

# 2017 Statewide Soybean Survey - *Aphelinus certus* is a "Good Guy"

Cooperators: Minnesota Soybean Research and Promotion Council, NDSU IPM Survey, George Heimpel and Jonathan Dregni, Department of Entomology, U of Minnesota - St. Paul.

## Purpose of Study:

The Soybean IPM Survey was funded and conducted for the first time in 2015. Beginning in 2017, the survey collected information on the presence of the wasp parasitoid, *Aphelinus certus*, an important agent for natural control of the soybean aphid. Surveys were continued in 2018 and included a cooperative effort with the Soybean Aphid Biological Control Project led by Dr. George Heimpel and Jonathan Dregni, UMN Dept of Entomology, St. Paul campus. This effort helps to identify where the parasitoid is occurring, when it is present, and how abundant it is when found. Collections of parasitoid "mummies" were sent to UMN for emergence, species determination and whether hyperparasitoids were present. The entomological term, parasitoid, refers to insects whose larvae live as parasites that eventually kill their hosts. A hyperparasite/hyperparasitoid is a parasite whose host is a parasite and could negatively impact the natural enemies ability to suppress the pest host, in this case soybean aphid.

## *Aphelinus certus*: Wasp parasitoid of Soybean aphid

The 2017 survey added the recording of the presence of the wasp parasitoid, *Aphelinus certus*, to document when found and at what incidence defined as the percent plants with at least one mummy observed. The 2018 survey continued the scouting for *Aphelinus* spp.

The mummy is the host aphid's intact exoskeleton that hardens and turns black when parasitized by *Aphelinus* spp. Survey scouts were instructed to record the presence of the black, *Aphelinus* mummies but not to count them. In 2018, scouts also collected mummies when found and shipped them overnight to the St. Paul campus and the Heimpel Lab. In the lab. Mummies were held until emergence, species was determined, and the presence of hyperparasitoids was noted.

## Survey Summary

In 2017, *Aphelinus* mummies were found at 100% incidence early in July in fields in NW MN (Figure 3). The mummies were found later and at lower incidence in other areas of MN. The wasp requires the host, so its presence followed as aphid populations increased in those areas.

In 2018, a similar pattern was observed (Figure 4). The earliest detections of significant soybean aphid populations were in the central region. Those were the locations where

Figure 1. 2018 Soybean Crop Production Survey  
Final - ALL Sites Visited

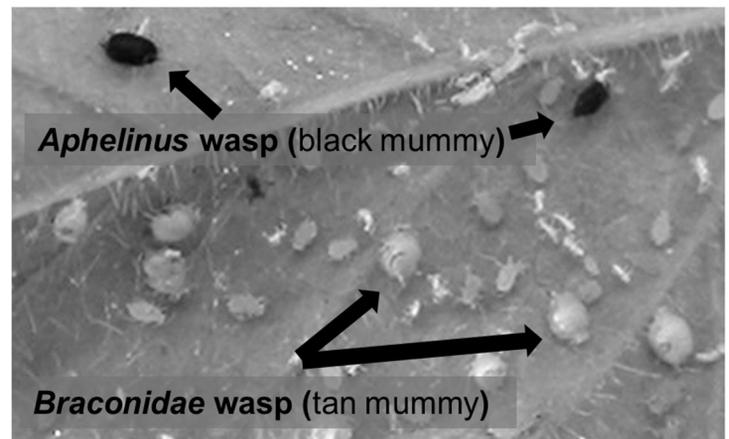
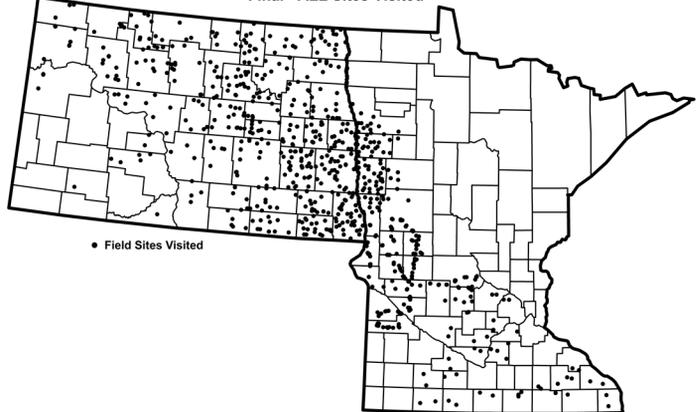


Figure 2. The black *Aphelinus* mummy and the tan *Braconidae* mummy of parasitized Soybean aphids.

the earlier and larger populations of *Aphelinus* were detected. Over time, as aphid populations increased in nearby areas, *Aphelinus* populations increased too. The much smaller aphid populations in NW MN had very low incidence of *Aphelinus* when compared with 2017.

