

## ENTOMOLOGY

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### ABSTRACTS

**Notes on the Biology and Oviposition of the Twobanded Japanese Weevil (*Callirhopalus bifasciatus* Roelofs).** WILLIAM E. CHANEY, DONALD L. SCHUDER, and DAVID K. REED, USDA-SEA, Vincennes, Indiana 47591.—A study was conducted on the biology and oviposition habits of the twobanded Japanese weevil, *Callirhopalus bifasciatus* Roelofs. A number of plant species were examined to determine feeding preference of this species. The effects of temperature, humidity, and substrate on oviposition and egg hatch were examined. A number of general observations on the behavior and biology of both the adult and larvae were made.

The number of pods produced by a given weevil was influenced by such environmental conditions as amount of contact with the substrate, temperature, and humidity. The nature of the substrate itself, natural or artificial, significantly affected the number of eggs per pod.

Oviposition, as measured by egg pod formation, was affected more greatly by humidity than temperature at the ranges examined. The number of eggs produced by an adult was not affected by the nature of substrate, since the number of pods produced was inversely proportional to the number of eggs per pod. Temperature and humidity did affect the number of eggs produced since the number of pods changed, but the number of eggs per pod did not. The percent of egg hatch was not significantly affected by either temperature or humidity, but the duration of the egg stage was affected.

**Laboratory and Field Evaluation of Oviposition Preference in *Toxorhynchites rutilus rutilus*.** A. YUMI CLEMONS and RAYMOND J. RUSSO, Department of Biology, Indiana University-Purdue University at Indianapolis, Indianapolis, Indiana 46205.—The oviposition preference of *Toxorhynchites rutilus rutilus* (Theobald) was examined through the use of various oviposition substrates: distilled water, food water, larval water, and larval water with prey. Replicated 5 gal. cage experiments using 15 females showed a significant difference in the number of eggs laid on each type of substrate. Similar results were obtained when females were released in isolated trees in the field which were equipped with artificial treeholes containing the same type of water treatments. A distinct preference was shown for water which presently contains or once had living prey larvae. This enables *Toxorhynchites* to select oviposition sites which have a high probability of containing food for its offspring.

**Clinical Variation of Temperature Dependent Survivorship in the Mosquito *Aedes sollicitans*.** ROSEMARIE FUNKHOUSER, Department of Anatomy, Indiana University Medical Center and RAYMOND J. RUSSO, Department of Biology, Indiana University-Purdue University at Indianapolis, Indianapolis, Indiana 46205.—

Survivorship of three strains of *Aedes sollicitans* from a north-south cline was determined at three constant temperatures of 22°, 25° and 28°C. Results were analyzed both graphically and statistically. The northern strain, Cedar Island, had better survivorship at temperatures of 22°C and 25°C. The intermediate latitude strain, Ft. Jackson, had better survivorship at 28°C and poorer at 22°C. The most southern strain, Ruskin, showed no significant difference in survivorship at the three separate temperatures.

**Spring-tailed Insects of the Genus *Proisotoma*, subgenus *Appendisotoma*, from Manlove Woods.** JOHN W. HART, Division of Education, Indiana University East, Richmond, Indiana 47374.—Collections of Collembola (1974 to date) from this unique woods (see A. A. Lindsey, et al. *Natural Areas of Indiana and Their Preservation*) have contained several species of this genus/subgenus. *Proisotoma (A.) vesiculata* was the subject of a previous paper. One species currently under study appears to be *Proisotoma (A.) bulbosa* Folsom. If this is true, Folsom's description was based on ecomorphic specimens; and since the Manlove Woods material contains both normal and ecomorphic forms, it will be possible to fully describe this species. The ecomorphic form of a second species closely resembles D. L. Wray's published description of *Frisonia veca*. It would be desirable to study types of his species. An additional species is similar to our normal "veca" specimens, but it has only been taken in normal form. Additional study of the *Proisotoma (A.)* is indicated.

