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COMPARISON OF TWO POPULATION SAMPLING METHODS USED IN
FIELD LIFE HISTORY STUDIES OF *MESOVELIA MULSANTI*
(HETEROPTERA: GERROMORPHA: MESOVELIIDAE)
IN SOUTHERN ILLINOIS

Steven J. Taylor¹ and J. E. McPherson²

ABSTRACT

A field life history study of *Mesovelia mulsanti* was conducted in southern Illinois, the results of which are compared with those from an earlier study also conducted in southern Illinois. The two studies differed in the collecting techniques used (quadrat sampler versus aquatic net). Results of the present study give a clearer picture of the life history of this insect because the quadrat sampler collected representative samples of nymphs and adults more effectively than the aquatic net and, thus, the quadrat samples more accurately represented the actual chronology of the annual generations.

The water treader *Mesovelia mulsanti* White occurs from Newfoundland, Nova Scotia, New Brunswick (Scudder 1987), New York, and Massachusetts south to Florida, and west to British Columbia and California; it also has been reported from Mexico to Argentina, the West Indies, and the Hawaiian Islands (Smith 1988). It occurs throughout much of Illinois (Taylor 1996).

Mesovelia mulsanti is epipleustonic, inhabiting shaded and unshaded areas, especially standing water with duckweed and algae (McPherson 1988, Taylor 1996). It is predaceous, feeding primarily on insects on the water surface and, possibly, on small organisms that come to the surface from below (McPherson 1988).

This insect's life history has been studied in southern Illinois (Galbreath 1973, 1975, 1976a, 1976b; McPherson 1988) and elsewhere (e.g., Hoffmann 1932; Hungerford 1917, 1920; Lanciani 1987). However, there is some question about the number of generations per year. In southern Illinois, for example, Galbreath (1973, 1975) stated that this species has five and possibly more generations per year, whereas McPherson (1988) found only three generations and a partial fourth, with eggs apparently overwintering.

McPherson's (1988) field study was conducted in the La Rue-Pine Hills Ecological Area (now La Rue-Pine Hills Research Natural Area) in Union

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County from 1983 to 1986. Specimens were collected with a 0.33 m-wide aquatic net at approximately weekly intervals during the active season (April to November). Data from the four years were combined to gain a better understanding of the annual life cycle. However, there is some question about the reliability of his data because of problems inherent in the use of an aquatic net (i.e., smaller specimens are more likely to be overlooked) and because the study was part of a larger qualitative study of both the semi-aquatic and aquatic Heteroptera. For this larger study, sweeps collected material below and on the surface of the water simultaneously and included aquatic vegetation, detritus, and insects. There was no attempt to limit sweeps to the surface of the water and, therefore, detecting the earlier instars of *M. mulsanti* (1st instars averaged less than 1.00 mm in length [unpublished data]) in samples containing much organic debris was difficult. As would be expected, the number of adults collected represented an artificially high percentage of the total number of individuals collected during the study (2,239/5,092; 44%).

This paper results from a larger study of the biology of the Gerromorpha in Illinois (Taylor 1996). As a part of that project, we studied the life histories and microhabitat distributions of several species (including *M. mulsanti*) during 1989 and 1990 at President's Pond on the campus of Southern Illinois University at Carbondale, Jackson County, Illinois. President's Pond is roughly triangular, with a surface area of approximately 0.29 hectare (0.72 acre) (see Taylor [1996] and Taylor and McPherson [1998a, 1998b, 1999] for detailed description of pond).

The collecting technique for President's Pond was designed specifically to sample all gerromorphan instars, regardless of size. Because McPherson's (1988) study was conducted only 25 km southwest of President's Pond, we were able to compare our results and collecting techniques with his. Therefore, the purposes of this paper are to present the results of our study of the annual life cycle of *M. mulsanti* at President's Pond, compare the efficacy of the collecting technique with that of McPherson (1988) for sampling nymphal and adult stages, and examine the influence of these techniques on our ability to distinguish between generations.

MATERIALS AND METHODS

Samples were collected weekly from 18 March to 25 November 1989 and, because of overcollecting in 1989, biweekly from 11 February to 2 December 1990. Sampling was limited to an area along the eastern shore because (1) the cattails along the western shoreline prevented use of the quadrat sampler (see below); (2) the riprap shoreline of the southern border was unnatural and, often, disturbed by fishermen; and (3) the water surface along the eastern shore, which was a mosaic of open water, duckweeds, and emergent stems, supported a diverse gerromorphan fauna.