To receive notification of the survey, subscribe to the Northwest Cropping Issues Newsletter at:

<http://nw-minnesota-crops.blogspot.com/>

Archived maps for MN-ND from 2011 to present are maintained by NDSU and can be found at:

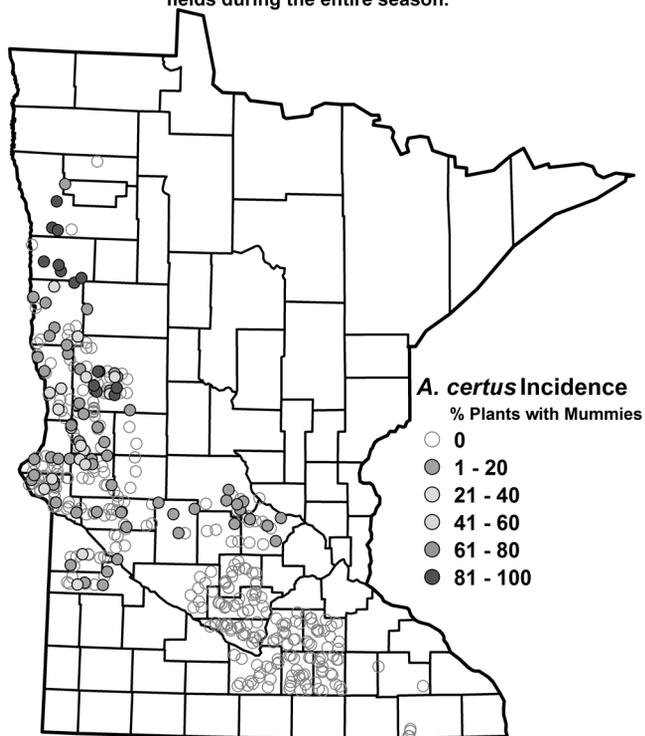
<https://www.ag.ndsu.edu/ndipm/ipm-survey-archives>

# Soybean Survey (continued) — *Aphelinus certus* is a “Good Guy”

Results (continued):

## 2017 Soybean Crop Production Survey

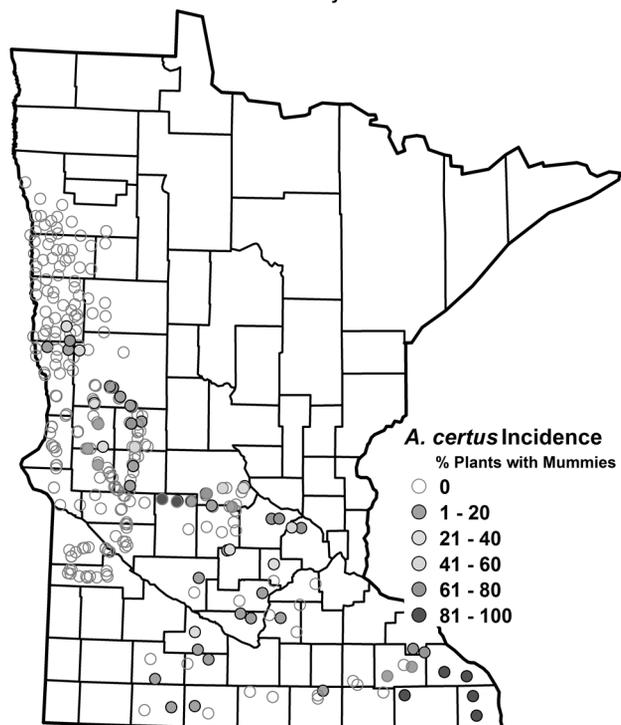
Incidence of *Aphelinus certus* observed in surveyed fields during the entire season.



**Figure 3.** Percent of soybean plants with at least one *Aphelinus* spp. mummy seen on scouted plants in 2017.

## 2018 Soybean Crop Production Survey

Incidence of *Aphelinus certus* observed in ALL surveyed fields



**Figure 4.** Percent of soybean plants with at least one *Aphelinus* spp. mummy seen on scouted plants in 2018.

# Soybean Survey (continued) — *Aphelinus certus* is a “Good Guy”

Source: Excerpt from poster presented at the 2018 Upper Midwest Invasive Species Conference. Rochester, MN. October 15–18, 2018.

