

**NCERA125**  
**Illinois Report 2005 – 2006**

**1) Project title:** Effects of commercially available surfactants on the survival and infectivity of the entomopathogenic nematodes, *Steinernema feltiae* (Nematoda: Steinernematidae) and *Heterorhabditis indica* (Nematoda: Heterorhabditidae), and control of Western flower thrips, *Frankliniella occidentalis* (Thysanoptera: Thripidae).

**Investigators:** R. A. Cloyd and E. X. Caamano, University of Illinois, Department of Natural Resources and Environmental Sciences; L. F. Solter, Illinois Natural History Survey, Center of Ecological Entomology; and D. J. Fallon University of Hawaii, Department of Plant and Environmental Protection Services.

**Contact:** R. A. Cloyd ([rcloyd@ksu.edu](mailto:rcloyd@ksu.edu))

**Project description:** This project determined the survival rates of five commercially-available entomopathogenic nematode formulations of *Steinernema feltiae* (NemaShield, Nemasys, Gnat Not, Horticultural Scanmask), and *Heterorhabditis indica* (GrubStake-Hi), and the effects of commercially-available surfactants on the entomopathogenic nematodes were determined on waxworms (*Galleria mellonella*). In addition, we assessed the efficacy of entomopathogenic nematodes for control of Western flower thrips (*Frankliniella occidentalis*) under both laboratory and greenhouse conditions.

**2) Project title:** Food preference of the rove beetle, *Atheta coriaria* Kraatz (Coleoptera: Staphylinidae) under laboratory conditions.

**Investigators:** R. A. Cloyd and E. M. Birken, University of Illinois, Department of Natural Resources and Environmental Sciences.

**Contact:** R. A. Cloyd ([rcloyd@ksu.edu](mailto:rcloyd@ksu.edu))

**Project description:** This study, involving laboratory choice tests, was conducted to determine the feeding behavior, based on food preference, of the adult and larval stage of the rove beetle, *Atheta* (= *Dalotia*) *coriaria* when presented with both fresh moistened oatmeal and 2<sup>nd</sup> instar fungus gnat, *Bradysia* sp. nr. *coprophila* larvae in Petri dishes.

**3) Project title:** Effect of insecticides on mealybug destroyer, *Cryptolaemus montrouzieri* (Coleoptera: Coccinellidae) and parasitoid, *Leptomastix dactylopii* (Hymenoptera: Encyrtidae), natural enemies of citrus mealybug, *Planococcus citri* (Homoptera: Pseudococcidae).

**Investigators:** R. A. Cloyd and A. Dickinson, University of Illinois, Department of Natural Resources and Environmental Sciences.

**Contact:** R. A. Cloyd ([rcloyd@ksu.edu](mailto:rcloyd@ksu.edu))

**Project description:** In this study, we measured, under laboratory conditions, the direct and indirect effects of insecticides on mealybug destroyer, *Cryptolaemus montrouzieri*, and parasitoid *Leptomastix dactylopii*, which are both natural enemies of the citrus mealybug, *Planococcus citri*. The adult stages of both natural enemies were exposed to sprays of the insecticides buprofezin, pyriproxyfen, flonicamid, acetamiprid, dinotefuran,

and clothianidin at label-recommended rates to assess direct mortality after 24, 48, and 72 hours, respectively. The effects of the insecticides on *L. dactylopii* parasitization rate and percentage parasitoid emergence were also monitored using the label and 4X the recommended label rate.

**4) Project title:** Compatibility of three miticides with the predatory mites *Neoseiulus californicus* McGregor and *Phytoseiulus persimilis* Athias-Henriot (Acari: Phytoseiidae).

**Investigators:** R. A. Cloyd, University of Illinois, Department of Natural Resources and Environmental Sciences; and Steve R. Keith, AllTech Research and Development, Sparta, IL.

**Contact:** R. A. Cloyd ([rcloyd@ksu.edu](mailto:rcloyd@ksu.edu))

**Project description:** In this study, we determined the compatibility of two commercially-available predatory mites, *Neoseiulus californicus* and *Phytoseiulus persimilis*, with three miticides used in greenhouse production systems to control the twospotted spider mite, *Tetranychus urticae*. We assessed the lethal effects of the miticides chlorfenapyr, spiromesifen, and bifentazate to both predatory mite species 24 hours after exposure to spray applications in Petri dishes.