Four 60 m transects were made parallel to a relatively uniform section of the eastern margin at 0, 0.5, 1.0, and 1.5 m from the shoreline. Each sample was collected with a floating quadrat sampler (0.25 x 0.25 x 0.05 m) (see Taylor 1996), with four replicates placed randomly along each transect; the resulting 16 quadrat samples were pooled, providing a broad sampling of the habitat. Prior to each sample, the collector (SJT) stood for approximately 3 minutes to allow the insects to acclimate to the disturbance; then, the sampler was placed on the surface of the water. Epiluestonic arthropods were removed with a fine mesh nylon net (0.42 mm diam. mesh openings), preserved in alcohol, and sorted in the laboratory by instar, and, ad-

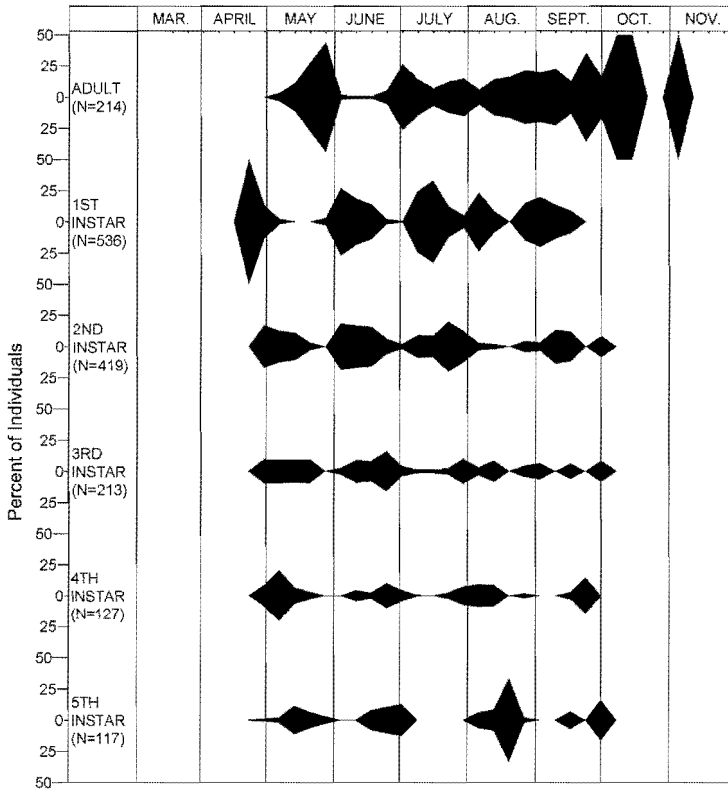


Figure 1. Percent of individuals in each stage per sample of *Mesovelia mulsanti* collected at President's Pond, Southern Illinois University at Carbondale campus, Jackson County, during 1989. Beginning and end points of each shaded area represent sample dates preceding and following collection of specimens, respectively.

ditionally for 5th instars and adults, by sex and wing morph (apterous and macropterous). Galbreath's (1975) intermediate morph was not distinguished from the apterous morph in our study. Nymphal instars were distinguished by tergal and genitalic features (see McPherson and Taylor 1993).

RESULTS AND DISCUSSION

Mesovelia mulsanti apparently overwinters as eggs. Combining data from 1989 and 1990, first instars were found from late April through mid-September, second instars from mid-April through late September, third instars from late April through late September, fourth instars from late April

