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Michigan State University

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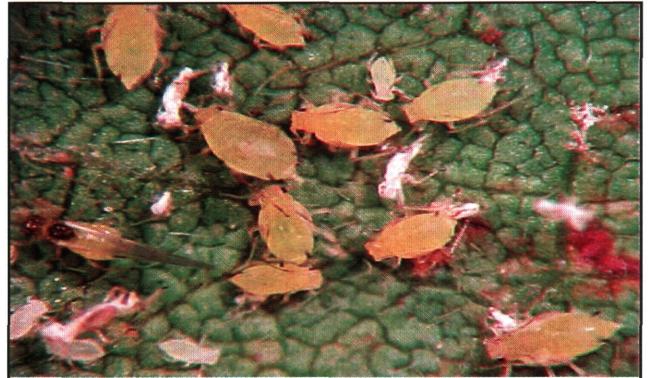
# Soybean Aphid in Michigan

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In 2000, a new insect was found in soybean fields across the Midwest. Researchers do not know how, when, or where this exotic species, the **soybean aphid** (*Aphis glycines*) entered our country, and it is too early to predict if this insect will significantly change soybean production in the United States. However, this bulletin summarizes what we do know about soybean aphid biology, distribution, and damage in Michigan, and makes recommendations for the 2001 field season.

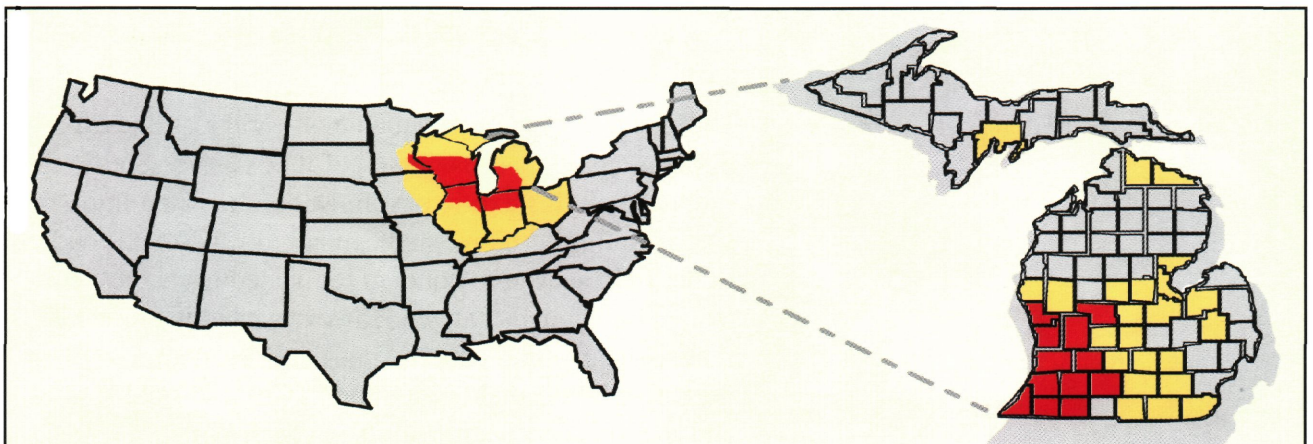


Soybean aphid (*Aphis glycines*)



Underside of a soybean leaf heavily infested with soybean aphids, Battle Creek, MI

Soybean aphid is native to Asia, where soybean (*Glycine max*) itself originated. Its distribution includes China, Korea, Japan, the Philippines, Thailand, Vietnam, and the Russian far-east. In July of 2000, researchers in Wisconsin and several other states discovered aphids feeding on soybean. The identity of the aphid was confirmed by taxonomists as *Aphis glycines*. This was the first report of this species in North America. By the end of the field season, soybean aphid was confirmed in eight Midwestern states, with heaviest populations in areas bordering Lake Michigan. In the state of Michigan, the aphid was found in 35 counties, particularly in fields in the southwest part of the state.



U.S. distribution of soybean aphid in 2000. Areas with heaviest populations (hundreds of aphids per soybean leaf) are in red. Michigan counties are highlighted if the presence of aphids was confirmed by the Michigan State University Diagnostic Clinic or the MSU field crops entomology team.

## Damage

The soybean aphid feeds by using a needle-like, sucking mouthpart to remove plant sap. Plant damage occurs from large numbers of aphids feeding on leaves and stems, removing a significant amount of water and nutrients. In some fields in Southwest Michigan, plants were covered with aphids, and leaves were curled and wilted. Leaves on the bottom-third of plants were covered with shed aphid skins (resembling dandruff) and honeydew, a sticky substance secreted by feeding aphids. Gray sooty mold, growing on the honeydew, also covered these leaves. Plants covered with aphids were often stunted compared to plants from other parts of the field. In some cases, heavily infested plants showed dramatic leaf yellowing. This yellowing may have been associated with potassium (K) deficiency, since symptoms were more pronounced in fields that were both heavily aphid-infested and K deficient.