**5) Project title:** Taxonomy and biology of lymantriid microsporidia

**Investigators:** L. F. Solter, Illinois Natural History Survey; M. L. McManus and Vince D'Amico, USDA Forest Service, Hamden, CT; D. K. Pilarska, Bulgarian Academy of Sciences, Sofia, Bulgaria; G. Hoch, BOKU, Vienna, Austria; A. Linde, Fachhochschule Eberswalde, Eberswalde, Germany; J. Vavra, Charles University, Prague, Czech Republic; J. Novotny, M. Zubrick, Forestry Institute, Banska Stiavnica, Slovak Republic; C. Vossbrinck, Connecticut Agricultural Experiment Station, New Haven, CT;

**Contact:** Leellen F. Solter ([lsolter@uiuc.edu](mailto:lsolter@uiuc.edu))

**Project description:** A species characterization and re-description was published for *Vairimorpha disparis* (Timofeevja, 1957), a common microsporidian parasite of the gypsy moth, *Lymantria dispar* (L.).

Studies of the variability of several isolates of *Nosema lymantriae* and *Vairimorpha disparis* using 2-D PAGE gel evaluations are complete and a manuscript is in progress. The study corroborates relative rDNA-based relationships but indicates considerable variation in gene activity between the isolates.

Permits were received to release three species of microsporidia, *Vairimorpha disparis*, *Nosema lymantriae* and *Endoreticulatus schubergi*, against the gypsy moth in the U.S. A May 2007 release in Northern Illinois is planned.

A third season was added to cage experiments designed to study transmission of *Nosema lymantriae* among gypsy moth larvae in the field. These experiments were completed and data analysis is underway. Laboratory bioassays suggest that the pathogen is transmitted via the feces due to infected Malpighian tubules during mid-stage infection but transmission in the silk was not found to be important.

**6) Project title:** Eastern tent caterpillar microsporidia

**Investigators:** L. F. Solter, Illinois Natural History Survey; D. Streett, USDA-ARS, Stoneville, MS; M. Baker, Iowa State University

**Contact:** Leellen F. Solter ([lsolter@uiuc.edu](mailto:lsolter@uiuc.edu))

**Project description:** A *Nosema*-type microsporidium recovered from Eastern tent caterpillar (*Malacosoma americanum*) populations in Kentucky is biologically different from a *Nosema* isolate from Illinois and a *Nosema* isolate from the forest tent caterpillar, *M. disstria*. These three isolates were sequenced and found to be nearly identical, suggesting that all three are the previously described *Nosema disstriae* isolated from *M. disstria*. This finding corroborates studies of the gypsy moth microsporidia showing that DNA sequence identity does not necessarily correspond to specific biological characteristics.

**7) Project title:** Role of Pathogenic Microsporidia in the Hemlock Woolly Adelgid Natural Enemy Complex

**Investigators:** L. Solter, Illinois Natural History Survey; B. Onken, USDA Forest Service NA, Morgantown, West Virginia; R. Reardon, USDA Forest Service FHTET, Morgantown West Virginia; D. Palmer, New Jersey Dept. of Agriculture Beneficial Insect Lab, Trenton, NJ; S. Salom, Virginia Polytechnic State University; K. Shields, USDA Forest Service NERS, Hamden, CT; K. Wallin, Oregon State University; C. Cheah, CT Agriculture Experiment Station, Hamden, CT; M. Baker, Iowa State Univ.; C. Franzen, Universität Regensburg, Regensburg, Germany

**Contact:** Leellen F. Solter ([lsolter@uiuc.edu](mailto:lsolter@uiuc.edu))

**Project description:** Microsporidia were found in a NJ Dept. of Agric. laboratory colony of *Sasajiscymnus tsugae*, a coccinellid predator of the hemlock woolly adelgid, *Adelges tsugae*, and in a field collected predator, *Laricobius nigrinus* (Derodontidae) of the Western hemlock adelgid. A ribosomal DNA sequence was produced for the *S. tsugae* microsporidium that places it in the genus *Tubilinoosema*, a group that includes grasshopper and *Drosophila* hosts. Further sequencing is in progress. No new infections were found in *L. nigrinus*, but host populations were not found in the Washington State site where the microsporidium originated. Colonies at the Connecticut Agric. Expt. Station were also surveyed. No microsporidia were found in the beetle predators *Scymnus ningstanensis* or *Scymnus sinuanodulus*, but a microsporidium was found in *S. tsugae* that is morphologically different from the NJ colony isolate.

