

**ANNUAL REPORT OF CONTRIBUTING PROJECT TO  
COOPERATIVE REGIONAL PROJECT W2185  
Biological Control in Pest Management Systems of Plants**

January 1, 2007 to December 31, 2007

**1. PROJECT:** Regional W2185: Biological Control in Pest Management System of Plants.

**2. COOPERATING AGENCIES AND PRINCIPAL LEADERS:** **Christiane Weirauch, Assistant Professor of Entomology, University of California Riverside:** Morphological and molecular systematics of Hemiptera- Heteroptera, with emphasis on Reduviidae and Miridae; natural history and predation of Reduviidae.

**Objectives** GOAL A. **Import and Establish Effective Natural Enemies:** **A1.** *Survey indigenous natural enemies.* **A3.** *Determine systematics and biogeography of pests and natural enemies.* GOAL C. **Augment Natural Enemies to Increase Biological Control Efficacy.** **C10.** *Assess biological characteristics of natural enemies.*

**3. PROGRESS OF WORK AND PRINCIPAL ACCOMPLISHMENTS:**

**Objective A.1. Survey of natural enemies**

Since joining the faculty at UCR in January 2007, I have started surveying for assassin bugs, Reduviidae, in Southern California in the spring of 2007. More than 150 species of Reduviidae are reported worldwide as predators of a wide range of insect pests. Several species in the subfamily Harpactorinae – mostly rather generalized, vegetation-dwelling, diurnal predators – are currently used as natural enemies, most importantly *Pristhesancus plagipennis* (Walker) as predator of cotton bollworm in Australia. Other species are currently being explored for integrated pest management. Species of *Zelus*, among them the leafhopper assassin bug *Zelus renardii* (Kolenati), which is native to California, feed on a wide range of prey organisms, including lygus bugs, caterpillar larvae, and boll weevils. Other groups of interest as natural enemies include native species of *Pselliopus*, *Sinea* and *Apiomerus* (all Harpactorinae). Species of *Apiomerus* are reported to be polyphagous, feed on a range of crops pests, and are expected to be of future economical importance as natural enemies. Up to date information on distribution and natural history of these species is virtually non existent. This year's collecting effort in San Bernardino, Riverside, and San Diego counties is the first step into the direction of updated distribution maps of these species. The majority of the collected specimens belong to the genus *Zelus*, but we also sampled specimens of *Phymata*, *Apiomerus*, *Pselliopus*, *Sinea*, several Emesinae and Triatominae.

**Objective A.3. Systematics.**

The phylogenetic relationships of the Nearctic and Neotropical genus *Apiomerus* (Heteroptera: Reduviidae) were studied using molecular information. We have established several genes (16s, 18s, 28s D2, 28sD3-5, CO1, CO2) in our lab, have evaluated which genes will be most informative for generic and subgenus-level phylogenetics within the genus *Apiomerus* and for the tribe Apiomerini, and we have generated a preliminary data set. The results indicate that the genus is monophyletic and that the current subgeneric classification is flawed. These results are the basis for ongoing studies on the genus *Apiomerus* with drastically increased taxon sampling.

**Objective C.10. Assess biological characteristics of natural enemies.**

In an effort to shed light on the predation strategies of species of the genus *Zelus*, lab cultures were established of *Zelus renardii* and *Zelus tetracanthus*. Adults of *Zelus luridus* engage in sticky trap predation enabled by glands on the legs that release a sticky secretion. First instar immatures lack these glands, but use secretions deposited over the egg batch by the female to make their integument sticky. These results were previously published by the PI. Observations on *Z. renardii* and *Z. tetracanthus* show that these behaviors are present also in those species. This year's studies further show that immatures of *Z. luridus* and *Z. tetracanthus* develop sticky glands in the second instar and that the number of glands increases through the immature stages. This results in an increasing independence of exogenous, female-derived secretions for prey capture.

In a parallel effort, we are investigating prey capture strategies of one undescribed species of *Apiomerus* native to Southern California. We could show that the behavior of first instar immatures with respect to sticky substances is strikingly similar to the behavior seen in *Zelus* spp.

**USEFULNESS OF FINDINGS:**

Reduviidae have been called a neglected group of potential natural enemies among Heteroptera or True Bugs. With our studies, aiming on systematics and biology of Reduviidae, we will provide a foundation for establishing assassin bugs as pest control agents. Data on distribution, biology, and relationships of native species are essential components for this foundation.

**WORK PLANNED FOR NEXT YEAR:**

The survey of Reduviidae in Southern California is an ongoing project, as are systematic studies of the genus *Apiomerus*. Our efforts to reveal the predatory mechanisms of Harpactorinae, with a special emphasis on *Apiomerus* and *Zelus*, will continue.

**PUBLICATION in preparation.**

Ontogeny of glands in the sticky trap predators *Zelus renardii* and *Zelus tetracanthus* (Heteroptera, Reduviidae, Harpactorinae).