

Reuniting old enemies

Courtesy of Roy Sontz, SDSU

Releasing aphid enemies from Asia into Midwest soybean fields

After three years of safety testing in quarantine laboratories – and another one and a half years getting the government permits – checkoff-funded researchers got the go-ahead to release an “exotic biological control agent” that attacks soybean aphids. This tiny, stingless wasp, called *Binodoxys communis*, hails from China and Japan, where it has been a long-time natural enemy of soybean aphids.

During the summer of 2007, wasps were released in 30-plus locations throughout Minnesota, Michigan, Iowa, Illinois, Indiana, South Dakota and Wisconsin. Release sites were a mixture of ag experiment stations and farmers’ fields, near buckthorn whenever possible because that’s where soybean aphids overwinter.

“The first step was to see if *Binodoxys* would attack soybean aphids in U.S. soybean fields,” says Bob O’Neil, Purdue University entomologist. “We can’t prove it at every location, but for the most part they did.”

The next step will be for *Binodoxys* to make it through the Midwestern winter. “They have to find something to live on during the winter,” says O’Neil, who visited Asia several times looking for parasitoids (insects that use other insects as hosts) that attack soybean aphids. Fortunately, *Binodoxys* is from a region that has the same climate, so weather shouldn’t be a problem.

It’s not a yellow jacket

What could have been a problem – public discomfort with the idea of scientists introducing a wasp into the Midwest – has been minimal. “I’ve received a few e-mails,” says George Heimpel, University of Minnesota entomologist leading the *Binodoxys* release.

“When you say ‘wasp’ people think yellow jackets. But *Binodoxys* is completely different,” he adds. “That’s why we call them tiny, stingless wasps.”

O’Neil points to biological control examples in other crops. “Parasitoids from the Mediterranean have been successfully introduced to control alfalfa weevil,” he explains. “Thanks to biological control, alfalfa weevils went from being a significant pest problem that farmers were spraying most years, to no problem at all.”

It won’t eat Toledo

Researchers also spent years testing the host range of *Binodoxys* to make sure it won’t disrupt non-target aphid species. According to O’Neil, “When you release a natural enemy, one of the big questions is, ‘Is it going to eat Toledo?’ We’ve done a lot of host specificity testing because we didn’t want to release something that attacks everything. *Binodoxys* has a narrow host range, and soybean aphid is by far its No. 1 target.”

Scientists also have 15 to 20 other parasitoid species still in quarantine. “It looks like a couple of those also have high host specificity to soybean aphids,” says O’Neil. “We’re looking at those, too.”

How the wasp works

Binodoxys lays an egg inside the soybean aphid. “As the egg hatches, the larva eats the aphid from the inside out, starting with the blood and ending with vital organs,” says Minnesota’s Heimpel. (The larva also spreads glue to keep the aphid stuck on the soybean plant.)



Courtesy of David Hansen, U of Minn.

Researchers hope this *Binodoxys communis* parasitoid – an enemy of soybean aphids – establishes itself throughout the North Central region.



Releasing *Binodoxys communis*

University of Minnesota Entomologist George Heimpel says researchers tried several different methods of releasing *Binodoxys communis* last summer.

“Early in the season when aphid levels were low, we used a mesh-covered insect cage over a square meter of soybean plants. We removed the soybean aphid predators (i.e., Asian lady beetles) from the cage, so aphid numbers built up enough for the *Binodoxys* wasps to parasitize. Then we added potted soybean plants from a greenhouse that had lots of *Binodoxys* about to hatch from aphid mummies.

“The idea was to get *Binodoxys* to establish within the cages and reproduce, so we tried waiting 10 days for one generation of wasp, and three weeks for two generations before removing the cages,” Heimpel explains. “What worked best was waiting three weeks, when we had 100 to 500 mummies per plant – and 40 to 50 plants – inside the cage. Adult wasps were taking off from second-generation mummies and dispersing through the field.”

Once the larva is done feeding, it goes through the pupal stage, which involves spinning silk on the inside of the dead aphid skin. The aphid skin hardens, partly due to the silk, to form a puffy shell called a mummy.

Mummies look like puffy brown versions of the aphid, or sesame seeds. The adult wasp cuts a “poptop” hole in the mummy and emerges. The mummy stays attached to the plant, thanks to the glue. “What’s nice about the mummies is they’re easy to detect in the field, so you’ll know whether you have *Binodoxys*,” Heimpel explains.



Binodoxys emerging from mummified aphid body

Courtesy of Matt O’Neal, IA State

Keeping aphid levels low

Heimpel says if we do eventually get aphid control from *Binodoxys*, it’ll take a few years. “Aphid densities in China are very

low. So I think *Binodoxys* is probably better adapted to low levels of aphids.

“I don’t think they’ll be very good at knocking down high aphid levels. But once levels are low, they’ll keep them low,” he continues. “If aphid levels spike, then Asian lady beetles have a better chance of knocking them back.”

The problem with that tag team – Asian lady beetles and *Binodoxys* – is that they’re competitors, not partners. “The beetles don’t mind munching on *Binodoxys* eggs within mummies,” Heimpel adds. “My hope is that eventually, *Binodoxys* can keep aphid numbers so low that lady beetles aren’t interested in visiting soybean fields.

“Asian lady beetles tend not to lay eggs in fields with low aphid numbers,” he explains. “I’m hopeful that *Binodoxys* will also suppress them, because I think Asian lady beetle numbers are out of whack from feasting on aphids. And other than farmers, most people hate Asian lady beetles.”

What’s next for *Binodoxys*

O’Neil says checkoff-funded researchers will continue releasing *Binodoxys* in aphid overwintering habitats, to continue establishing the population. “It’s up to the bugs, but we’ve given them every chance.

“If *Binodoxys* takes off,” O’Neil adds, “farmers won’t be paying attention to aphids anymore.”

Read more about it
 Dan Mahr, entomologist at the University of Wisconsin, developed a Web site specifically about the *Binodoxys communis* release, as well as other biological control efforts. Visit www.entomology.wisc.edu/sabc to read more about these projects, and to view photographs of *Binodoxys*, mummies and other beneficial natural enemies to look for in your soybean fields.