**Oviposition and Larval Development of *Toxorhynchites brevipalpis* (Diptera: Culicidae) at Selected pH Levels.** SUE HENDERSON and ROBERT R. PINGER, Department of Physiology and Health Science, Ball State University, Muncie, Indiana 47306.—A study was conducted to determine the effects of pH on oviposition, larval development, pupation and emergence success of *Toxorhynchites brevipalpis*. For the oviposition preference study ten male and ten female *T. brevipalpis* mosquitoes were placed in each of 8 1' x 1' x 1' cages. Four oviposition sites containing rainwater adjusted to pHs of 4, 5, 6 and 7 were placed in each cage and rotated daily to nullify the effect of lighting and air movements. Eggs were counted daily and tabulated by pH and position of site. This experiment was replicated four times, giving a total of 32 replications. No oviposition preference was indicative with regard to pH but differences were noted in the preference exhibited for site location within cages.

In the second phase of the study, 30 first instar larvae were individually raised in glass containers at each of 5 pH levels (3, 4, 5, 6, 7). Larvae were fed ad libitum with larvae of *Aedes triseriatus*. Larvae were examined each day and mortality, dates of molting, pupation and emergence were recorded. Data were examined for differences in rates of development and success of molting, pupation and emergence.

Mortality was greatest at pH 3. Development appeared to be most successful at pHs 4 and 5. Differences in development rates in different instars were noted.

**Effectiveness of the Ovitrap for Monitoring *Culex* Populations.** BRIDGET HOBAN, and GEORGE B. CRAIG, JR., St. Joseph County Mosquito Abatement Program, Department of Biology, University of Notre Dame, Notre Dame, Indiana 46556.—In an attempt to monitor populations of *Culex pipiens* and *Culex restuans*, *Culex* ovitraps were used throughout the county. These ovitraps were designed to collect egg rafts from ovipositing females. The trap was a 5-liter plastic bucket with a cover in place but ajar to leave a 1 inch opening; the trap contained

water and cow manure in a cheesecloth sack. On May 21, 25 ovitraps were distributed throughout the county, with 11 of them placed close to a light trap. Egg rafts were collected on Monday, Wednesday and Friday of each week until 23 June. On 27 June the ovitraps were replaced with fresh ovitraps. Egg rafts were collected and identified to species as before. However, beginning July 9, only 20 rafts per site were identified because some traps were producing up to 100 egg rafts and logistics for rearing became impossible. Altosid was added to all the traps. The ovitraps were replaced again in 14 July. At the five most productive sites, a second ovitrap lacking Altosid was added. This was to determine whether Altosid had an influence on ovipositing females. These ovitraps were discontinued on 6 August. Over the summer, 8,353 egg rafts were collected. *Culex restuans* was predominant. There were no *Culex pipiens* collected until 27 June. At the end of the experiment on August 6, the proportion of *Culex pipiens* had increased to only 35%. The Altosid was effective in preventing adult emergence; and from results of the Altosid comparison tests, the Altosid did not significantly reduce the effectiveness of the traps. The total numbers of rafts collected per trap collected corresponded with the total number of mosquitoes caught out of the light traps. The use of the manure attractant oviposition traps has been a very successful method of monitoring *Culex* populations in St. Joseph County. By standardizing the traps, and by adding Altosid to prevent adult emergence, we have developed a good tool.

**The Burrowing Mayflies (Ephemeroidea) of Indiana.** JOHN KELTNER and W. P. McCAFFERTY, Department of Entomology, Purdue University, West Lafayette, Indiana 47907.—Twelve of the thirty species of burrowing mayflies have been recorded for Indiana, representing four families and six of the nine U.S. genera. General information was sought regarding geographic and phenological distribution and aquatic micro-habitat preferences for all Indiana species along with detailed burrowing and feeding behavior of larval exemplars for all genera. Larval *Potamanthus* inhabits lotic environments, clinging to the undersides of rocks and other surface substrates, however, larvae of all other genera live within bottom substrates at various depths and construct various subterranean burrows. *Ephemera* and *Ephoron*, in Indiana, are found in a wide range of lotic and more rarely lake substrates, from cobble-sand-gravel to finer sediments. *Hexagenia*, in Indiana, occurs in soft, often organically enriched, silt bottoms in both lentic and lotic environments, whereas *Tortopus* and *Pentagenia* are adapted for burrowing in compacted clay bottoms and/or submerged banks of large rivers. Most genera are widely distributed in the state. *Tortopus* and *Pentagenia*, however, have been taken only on the lower Wabash River. *Pentagenia* was apparently previously more widespread in the larger rivers. *Ephoron* and *Tortopus* are univoltine with extremely synchronized and short emergence periods. *Hexagenia*, *Pentagenia*, and *Ephemera* have more complex life histories with overlapping generations and more prolonged population hatches. *Potamanthus* is univoltine or possibly requires two years for development with a very prolonged summer emergence period.

