



THE SOYBEAN APHID

Aphis glycines

OVERVIEW

The soybean aphid is an exotic pest of soybean (*Glycine max*) accidentally introduced into the United States from Asia. It was first detected in the Midwestern U.S. in 2000 and in Pennsylvania in 2001. Since its introduction, the soybean aphid has developed into the foremost insect pest of soybeans across the northern US and Canada, altering patterns of insecticide use. While the soybean aphid is more pervasive in the Midwest, populations in Pennsylvania can reach damaging levels that require insecticide treatments to protect yields. These economically damaging levels have occurred during odd-numbered years in Pennsylvania (e.g., 2007 and 2009) with even-number years seeing only minor, non-economically damaging populations. Nevertheless, soybean aphid colonizes Pennsylvania soybean fields annually, and there is the potential for the pest to be problematic every year.

DESCRIPTION

Soybean aphid adults are small insects, with oval-shaped bodies around 1/16th of an inch in length. They are greenish-yellow in color, with dark eyes and a pair of tubes, called cornicles, projecting from the rear of their abdomen (Fig. 1). Young aphids, or nymphs, look the same as adults, but are much smaller and appear as very light green dots on plants. Soybean aphids also occur in a winged form that possesses two pairs of delicate, transparent wings. The winged form is slightly larger than the



Figure 1. Wingless adult soybean aphid and nymph with wing buds (Ian Grettenberger, PSU)



Figure 2. Winged adult soybean aphid (Ian Grettenberger, PSU)

wingless adults and darker in coloration, retaining the greenish-yellow abdomen, but with both the head and thorax nearly black in color (Fig. 2). A nymph developing into a winged form will possess wing buds that look like dark shoulder pads (Fig. 1).

LIFE HISTORY

Soybean aphids rely on two plant species, soybean and common buckthorn (*Rhamnus cathartica*) (Fig. 3), as hosts to complete their annual life cycle in the U.S. Soybean aphids spend winter as eggs on buckthorn trees. In spring, females hatch from these eggs and feed on buckthorn, reproducing asexually. After two to three generations on buckthorn, offspring develop wings and disperse to soybean fields in June. Most aphids that colonize Pennsylvania fields are long-distance migrants that travel here on high altitude winds from buckthorn in NY, Canada, and the upper Midwest. These winged females lay live offspring, rather than eggs, in many different fields and the quick growth of the offspring and their clonal reproduction can lead to local population outbreaks. As populations build during the summer, more winged aphids are produced that further infest a field or spread infestations between fields. The greatest population growth occurs around 70-80°F. Higher temperatures can diminish population growth as can thunderstorms that dislodge soybean aphids from plants. As soybean senesces in the fall, a new generation of winged aphids is produced.



Figure 3. Soybean aphid secondary host, buckthorn (Paul Wray, Iowa State University, Bugwood.org)

These aphids search for buckthorn, where they sexually reproduce and lay eggs that will overwinter. Because most of Pennsylvania tends to have low populations of buckthorn, it appears that most of the aphids that leave our soybean fields have little chance of passing on their genes to the next generation.

The two-year cycle of large and small soybean aphid population is driven by predators (see below) and has persisted in Pennsylvania with populations reaching outbreak levels during odd-numbered years. A similar cycle also existed in the Upper Midwest for a few years, but soybean aphid has since developed into an annual pest and each year sees fields that require insecticide applications.

DAMAGE

Soybean aphids have sucking mouthparts and damage soybeans by extracting sap, or phloem. During vegetative growth (V1-V7 stages), or when aphid populations are relatively low, they feed on the undersides of newly emerged or emerging leaves (Fig. 4). As the growing season progresses and aphid populations build, aphids spread throughout the plant and attack flowers, pods and stems in addition to the leaves.

