Garden Symphylans on Broccoli, Cabbage, and Cauliflower

- Garden symphylans are centipede-like arthropods that feed on the roots of brassicas and other plant species.
- Root damage from symphylan feeding can result in stunted plants and reduced plant stands.
- Managing garden symphylans can be difficult because of their ability to move through the soil easily.

The garden symphylan (*Scutigerella immaculata*) is a common soil arthropod that looks something like a centipede. It is not an insect nor a true centipede. Symphylans feed on germinating seeds, seedlings, roots, and soil organic matter. The garden symphylan (GS) is a pest of vegetable crops, including solanaceous crops, brassicas, leafy greens, cucurbits, beets, and onions. Broccoli, cabbage, and cauliflower are moderate to highly susceptible to GS damage.[1,2,3,4]

Crop Damage

GS damage is a problem for seeds and seedlings, but the pest can continue to feed on older plants throughout the season. GS feeding can result in poor stand establishment, seedling death, poor growth, stunting, reduced vigor, and yield reductions.[2] Feeding can kill young roots, and feeding wounds can create sites of infection for soilborne pathogens.[5] GS feed primarily on root hairs and rootlets, as well as new roots emerging from transplant plugs resulting in stunted growth of transplants.[4] Root damage reduces the ability of the plant to take up water and nutrients leading to above-ground symptoms indicative of a malfunctioning root system.[2,4,6]

Identification and Biology

Figure 1. An adult garden symphylan. Photo by Andy Murray.

The garden symphylan (GS) is the primary species that causes vegetable crop damage in the U.S.[2] GS are small, white, centipede-like organisms. When mature, they are ¼ to ½ inch long, have 15 body segments, 11 or 12 pairs of legs, and prominent, beadlike antennae (Figure 1).[2,4] They spend their whole lives in the soil and can move rapidly when disturbed.[2,5]

The GS lifecycle includes eggs, six immature stages (instars), and adults. All stages can be found year-round, but eggs tend to be more common in the spring and fall. It usually takes two or more months to complete the lifecycle.[2,6]

Occurrence and Movement

Management practices that improve soil structure (good soil tilth, high organic matter levels, and low soil compaction) provide conditions that are ideal for GS.[6] GS cannot burrow through the soil but rather move through channels, cracks, and tunnels created by other organisms, such as earthworms and plant roots. However, they migrate vertically through the soil, easily moving from the soil surface to depths of more than three feet.[2] GS are often found in heavier, irrigated soils and are less common in sandy soils. However, they do not do well in compacted soils.[3,4,6]

Figure 2. A field of broccoli showing plants stunted by garden symphylans. Photo by Jennifer Brenneman.

Distribution of GS within a field is typically aggregated with symptoms appearing in circular hotspots a few square feet to several acres in size (Figure 2).[2] Movement in the soil is affected by several factors, including the soil structure, moisture, temperature, time of day, season, crop developmental stages, and feeding cycles.[2,3] GS tend to migrate up to the root zone when soils are warm and moist. They move deeper when soils dry and when the weather cools.[3]

Sampling

Sampling can be used to detect the presence or to estimate the population levels of GS in the soil. Evaluations of the presence or populations of GS are difficult because of their clumped distribution. High numbers can be detected in one spot and none detected several feet away. It is best to use a grid pattern when sampling to get an estimate of the field average and distribution. It is also best to sample at times when GS are most likely to be found in the surface layers of the soil.[2,6] Sampling is often conducted in the spring before planting, but it is best to sample when soils are warm and moist. Counts typically increase over the course of the spring as soils warm. Sampling too soon after tillage (within three weeks) may result in counts that are too low.

Three methods are used to sample for GS: soil sampling, bait sampling, and indirect sampling. Soil sampling involves counting numbers of GS in a volume of soil. The soil is placed on a dark-colored cloth. Soil aggregates are broken up, and the number of GS are counted.[2,6]

Bait sampling involves using a piece of potato or beet as a lure for nearby GS. The top layer of the soil is scraped off to expose moist soil. Half of a beet or potato is placed, cut side down, on the soil, and covered with a protective cover, such as a white pot or four-inch PVC cap. After a few days, the bait is pulled up, and the number of GS on the soil surface and on the bait are counted. Bait sampling often works best two to three weeks after tillage but before the plants become well-established.[2,4,6] Soil and bait sampling are usually done using a grid sampling pattern with at least one sample per acre.

With indirect sampling, evaluations of plant growth and stand establishment are used to estimate the levels of GS infestation. Healthy plants are usually associated with low GS populations while stunted plants and reduced plant stands indicate higher GS populations. Indirect sampling should not be used in place of direct (soil or bait) sampling, but it can be used to evaluate the distribution of GS infestations within a field.[2,6]

Action Thresholds

Action thresholds for GS are not well established. Damage of susceptible crops such as broccoli and cabbage is often associated with GS counts of five to ten per cubic foot of soil.[1,2,6] An action threshold of 0.5 to 3 GS per sample (cubic foot or "shovelful") is commonly used.[1,2,5,6]

Management

Managing GS can be difficult because of their ability to easily move vertically in the soil and evade control measures, the patchy distribution, and the complexity of sampling. Control measures are usually focused on decreasing populations of GS in the soil or reducing crop damage. Finding an effective balance between these two objectives is often recommended.[6]

If GS are not present in a field, then the best management strategy is to prevent their introduction in infested soil or compost. Soil and organic amendments that are brought into a field should be screened for possible GS contamination. [6]

There are no methods to completely eradicate GS from a field once they are established. Most methods aimed at reducing GS populations will be effective for one to three years at most. Applications of non-composted manure and other forms of organic matter can serve as a food source for GS and result in increased population levels. Therefore, reducing the application of these materials can help keep GS populations from growing. Tillage can physically crush GS if done when GS are in the upper levels of the soil. Planning tillage operations for times when the soil is warm and moist can help maximize the effect on GS numbers. This method may only be effective for two or three weeks, but that may be enough time for transplants to become established and less sensitive to GS feeding.[2,4,6] Compacting the soil by rolling after planting can help to eliminate the pores and channels that GS move through, also limiting the population levels in the root zone.[4]

Pesticides applications are the primary means to help lower populations of GS in conventional production systems. Insecticides are often most effective when they are broadcast and incorporated before planting. Some insecticides work as repellents, keeping GS away from susceptible plants for a period of time and some are lethal to GS.[1,2,6,7] Pyrethroid, neonicotinoid, and tetranortriterpenoid insecticides are most commonly used to help manage GS.[4] The use of some products may be limited to specific states or regions.

Garden symphylans have a wide host range and can feed on non-living organic matter. Therefore, management through crop rotation is often not effective. However, potatoes as a rotation crop have been shown to decrease GS populations. Spring oats also have been effective in some situations.[2,5,6]

There are several management strategies that help to reduce crop damage but not necessarily GS population levels. Increasing planting density can help by diluting the number of GS feeding on individual plants, resulting in less stress per plant. Tillage or light rolling of the soil to remove soil pores inhibits the ability of GS to move through the soil and get to the roots of the crop in the upper soil layers. This can help young crops to become established. Delaying transplanting until incorporated weed and cover crop debris is completely broken down can also help reduce GS feeding on new transplants, and older transplants tend to tolerate GS feeding better than younger ones.[1,4,6]

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Websites verified 10/13/2022

For additional agronomic information, please contact your local seed representative.

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