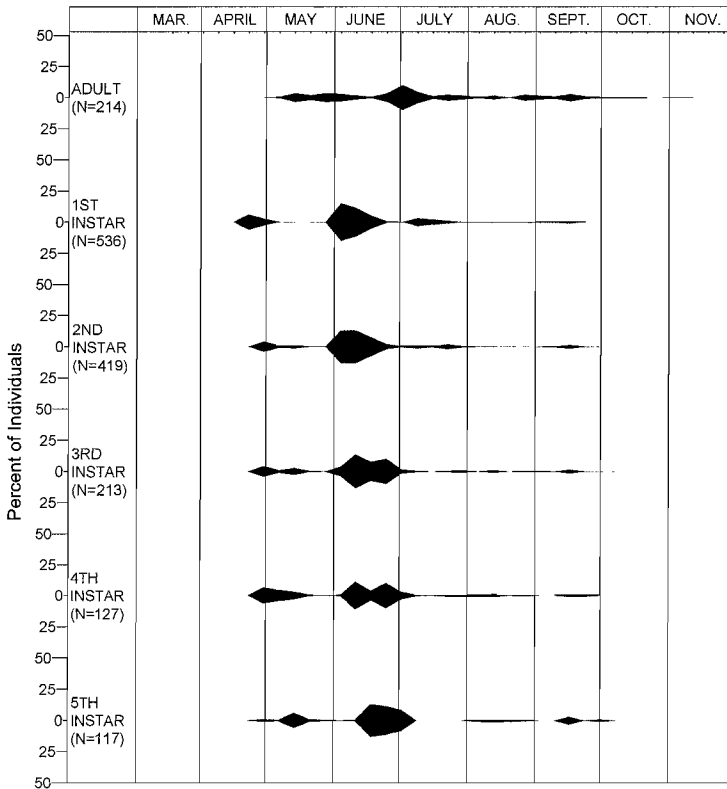


Figure 2. Percent in each sample of total individuals of same stage of *Mesovelia mulsanti* collected at President's Pond, Southern Illinois University at Carbondale campus, Jackson County, during 1989. Beginning and end points of each shaded area represent sample dates preceding and following collection of specimens, respectively.

through late September, fifth instars from late April through late September, and adults from early May through early November (Figs. 1–4).

The number of generations per year was difficult to determine although apparently there were four or five. Hoffmann (1932), under uncontrolled laboratory conditions, reported nymphal development averaged 20.02 days; whereas Lanciani (1987), under controlled conditions (28°C, 12L:12D photoperiod), reported it averaged 13.38 days. Because these insects are active from April to November in Illinois (McPherson 1988, Taylor 1996), and developmental time varies with changes in temperature (Galbreath 1975), the short generation time reported by Lanciani (1987) suggests that the active season is of sufficient length to allow four or five generations per year in southern Illinois.

McPherson (1988) reported three generations and a partial fourth. Al-

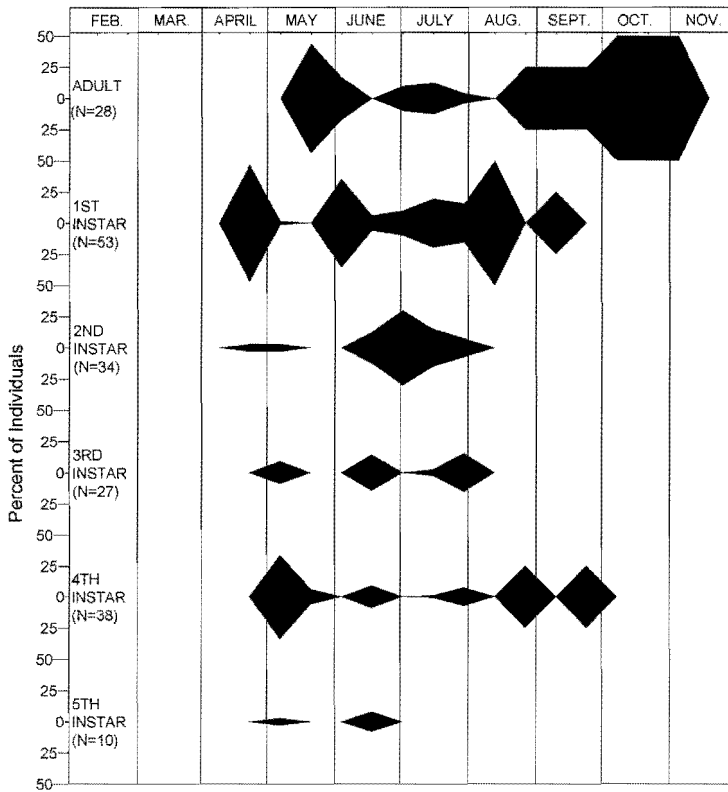


Figure 3. Percent of individuals in each stage per sample of *Mesovelia mul-santi* collected at President's Pond, Southern Illinois University at Carbondale campus, Jackson County, during 1990. Beginning and end points of each shaded area represent sample dates preceding and following collection of specimens, respectively.

though it might seem that his study would have been more thorough because it was conducted over four years rather than two, voltinism was determined by combining the data across all years into a single year because the numbers of early instars were low. In addition, sample dates varied slightly from year to year, and, therefore, samples from the four years were lumped into weekly samples (JEM, unpublished data). Therefore, it is likely that the peaks corresponding to generations were obscured.