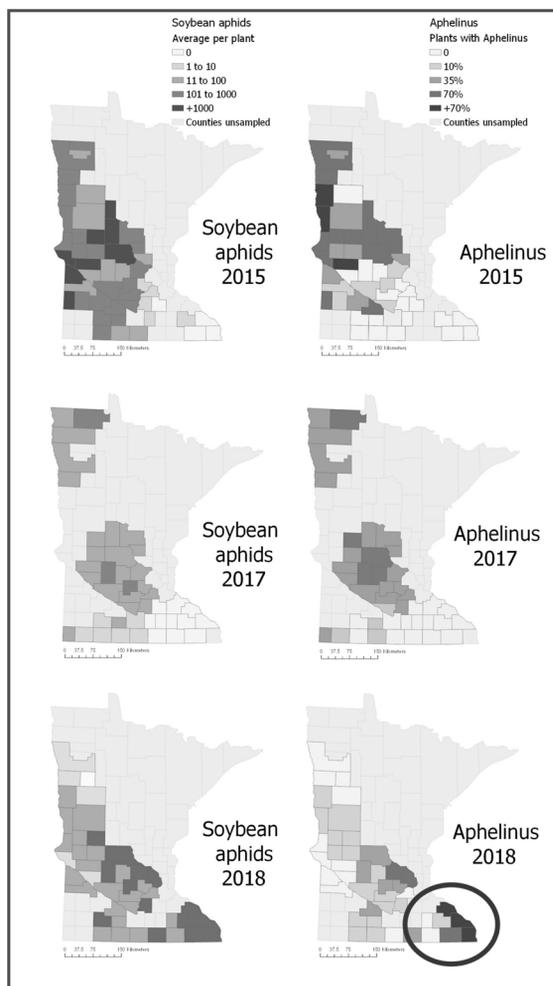
## Biological control of soybean aphid: impacts of neonicotinoid seed-treatments and aphid-resistant soybeans.

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**Occurrence:** Minnesota maps (Figure 5) show soybean aphids tend toward the north and west, and are tracked well by parasitoids. Minnesota maps of soybean aphids and *Aphelinus* mummies show 3 years of scouting. *Aphelinus* was not found in the southeastern portion of the state until 2016, though it was found in high densities in 2018, apparently tracking the aphid population. All *Aphelinus* are *A. certus*; the biological control agent *A. glycinis*, mass-released from 2012 to 2016, has not been recaptured.

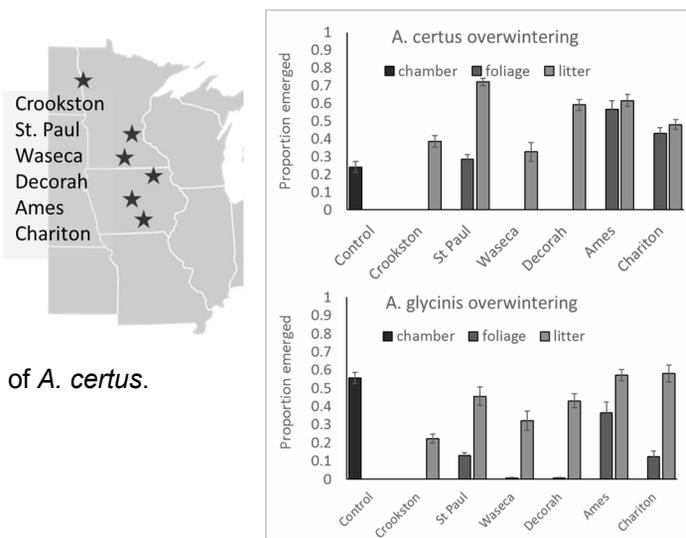
## Summary: Overwintering in Minnesota and Iowa does not limit parasitoids.

Soybean aphid overwinters on European buckthorn, and there is evidence that some soybean aphid parasitoids do too. Soybean aphids can migrate hundreds of kilometers, and recently parasitized winged soybean aphids exhibit normal flight behavior and thus parasitoids may hitch a ride to buckthorn sites to overwinter. Adult parasitoids may disperse in the Fall. We documented a sharp increase in migration at the end of soybean season when plants are almost completely senesced. We found *Aphelinus* mummies on soybean in October, suggesting overwintering within soybean fields. An examination of leaf litter from soybean fields found both *A. certus* and *A. glycinis* can overwinter in fields.



**Figure 5.** Counties in Minnesota classified per soybean aphid density and proportion of plants with *Aphelinus* mummies. Data from 3 separate regimens, with 2015 including 10 plants from 1 to 6 fields per county, 2017 including 20 plants from 6 fields per county, and 2018 including 31 plants sampled from 2 to 12 fields per county.

We evaluated overwintering success by placing diapausing *Aphelinus* mummies in winter conditions along a transect from northern Minnesota to southeastern Iowa. Mummies were at ground level, 1 m above ground, at foliar level within buckthorn shrubs. *A. certus* overwintered successfully across all sites in the leaf litter habitat which has a moderated temperature due to snow cover (Figure 6). Overwintering success of *A. glycinis* was lower overall and showed a general trend with patterns similar to those



**Figure 6.** Overwintering figures: Proportion of parasitoid mummies that successfully eclosed as adult parasitoids at 1 m above ground in buckthorn (foliage) and at ground level (leaf litter) across a 1000 km north to south transect from Crookston, MN, to Chariton, IA. ANOVA of *Aphelinus* survival shows parasitoids are better able to survive in lower latitudes and in leaf litter.