**8) Project title:** A microsporidium of the black vine weevil, *Otiorhynchus sulcatus*

**Investigators:** D. Bruck, USDA Forest Service, Corvallis, OR; L. Solter, Illinois Natural History Survey

**Contact:** Leellen F. Solter ([lsolter@uiuc.edu](mailto:lsolter@uiuc.edu))

**Project description:** A microsporidium found in an Oregon population of the black vine weevil, *Otiorhynchus sulcatus*, was shown in bioassays to be highly virulent to the weevil

larvae. Ribosomal DNA sequencing efforts have been unsuccessful thus far, suggesting that this isolate may be a primitive microsporidium. Ultrastructural studies are in progress to evaluate this assumption. Soil drenching studies are also in progress to determine the effects of the microsporidium when applied to nursery stock in pots.

**9) Project title:** Native natural enemies of native wood borers: Potential biological control agents of the Asian longhorned beetle and other invasive wood borer species

**Investigators:** L. M. Hanks, University of Illinois; M. T. Smith, USDA-ARS-BIIR, Newark, DE

**Contact:** Lawrence M. Hanks ([hanks@life.uiuc.edu](mailto:hanks@life.uiuc.edu))

**Project description:** Field and laboratory studies are being conducted to characterize the natural history and behavior of a broad range of natural enemies of native wood borers. The resulting data will allow predictions of natural enemy species that have the greatest potential as biological control agents of ALB in the US and abroad, as well as of other current or potential invasive wood borer species.

**10) Project title:** Biological control of invasive exotic wood borers of eucalyptus in California

**Investigators:** L. M. Hanks, University of Illinois; T. D. Paine and J. G. Millar, University of California, Riverside

**Contact:** Lawrence M. Hanks ([hanks@life.uiuc.edu](mailto:hanks@life.uiuc.edu))

**Project description:** Research on interactions between parasitoids and their cerambycid hosts that are important pests of ornamental eucalyptus trees. Current projects include host effects on performance of larval parasitoids, host resistance to egg parasitoids, and the host/parasitoid population dynamics.

**11) Project title:** Long-range pheromones of cerambycid beetles

**Investigators:** L. M. Hanks, University of Illinois, J. G. Millar, U. C. Riverside

**Contact:** Lawrence M. Hanks ([hanks@life.uiuc.edu](mailto:hanks@life.uiuc.edu))

**Project description:** We are pursuing the identification of long-range pheromones and attractant host plant volatiles of several cerambycid species of the subfamily Cerambycinae. Pheromones of these species are apparently structurally related, variations on a common structure motif. These compounds may have relevance for biological control of some wood-boring pests because they apparently serve as kairomones for the natural enemies of cerambycid species.

**12) Project title:** Evaluating floral attractants of parasitic insects to improve regulation of plant-feeding pests

**Investigators:** L. M. Hanks, University of Illinois

**Contact:** Lawrence M. Hanks ([hanks@life.uiuc.edu](mailto:hanks@life.uiuc.edu))

**Project description:** Our earlier research has demonstrated that insects that parasitize pine needle scale and evergreen bagworm can be encouraged to suppress infestations by including flowers in landscape plantings, and that these parasitoids are attracted by volatile chemical released by flowers. The current research project explores the potential for managing plant-feeding insect pests in urban landscapes by manipulating their natural enemies with floral attractants alone. Because the parasitoid species that we study are highly generalized, attacking a broad variety of herbivorous species, the research likely will have applications for controlling other pest species. This ecological strategy for pest management could reduce application of pesticides in urban environments, improving their ecological balance and quality as habitats for humans.

**13) Project title:** Tritrophic interactions in endophytic insect communities of perennial prairie plants

**Investigators:** J. F. Tooker and L. M. Hanks, University of Illinois

**Contact:** Lawrence M. Hanks ([hanks@life.uiuc.edu](mailto:hanks@life.uiuc.edu))

**Project description:**

We have characterized communities of endophytic insects that inhabit stems of *Silphium laciniatum* L. and *S. terebinthinaceum* Jacquin (Asteraceae), endemic plants of tallgrass prairies. Endophytic herbivores, gall wasps *Antistrophus rufus* Gillette and *A. minor* Gillette (Hymenoptera: Cynipidae) and stem-boring larvae of the beetle *Mordellistena aethiops* Smith (Coleoptera: Mordellidae), were attacked by ten species of natural enemies. We report new host plant associations for herbivores, new host insect associations for parasitoids, and evidence that *A. rufus* is actually comprised of two species. We evaluated the role of plant volatiles in location of hosts by parasitoids in the prairie system and the relative impact of herbivores and their parasitoids on host plant fitness.

