Squash vine borer eggs are resistant to insecticides and take six to 11 days to emerge. This means that two insecticide applications will be necessary, seven days apart, to ensure that the insecticide will be effective when larvae emerge, as many insecticides only have four to five days of effective residual control. However, insecticides in the diamide chemical class that contain chlorantraniliprole, cyantraniliprole or cyclaniliprole have a longer residual and would likely only necessitate one application.

Pyrethroids are commonly used for control of squash bugs and cucumber beetles and are effective at controlling SVB. Monitoring should continue each week and additional insecticides should be considered 21 days after the initial treatment decision, or seven days after any other insecticide applications for other pests, depending on their effectiveness for SVB and what you are observing via monitoring. See the Southeastern U.S. Vegetable Crop Handbook for more information regarding insecticide efficacy[8].

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