NCERA-125
2006 State Report
Department of Entomology
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Project title: Soybean aphid research.
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Project description: Our soybean aphid (SBA), *Aphis glycines* Matsumura (Homoptera: Aphididae), research program focuses on study of the impact of endemic natural enemies impact on aphid dynamics, life history characteristics of an important soybean aphid predator, *Orius insidiosus* (Say), and classical biological control of the SBA.

Endemic natural enemy impact on aphid dynamics. (HJY, RJO).

In six years of within-field survey of the soybean insect community in Indiana, we have noted a two-year periodicity in SBA population dynamics. Years of high SBA populations (100s to 1000s per plant) alternate with years of SBA scarcity (<10 per plant). In the same fields, coccinellids have been seen to reproduce in soybean only during periods when SBA density reaches high levels (ca. > 100 per plant). Their larvae increase in number until SBA populations peak and crash, then their own numbers begin to crash. During this late season period, plants are beginning to senesce rapidly, and both alatoid nymphs and alates are relatively scarce in soybean. Suction trap data from Illinois further show that flight levels of fall migrants are typically very low following summers of SBA infestations in soybean. These data suggest that in our area of the Midwest, coccinellids play a major role in driving the high-to-low transition phase of the two-year periodicity; after over a year of building up in number, outbreaking SBA populations are reduced back to very low levels during the switch from late season soybean to the overwintering host.

Life History Characteristics of *Orius insidiosus* (Say). (CB, RJO).

We measured the life history characteristics of *O. insidiosus* fed different levels of soybean aphid, soybean thrips (*Neohydatothrips variabilis* [Beech]), and combination diets of soybean thrips and aphids. *Orius insidiosus* nymphs exhibited decreased survival and longevity as they were fed less regardless if the diets were soybean aphids, soybean thrips or mixed prey. Nymphs that were fed soybean thrips had a higher percentage of individuals that completed development and these individuals developed faster compared to diets of soybean aphids. Mixed prey diets that contained more soybean thrips also exhibited this trend of higher percentages of nymphs to complete development and faster developmental rates. *Orius insidiosus* adults exhibited decreased survival and longevity as prey inputs decreased. Adults that fed on soybean thrips had a higher fecundity compared to diets of soybean aphids, while mixed prey diets that contained more soybean thrips resulted in a trend of increased fecundity.

Classical biological control. **(RJO, TH).**

We continued work on a project funded by the North Central Soybean Research Program (NCSRP)[1] to implement a classical biological control program against the soybean aphid. This past year we traveled to China and Japan to coordinate in-country research on non-target effects of Asian natural enemies *in situ*. For this work we collaborate with the University of Utsunomiya, the Japanese National Agricultural Research Agency, the Chinese Academy of Science, and the Illinois Natural History Survey. Research in Asia is evaluating the host specificity of SBA parasitoids through collection and rearing of parasitized non-target aphids for comparison with parasitoids attacking SBA. During travel to China, we collaborated with the USDA on collections of SBA parasitoids. Several populations of parasitoids (primarily braconids) are now in quarantine at the USDA/ARS Newark Delaware laboratory.

We initiated US study of potential non-target effects of Asian natural enemies in collaboration with the University of Wisconsin, Iowa State University, and the Illinois Natural History Survey. In this work, we identified a group of US aphids to focus field sampling that complements host specificity testing, and other studies. This group includes 84 aphid species on 32 plant taxa. We use transect sampling and visual observations to locate aphids, measure their relative densities (and those of their host plants), and rear their parasitoids. We also sweep to collect predators and get a measure of other aphids in the habitat. We will describe the relative abundance and distribution of the aphids, and estimate of the "natural enemy load" the aphid species are carrying (e.g., the relative parasitism rates and densities of predators). This works is the thesis research of Thelma Heidel. She has completed one year of study and is currently compiling and analyzing the data.

Project title: Biological control in subsistence agriculture.
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Project description: This project focused on understanding the relative contribution of the environment (both within- and extra-field) on farmer adoption of pest management particularly conservation biological control tactics.

Research was conducted by KW in Honduras who worked with subsistence maize farmers to measure the relative contribution of the environment (both within- and extra-field) and training on farmer adoption of conservation biological control practices. Overall, farmer perception of pest pressures, their knowledge of natural enemy impacts, and the local social and ecological environments interact to determine farming practices. Adoption of conservation biological control practices will depend on how farmers are trained, and the availability of natural enemies as influenced by local environmental conditions.

[1] Collaborating institutions include, The University of Illinois, Illinois Natural History Survey, Iowa State, Michigan State, South Dakota State University, University of Minnesota, University of Wisconsin, USDA/ARS (Delaware).

Publications

1. Butler, C. D., R. J. O'Neil. 2006. Defensive Response of the Soybean Aphid, *Aphis glycines* Matsumura (Hemiptera: Aphididae) to Predation by *Orius insidiosus* (Say) (Hemiptera: Anthocoridae). Ann. Entomol. Soc. Amer. (in press)**.**
2. Desneux, N., H. J. S. Yoo, and R. J. O'Neil. 2006. Suppression of population growth of the soybean aphid, *Aphis glycines* Matsumura, by predators: the identification of a key predator, and the effects of prey dispersion, predator abundance and temperature. Env. Entomol. 35: 1342-1309.
3. Rutledge, C. E. and R. J. O'Neil. 2006. Soybean plant age and population growth of the soybean aphid, *Aphis glycines* Matsumura J. Econ. Entomol. (in press).
4. Wyckhuys, K. and O,Neil, R.J. 2006. Population dynamics of *Spodoptera frugiperda* Smith (Lepidoptera: Noctuidae) and associated natural enemies in Honduran subsistence maize. Crop Protection. In press.
5. Wyckhuys, K. and O,Neil, R.J. 2007. Agro-ecological knowledge and its relationship to farmers, pest management decision making in rural Honduras. Agriculture and Human Values. In press.
6. Wyckhuys, K. and O,Neil, R.J. 2007. Role of opinion leadership, information sources and social connectedness in the diffusion of IPM in Honduran subsistence maize agriculture. International Journal of Pest Management. In press.