**14) Project title:** Identification of a sex pheromone of *Prionus californicus*, and its potential use in management of hop

**Investigators:** J. D. Barbour, University of Idaho, J. G. Millar, University of California, Riverside, and University of Illinois

**Contact:** J. D. Barbour ([jbarbour@uidaho.edu](mailto:jbarbour@uidaho.edu))

**Project description:** Isolate and identify active pheromone components and test their effectiveness at disrupting communication between male and female *P. californicus*, and the potential for use of pheromone components for managing the pest in hop.

**19) Project title:** Ecology and biological control of *Euphorbia esula* (leafy spurge)

**Investigators:** L.K. Schwab, R. N. Wiedenmann and S. Raghu, Illinois Natural History Survey

**Contact:** S. Raghu ([raghu@uiuc.edu](mailto:raghu@uiuc.edu))

**Project description:** *Euphorbia esula* is emerging as a significant weed in northern Illinois with infestations occurring in the collar counties around Lake Michigan. Since this weed has been a target for biological control through a large USDA project. Fifteen different insects, including six *Aphthona* flea beetle species, have been released as part of this effort. A recent study in the native range of the weed by Nowierski and colleagues, identified several habitat and plant traits correlated with the incidence of *Aphthona* flea beetles. By conducting a similar ecological study in leafy spurge infested habitats in northern Illinois we have identified the species of *Aphthona* likely to establish and be effective in Illinois. These predictions have the potential to make the biocontrol effort in Illinois more efficient, by targeting resources in releasing of beetles most likely to be effective in controlling the weed.

**20) Project title:** Biological Control of *Lythrum salicaria* (purple Loosestrife)

**Investigators:** S. Raghu and S. L. Post, Illinois Natural History Survey; R. J. Bartelt, B. Zilkowski and A. A. Cosse, USDA-ARS (Peoria, IL)

**Contact:** S. Raghu ([raghu@uiuc.edu](mailto:raghu@uiuc.edu))

**Project description:** After a decade-long rearing and release program for *Galerucella californiensis* and *Galerucella pusilla*, the survey has stopped the production of beetles. The project is moving into the next phase; evaluation of beetle establishment and impacts on purple loosestrife. The feasibility of using the beetle pheromones as tools to monitor establishment were trialed in 2006 with success. This study is being expanded to include investigations on the functional ecology of the pheromones.

**21) Project title:** Demography of *Alliaria petiolata* (garlic mustard): implications for its biological control

**Investigators:** A.S. Davis, USDA-ARS (Urbana, IL); S. Raghu and S. L. Post, Illinois Natural History Survey;

**Contact:** S. Raghu ([raghu@uiuc.edu](mailto:raghu@uiuc.edu))

**Project description:** In anticipation of biological control agents being available in the near future, a network of demographic plots has been set-up in Illinois to investigate the population dynamics of garlic mustard. The information gathered is being used to develop a matrix model to help predict the potential impacts of the different species being considered as candidate biocontrol agents. This project interfaces with similar efforts in Michigan headed by Doug Landis and Jeff Evans (Michigan State University, East Lansing, MI).

### Refereed publications:

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- Birken, E. M., and R. A. Cloyd. 2006. Feeding behavior of the rove beetle, *Atheta coriaria* (Coleoptera: Staphylinidae) under laboratory conditions. IOBC/WPRS Bulletin 29: 201-206.
- Birken, E. M., and R. A. Cloyd. 2006. Food preference of the rove beetle, *Atheta coriaria* Kraatz (Coleoptera: Staphylinidae) under laboratory conditions. Insect Science (in press).
- Cabrera, A. R., R. A. Cloyd, and E. R. Zaborski. 2005. Development and reproduction of *Stratiolaelaps scimitus* (Acari: Laelapidae) with fungus gnat larvae (Diptera: Sciaridae), potworms (Oligochaeta: Enchytraeidae) or *Sancassania* aff. *sphaerogaster* (Acari: Acaridae) as the sole food source. Exp. Appl. Acarol. 36: 71-81.
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- Dhileepan, K., Treviño, M. and Raghu, S. 2006. Temporal patterns in incidence and abundance of *Aconophora compressa* (Hemiptera: Membracidae), a biological control agent for *Lantana camara*, on target and nontarget plants. Environ. Entomol. 35: 1001–1012.

- Ellis, J. A., A. D. Walter, J. F. Tooker, M. D. Ginzel, P. F. Reagel, E. S. Lacey, A. B. Bennett, E. M. Grossman, & L. M. Hanks. 2005. Conservation biological control in urban landscapes: Manipulating parasitoids of bagworm (Lepidoptera: Psychidae) with flowering forbs. *Biol. Control* 94: 99-107.
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