Frequently Asked Questions

about using beneficial insects to control soybean aphids

What are soybean aphids?
The soybean aphid (*Aphis glycines)* is native to eastern Asia where it is only an occasional pest. Soybean aphid was first confirmed to be in the United States in 2000 and has since spread to 22 states and 3 Canadian provinces. The pale yellow aphid is less than 1/16" long and is the only aphid that forms colonies on soybeans. Soybean aphids cause damage by piercing the soybean's plumbing system and sucking sap reducing the ability of the plant to grow properly. They also may transmit soybean mosaic virus, which causes additional loss. Buckthorn, a commonly found invasive plant in Minnesota, acts as a winter host for soybean aphids.

How did the soybean aphids get from eastern Asia to the U.S.
Scientists do not know for sure, but most scenarios center the accidental introduction by tourists entering the U.S. through the Chicago O'Hare airport with plant material contaminated with soybean aphid. One likely scenario is a traveler purchased edamame, a green soybean delicacy, in China and put them in their luggage. Once the traveler got home they noticed bugs on the edamame and tossed the edamame into the trash. The bugs were soybean aphids, and the winged aphids can move up to six miles a day and thus began their spread into Midwest soybean fields. Note: Certain items brought into the United States from foreign countries are restricted according to U.S. Department of Agriculture (USDA) regulations. Prohibited agricultural items can harbor foreign animal and plant pests and diseases that could seriously damage America's crops, livestock, pets, and the environment – and a large sector of our country's economy.

How much damage do they cause?
Weather, rainfall and other crop conditions influence the number of soybean aphids in Minnesota and the damage they cause. Minnesota's soybean crop is valued at $1.5 billion a year and losses from aphid damage and the costs of chemical control of aphids can be as high as $200 million a year in Minnesota.

What are beneficial insects?
Beneficial insects are predators, parasites, or pathogens of insect pests that help to regulate pest populations without harming crops.

Which beneficial insects show the most promise for controlling soybean aphids?
A minute stingless wasp (1/25 of an inch) that is about the same size of the aphid itself has shown promise in laboratory studies. It lays its eggs inside soybean aphids; when the eggs hatch, larvae develop inside the aphid and then eat the aphid's internal organs.

The particular stingless wasp species being field tested this summer is *Binodoxys communis.* This species was approved for release based upon four years of laboratory safety testing. It is an especially promising species for control of soybean aphid because it comes from a region in China that is a good climate match to Minnesota, and also because it specializes on soybean aphid and has been observed apparently controlling it in China.

Approval for field testing came from the United States Department of Agriculture, the Minnesota Department of Agriculture and the North American Plant Protection Organization, an international governing board. This approval was based on evaluation of research conducted in the Insect Quarantine Facility on the University of Minnesota St. Paul Campus. This research showed that *B. communis* will only attack soybean aphids and a few closely related aphids.

What are the next steps?
University researchers hope *Binodoxys communis* will reproduce, spread, attack soybean aphid during the summer, then resume the attack on soybean aphid as the aphid switches to buckthorn in the fall, survive the winter and reappear next spring. If it passes all these tests than a mass release will begin in the summer of 2008. Researchers estimate it may take three to five years for a successful beneficial insect to establish itself in Minnesota.

Are there other options for natural control of soybean aphids? Yes. *Binodoxys communis* is only one option. Eleven other stingless wasp species from China, Japan and Korea are under evaluation and some of these that have shown show promise from both a safety and efficacy standpoint may be field tested in 2008. Having multiple species in the supply chain is a prudent step because the rule of thumb is that only one out of nine beneficial insect introductions are successful on their first try.

How were they collected?
University of Minnesota Entomologist George Heimpel and Dave Ragsdale and Minnesota Department of Agriculture Entomologist Zhishan Wu searched Chinese soybean fields in 2001 to find small stingless wasps that naturally control soybean aphids. To increase chances that the stingless wasp would thrive in Minnesota they focused their research on parts of China with similar weather to Minnesota. In addition, biological control experts and aphid biologists from USDA Newark, Delaware, faculty from Purdue University and the Illinois Natural History Museum have been collaborated in collecting from Korea, Japan and other areas of China since 2001.