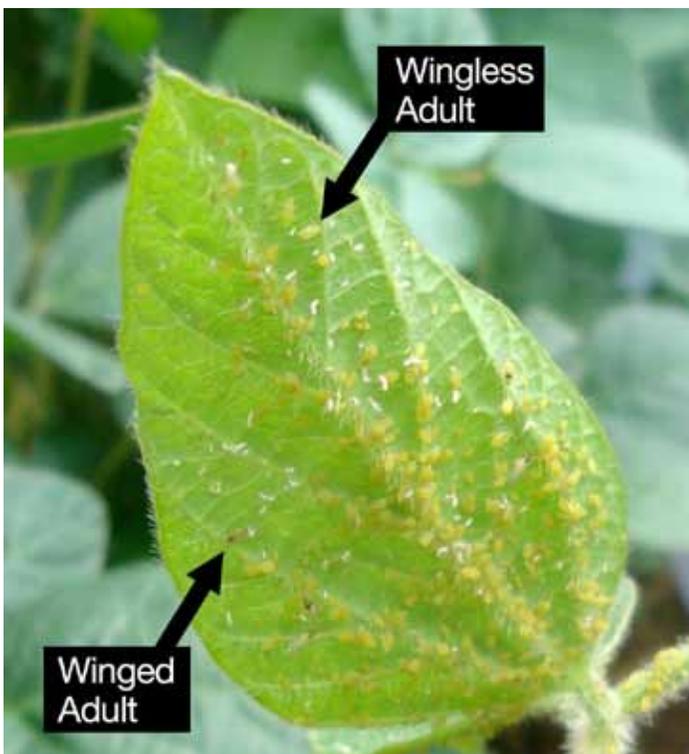


Figure 4. Soybean leaf infested with approximately 400 aphids (Ian Grettenberger, PSU)

Low levels of aphid infestation have little or no influence on soybean growth or reproductive output. However, larger aphid populations can heavily stress plants, reducing yields by up to 40%. Aphid damage can stunt or kill plants. Heavy feeding can also cause plants to abort flowers or pods and reduce the number of pods and seeds per pod. Yellowed and warped leaves

are symptoms of plants damaged by soybean aphids, although other pests and stressors can cause similar damage, necessitating proper scouting.

As they feed, aphids produce honeydew, which is the sugary substance they excrete. On foliage of heavily infested plants, honeydew accumulates and can be colonized by sooty mold. This fungus obscures the surfaces of the leaves and exacerbates aphid damage by inhibiting photosynthesis.

CONTROL

Numerous natural enemies, including predators, parasitoids, and pathogens can help control soybean aphids. In fact, these natural enemy species are responsible for the two-year population cycle of soybean aphid; when populations peak, natural enemies drive the aphid populations down and they take two years to peak again. In Pennsylvania, many different predators, including ladybird beetle adults and larvae (Fig. 5), attack soybean aphid and help maintain populations below damaging levels. In fact, these predators appear responsible for keeping aphid populations low in even-numbered years. The Asian multicolored lady beetle efficiently consumes aphid at a rate of up to 200 aphids a day. However, the high reproductive output of aphids can allow them to escape control by natural enemies.



Figure 5. Multicolored Asian lady beetle (*Harmonia axyridis*) larva, adult and pupa. Both the larvae and adults are important mid- to late-season predators of soybean aphid. (Ian Grettenberger, PSU)

Effective management of soybean aphid requires consistent field scouting to track aphid populations and permit the use of an economic threshold (ET) to inform insecticide applications. The ET developed from extensive research is an average of 250 aphids per plant on 80% of the plants with aphid populations increasing. This allows for a 5-7 day window for an insecticide application before populations reach the economic injury level of 670 aphids where economic damage is incurred. The ET of 250 aphids can be applied to R1-R5 plants; treatments after the R5.5 stage using this threshold have not shown any yield benefits. Growers should scout every 2-3 days when aphid populations are near the economic threshold to assess whether populations are increasing or decreasing. To streamline the scouting process, entomologists have developed a “speed scouting” technique (<http://ento.psu.edu/publications/speed-scouting-form-for-PA.pdf>), which greatly reduces the time necessary to thoroughly scout. Mistiming pesticide applications when aphid populations are decreasing and natural enemies are present may eliminate the benefits of natural enemy control and allow aphid populations to rebound. The presence of lady beetles or ants, the latter

which tend the aphids and feed on their honeydew, can assist in detecting the presence of aphids early in the season when aphid populations are relatively low averaged over the entire field (Fig. 6).



Figure 6. *Ants tending soybean aphids and gathering honeydew* (Ian Grettenberger, PSU)

Numerous insecticides are effective and labeled for use against the soybean aphid (see Penn State's Agronomy Guide at <http://extension.psu.edu/agronomy-guide> for some potential insecticide options). The timing of the spray and proper coverage is more important than the identity of the insecticide. Because aphids feed throughout the canopy on the undersides of the leaf, application with high pressure, large carrier volume and large droplet size is important. Tank mixing insecticides with herbicides is not recommended because of the different application conditions needed for spraying herbicides and insecticides against the soybean aphid. Preventative insecticide applications often provide no control because residual activity may not be long enough and these applications can actually spike aphid populations by killing natural enemies that would otherwise limit aphid growth. Seed treatments with a systemic insecticide can protect young and/or late-planted soybeans (especially "double-cropped" soybeans), but for most regular plantings in Pennsylvania the protection typically does not persist into the soybean reproductive stages when aphid populations typically peak.

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