As discussed earlier, McPherson (1988) collected aquatic and semiaquatic Heteroptera with an aquatic net, whereas the present study used a quadrat sampler. Because sampling was limited to the epipleuston in the present study, samples were relatively free of organic debris compared to those collected in McPherson's (1988) study. Comparisons of the numbers of nymphal instars and the adults showed that the quadrat sampler collected representa-

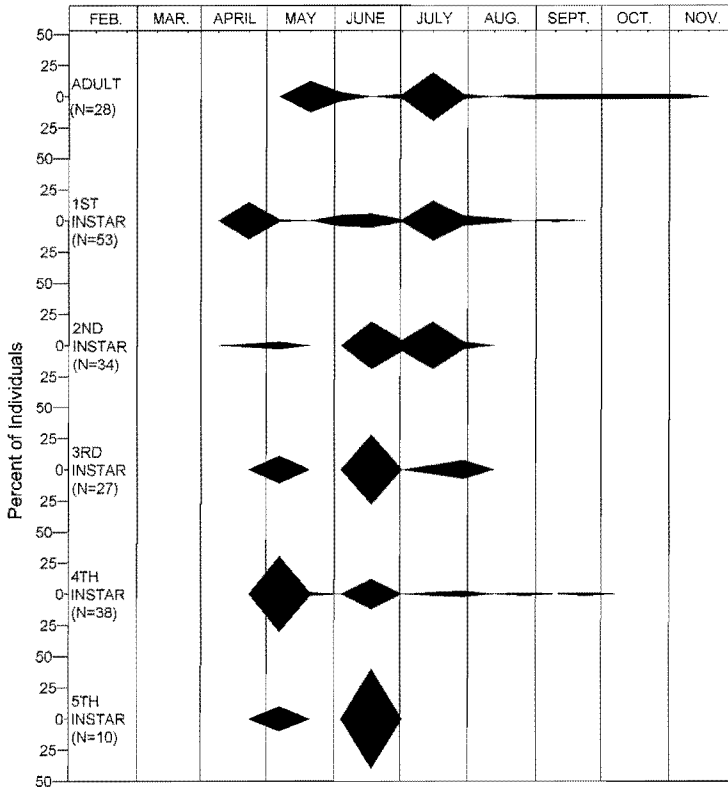


Figure 4. Percent in each sample of total individuals of same stage of *Mesovelia mulsanti* collected at President's Pond, Southern Illinois University at Carbondale campus, Jackson County, during 1990. Beginning and end points of each shaded area represent sample dates preceding and following collection of specimens, respectively.

tive samples of all stages more effectively than the aquatic net (Fig. 5). Although the results of the present study were not dramatically different from those of McPherson (1988), the quadrat samples more accurately represent the actual chronology of the annual generations and provide higher confidence in our conclusions.

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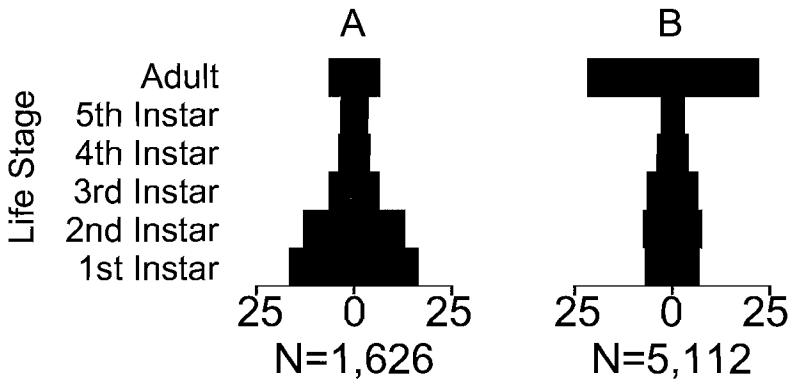


Figure 5. Life stage distribution (percent of individuals) for *Mesovelia mulsanti*. A—specimens collected with quadrat sampler in 1989 at President's Pond, Southern Illinois University at Carbondale campus, Jackson County. B—specimens collected with aquatic net from 1983 to 1986 at La Rue-Pine Hills Research Natural Area, Union County (McPherson 1988).

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