Multi-state Soybean Aphid RAMP Project
Soybean Aphid IPM on a Landscape Scale (SAILS)
-- Project Update --

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Vol. 3-1
May 2007

USDA | IOWA STATE UNIVERSITY | MICHIGAN STATE UNIVERSITY | UNIVERSITY of MINNESOTA | UNIVERSITY of WISCONSIN

Soybean aphid biocontrol….an exotic approach

This season marks the 7th year since the discovery of soybean aphid in North America. This year also marks the first introduction of an exotic natural enemy against soybean aphid. A tremendous amount of research was done to make this release possible. Funding came from a variety of sources including this USDA project, as well as soybean growers themselves through state and regional (NC Soybean Research Project) commodity check-off programs.

A soybean field in Korea

In its native region, SBA has all it needs to exist in the landscape, but it also has a cadre of natural enemies that attack and keep it in check. As a result, soybean aphid is rarely abundant in Asia.

The first soybean aphids invading North America had it made! They found environmental conditions similar to their Asian homeland. They found their food crop, soybeans, planted on millions of acres. They found their overwintering host, buckthorn, abundant in some areas. Initially they didn't encounter many natural enemies. The SBA population boomed, spreading rapidly across the Midwest. Within a few seasons, native insect predators and pathogens 'learned' to attack SBA. Mortality from these natural enemies likely contributes to the current cycling of SBA outbreaks across the region.

Parasitoid stinging an aphid.

Mostly missing from the natural enemies (pathogens and predators) attacking SBA in North America were parasitoids. The larvae of these tiny wasps develop inside the aphid body, eventually killing it. Parasitoids often have a narrow host range, specializing on a particular insect group or species. Under favorable conditions, parasitoid numbers can increase rapidly, reducing pest numbers dramatically. Entomologists identified SBA parasitoids as possible agents for classical biological control.

Parasitoid emerging from its host's dead body, a 'mummy'

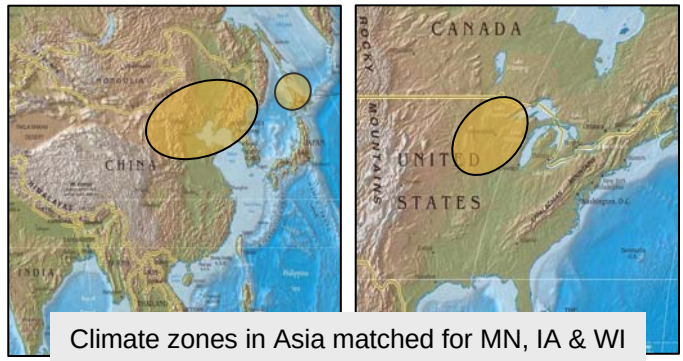
The idea behind classical biological control is to explore the native range of an introduced pest and identify natural enemies for importation into the U.S.. The long term goal for soybean aphid biocontrol is to introduce exotic parasitoids that become established (survive and reproduce) in the Midwest and hold down aphid numbers from year-to-year with no further inputs.

Successful examples of classical biocontrol the U.S. include the introduction of parasitoids to control cereal leaf beetle and alfalfa weevil. Both of these non-native insects are now effectively suppressed by biological control, and rarely have to be managed by growers.

The steps to a successful introduction

1 Climate / Habitat Matching

Entomologists, working with Asian cooperators, identified suitable areas for collecting parasitoids. These areas had both soybean production and buckthorn, and were a climate match for important soybean production areas in the U.S. Climate matching increases the likelihood of finding insects adapted to U.S. conditions, increasing the success of an introduction.



Climate zones in Asia matched for MN, IA & WI

2 Foreign Exploration

From 2001 to 2006, entomologists from Univ. of Minnesota, the Illinois Natural History Survey, Purdue, and USDA-ARS worked with in-country scientists in China, South Korea, and Japan to collect natural enemies of soybean aphid. Parasitoid collections were made from both soybean and buck-thorn, at different times of the year. These insects were shipped back to U.S. quarantine facilities.

Dave Ragsdale (U of MN) & Zhishan Wu (MN Dept of Ag) collecting in China

3 Importation

It was an administrative & logistical challenge, requiring many permits, to move live insects from foreign countries to the U.S. Parasitoids have a short life cycle. Insects must thus reach the U.S. from Asia in a matter of days, or die in transit.

4 Rearing & Testing in Quarantine

Back in the U.S., parasitoids were kept in quarantine at the USDA Beneficial Insect Research Lab in Delaware or at a new MAES/MDA Facility at the University of Minnesota in St Paul. It is very labor intensive to rear plants and keep aphid colonies to rear the wasps.

Each parasitoid was tested for how effective is was at using SBA as a host. The wasp *Binodoxys communis* was chosen for further detailed host range testing to determine if it specialized on SBA or attacked other aphid species as well. It is important not only to release an effective natural enemy, but also one with a narrow host range that will not disrupt non-target aphid species. The host-range testing conducted for *Binodoxys* was some of the most thorough ever done for a parasitoid targeted against an aphid.

Parasitoid rearing & testing in Minnesota

5 Release Permits

Once efficacy and host range data were complete, more permits were needed from the U.S. and Canadian governments to make field releases. Permits for the release of *Binodoxys* were finalized this spring.

6 Field Introductions

The first field releases of *Binodoxys* will be done in IL, IN, IA,MN, SD and WI this summer. Researchers will determine the parasitoid's efficacy, spread, and survival over the winter into 2008.

Field cages to rear parasitoids for release.