Soybean leaf covered with sooty mold and aphid skins (left).

Leaf yellowing in a heavily infested field (below).



Soybean plants from lightly infested (A) and heavily infested (B) areas in the same field.

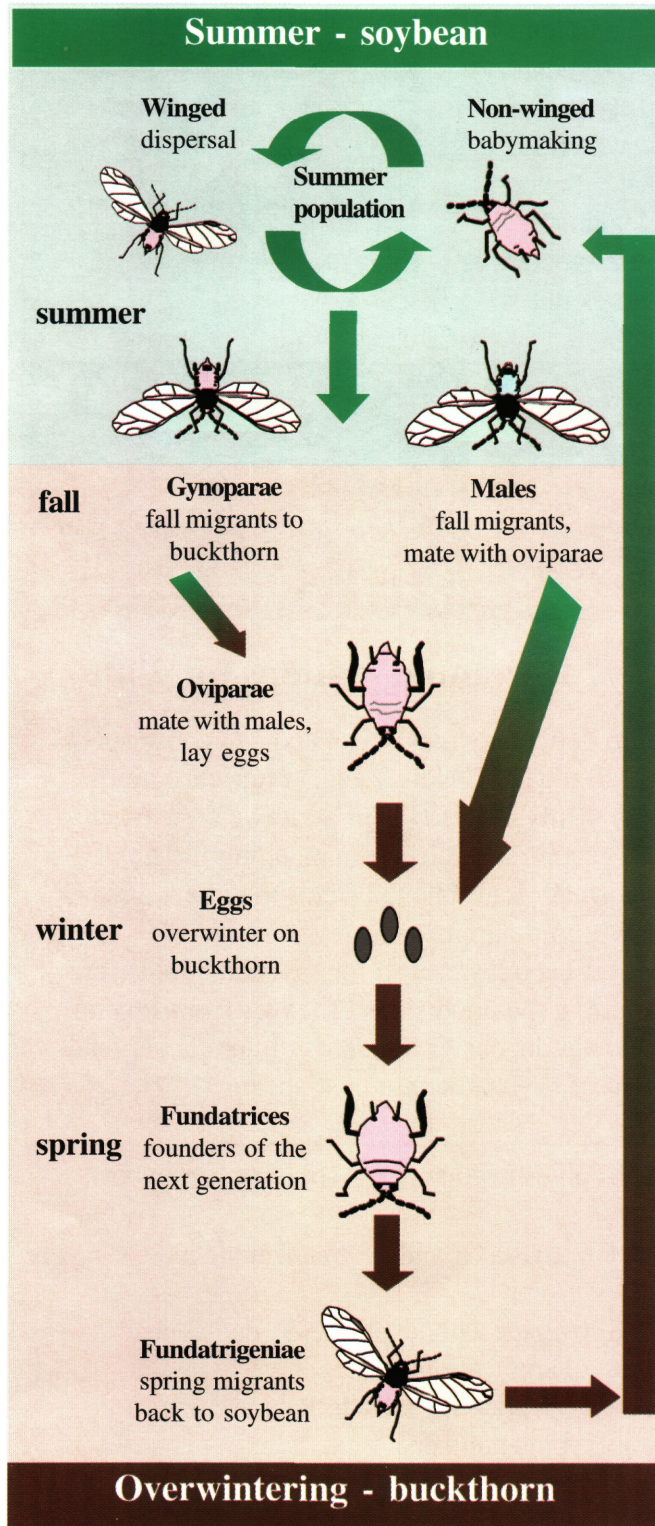
### FIELDS AT RISK?

There was only a short time in the 2000 field season to observe soybean aphid damage. However, some patterns emerged. Aphid numbers and damage tended to be greater in fields or parts of fields that were:

- ❖ late-planted.
- ❖ under stress (dry, sandy, or flooded after planting).
- ❖ potassium (K) deficient.

Little data is currently available on yield loss due to soybean aphid, because much of the Asian scientific literature on this exotic pest must be translated into English. Furthermore, soybean aphid was found too late in the field season to conduct replicated trials on yield loss in the United States. However, what is known is that soybean aphid caused significant reduction in plant height and 28% yield reduction in Chinese field studies, and that this species transmits soybean viruses in Asia. Based on limited observations in Southwest Michigan in 2000, heavy aphid infestation caused stunting and poor pod fill, as well as yield reduction in unreplicated strip trials.