**Effects of pH on Oviposition Preference and Larval Development of Mosquito Species *Aedes triseriatus*.** STEPHEN R. MADIGOSKY, ROBERT R. PINGER and HORST F. SIEWERT, Ball State University, Muncie, Indiana 47306.—A laboratory study was conducted to determine preference for pH levels of water by gravid female mosquitoes for oviposition and to evaluate effects of low pH levels on larval development of *Aedes triseriatus*. Oviposition preference was assessed by allowing F<sub>3</sub> generation females to lay eggs on one of six available oviposition sites. Seventy *Aedes triseriatus* females were placed in separate pint containers. Each container

accommodated six glass vials with rainwater, which was adjusted to one of six different pH levels (2 through 7). All vials contained a thin strip of balsa-wood which provided a medium for oviposition. The balsa-wood strips were soaked at pH levels 2 through 7, 21 days prior to use. Female mosquitoes were retained in the containers for 10 days. Very little oviposition preference was established between pH 4 through 7, however, oviposition sites at pH levels 2 and 3 were avoided.

Larval development was assessed by allowing 50 first instar larvae to develop in separate glass containers at 5 different pH levels 3, 4, 5, 6, 7, and a control. The time from hatching to pupation, and from pupation to emergence of adults were monitored. Mortality was greatest at pH levels 3 and 4.

**Effect of Prey Density on the Use of *Toxorhynchites rutilus* as a Biological Control Agent.** RAYMOND RUSSO and KIMBERLY RAUBENHEIMER, Department of Biology, Indiana University-Purdue University at Indianapolis, Indianapolis, Indiana 46205.—*Toxorhynchites rutilus rutilus* (Theobald) larvae were reared on *Aedes aegypti* (Linnaeus) prey larval densities of 5, 10, 25, and 50. Rate of development and amount of prey consumed were measured.

*Tx. r. rutilus* larvae offered 5, 10, 25, and 50 prey larvae daily, required 23.4, 21.5, 20.6, and 19 days, respectively, to complete development through emergence. As prey density increased, the number of prey consumed increased. *Tx. r. rutilus* larvae offered 5, 10, 25, and 50 prey daily consumed an average of 73, 106, 163, and 231 prey, respectively, during their larval development. A prey/predator conversion efficiency was determined by obtaining dry weights of prey and estimating the dry weight of predatory larvae.

The results of this experiment show that the rate of development of *Tx. r. rutilus* can be controlled by the quantity of prey available.

**Home Garden Insecticide Use in Indiana.** ALAN C. YORK and RONALD D. GARDNER Department of Entomology, Purdue University, West Lafayette, Indiana 47907.—A survey was conducted of 2800 home gardeners in Indiana. This survey consisted of face to face interviews of equal numbers of people in rural, small town (less than 5,000), medium town (5,000 to 50,000), and large city (greater than 50,000) areas. It was found that 54% of households surveyed used insecticide on vegetables or fruit. Information was obtained on 57 brands of 21 different active ingredients. Carbaryl was used most frequently, 44% of the uses. More than 50% of the uses on cucumber, cantaloupe, squash, pepper, beans, sweet corn, and potato were of this compound. Rotenone was second most frequently used, 29%. Methoxychlor (6.85%), malathion (6.69%), diazinon (5.6%), and pyrethrum (2.1%) comprised the majority of the remainder. Of the remaining compounds, only chlordane was used more than 1.0% of the time. Dusts were used most frequently (76.1%) followed by liquid, wettable powder, aerosol, and granular formulations. Most people (53.8%) said that they purchased insecticides by common name rather than by brand name; however, Ortho products were purchased 61 + % of the time. Use of insecticide was slightly, but positively correlated with age, years of experience, and the size of garden.