How will the field testing be conducted?
The initial releases of *Binodoxys communis* will be conducted in grower fields and on Research and Outreach Centers throughout the state. Releases will initially be made in cages so we can confine the aphids and parasitoids. Once scientists see new parasitoids emerging in 10-12 days, cages will be removed and parasitoids will be allowed to attack aphids in the field. Growers have agreed not to spray these fields in 2007 with insecticide to give parasitoids a chance to establish. The U of MN team and scientists from MDA will continually monitor these fields for presence of parasitoids, search the buckthorn this fall and return in early spring 2008 to see if parasitoids survived the winter.

What impact will natural control of soybean aphids have on organic producers?
Minnesota farmers raise about 20% of the organic soybeans grown in the U.S. Beneficial insects will provide a new option for protecting these organic acres from soybean aphid damage. Minnesota farmers currently control soybean aphids by spraying insecticides on their fields, a practice not allowed on organic acres.

What about unintended consequences from beneficial insects?
Extensive research and an exhaustive review of that research by state, federal and international agencies reduces the chance that a beneficial insect being field tested by the University of Minnesota will harm things other than soybean aphids and a few of its close relatives.

Is this process similar to how multicolored Asian ladybird beetles came to the U.S.?
No. It is not. The testing protocol followed before the stingless wasp field testing is designed to avoid introducing a nuisance like the Asian lady beetle. The multicolored Asian lady beetle did not undergo this type of testing and was more likely introduced into the U.S. as a hitch hiker in containers that were shipped directly from Asia and moved throughout the country.

The Asian lady beetle, also known as the Halloween lady beetle and the Japanese lady beetle, was released in California by the U.S. Department of Agriculture in 1916 and in 1964 -1965 for biological control of pecan aphids. They were also released in the late 1970's and early 1980's in Connecticut, Delaware, Georgia, Louisiana, Maine, Maryland, Mississippi, Ohio, Pennsylvania, and Washington. None of these releases ever resulted in establishment of the insect in the U.S. However, in 1988 a population of multicolored Asian beetles was found in Louisiana, apparently the result of an accidental introduction from a freighter in New Orleans.

What is the Insect Quarantine Facility?
It is a high security research laboratory located on the University of Minnesota St. Paul Campus and operated by the Minnesota Agricultural Experiment Station and the Minnesota Department of Agriculture. Researchers use the building to analyze the potential usefulness of beneficial insects in the control of soybean aphids, buckthorn, garlic mustard and other pests. Special security and air filtration systems ensure the insects don't venture out on their own. Its has a BL-2 or bio-safety level 2 designation and USDA APHIS regularly monitors security procedures and practices in the Insect Quarantine Facility. The building opened in May 2003 and is the only building of its kind in the Midwest.

What other techniques are being studied to control soybean aphids?
The goal of University of Minnesota scientists is to provide growers a multitactic approach that combines aphid-resistant plants, natural predators and informed spraying decisions.

Currently, University of Minnesota Extension experts help advise growers on making decisions about using insecticides to combat soybean aphids. A sophisticated University of Minnesota computer model combines weather information with agronomic and entomology expertise to guide growers on the making decisions about using insecticides to combat soybean aphids. The Soybean Aphid Growth Estimator computer simulation that drives the model continues to evolve. Future versions will factor in temperature, rainfall, planting date, plant growth stage, variety, soil type and natural predators. The goal is to combine this computer prediction of aphid growth with real-time data observed with field scouting to do the right thing in the field at the right time.

In addition to interrupting the soybean aphid life cycle through beneficial insects, University of Minnesota plant breeders are exploring developing soybean varieties that will be less tasty to aphids.