## Soybean Aphid Lifecycle in China

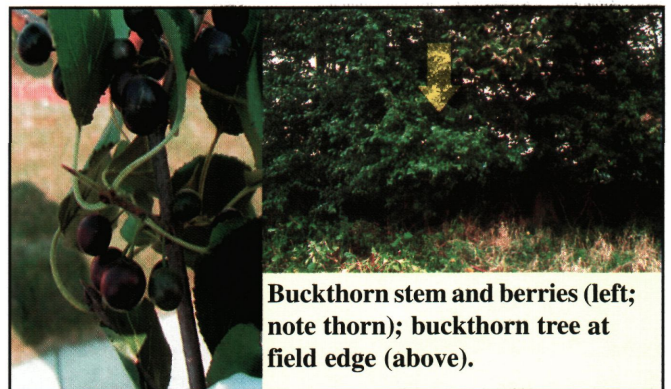


Soybean aphid infested field, near Battle Creek, MI. August 2000

Soybean aphid has a very complicated, but typical, aphid lifecycle. In China, it feeds and reproduces in the summer on soybean. Adult aphids in the summer population can be non-winged (baby-making machines) or winged (dispersers that start new colonies), but all are female; no males are present or needed for reproduction! Females give live birth to female offspring, so aphid numbers can increase quickly on soybean.

In the fall as temperatures drop and days grow shorter, a generation of winged females (“gynoparae”) and males are produced. They migrate from soybean to an overwintering host plant. In China, the overwintering host is *Rhamnus davurica*, a shrubby tree also known as **buckthorn**. Gynoparae give birth to non-winged females called “oviparae.” Oviparae mature, mate with the males, and lay eggs on the buckthorn.

Eggs overwinter and hatch in the spring. Aphids emerging in the spring are female. After several generations on buckthorn, winged spring migrants fly back to soybean to establish new colonies.

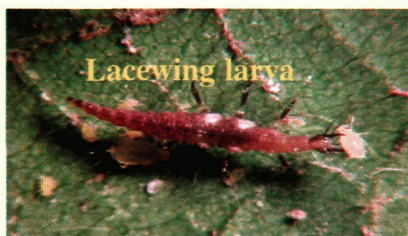


Buckthorn stem and berries (left; note thorn); buckthorn tree at field edge (above).

Soybean aphid's overwintering host, buckthorn, isn't just found in China. Several species of buckthorn are native to Michigan, and several other species (*Rhamnus cathartica* and *frangula*) were introduced from Europe to plant as hedges and shelterbelts. Buckthorn is common in some areas of Michigan along roadsides and in tree lines bordering fields. Like soybean aphid, some buckthorns are considered invasive species. And, some types of buckthorn probably are overwintering hosts for soybean aphid in the Midwest.

## Bushels of Biocontrol

A striking feature of soybean aphid infestation in soybean fields was the large number of beneficial biological control agents. Predatory insects, especially lady beetles, lacewings, and syrphid fly larvae, were very abundant in infested fields. Parasitic wasps, which lay eggs directly into aphids, were less abundant, but still present. Several different fungal pathogens infected and killed aphids, leading to spectacular reductions in aphid numbers. Together, these biocontrol agents dramatically reduced aphid numbers, but sometimes not enough to prevent damage to soybeans.



## 2001 field season: An Aphid Odyssey? Recommendations for 2001

- ⌘ **Before planting:** Soybean aphid damage and potassium deficiency may be related. If you suspect a field is K deficient, submit soil samples in the spring to the MSU Soil & Plant Nutrient Lab (517-355-0218) for testing. Pay particular attention to sandy or irrigated fields in Southwestern Michigan. Based on the soil test, the laboratory will return a recommendation for amending the field.
- ⌘ **At planting:** Watch fields that are planted later than normal. Late-planted fields may be at greater risk for infestation, and should be targeted for scouting in mid-summer.
- ⌘ **Mid-summer:** Although a sampling protocol has not yet been developed for soybean aphid, you can get a general idea of the aphid population by examining the undersides of leaves from several locations of the field. The concern is not a few aphids, but dozens or hundreds of aphids per leaf.
- ⌘ **Thresholds:** As yet, there is no threshold for treatment of soybean aphid in soybeans.

Based on experience with soybean aphid in 2000 and with aphids in other crops, spraying for soybean aphid is not recommended, except in extreme cases.

- ◆ Economic yield loss has not yet been documented in the United States, and treatment guidelines are not yet available.
- ◆ It is difficult to spray fields late in the season and get good coverage without physically damaging beans. Consider the price of soybeans relative to the cost of application.
- ◆ Infested fields tended to have large numbers of natural enemies. Spraying kills the natural enemies but not all of the aphids, usually resulting in a rebounding of aphid numbers.
- ◆ Fungal pathogens did a good job of killing soybean aphids, and populations crashed in a matter of days at many locations without application of insecticides.

**If you find a large aphid population or damage in your field,  
contact your MSU county extension agent for up-to-date information and recommendations.**

Photo Credits: field photos - Chris DiFonzo and Bruce MacKellar, MSU Extension. Close-up insect photos - Howard Russell, MSU Diagnostic Services.