POTENTIAL EFFECTS OF ALTOSID™ (METHOPRENE) BRIQUET TREATMENTS ON *EUBRANCHIPUS BUNDYI* (ANOSTRACA: CHIROCEPHALIDAE)

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A recent, preliminary study suggested that the insect growth regulator, methoprene, may slow development of the fairy shrimp *Eubranchipus bundyi* Forbes (R. W. Lawrenz, Minnesota Department of Natural Resources, personal communication). Population densities of fairy shrimp in methoprene-treated vernal ponds may be reduced because egg laying may not occur before sites dry up. A retardation of fairy shrimp development may also reduce pond biomass available to nesting ducks. A survey was designed to determine if population densities and individual sizes of fairy shrimp in sites with a history of methoprene treatments differed from similar never treated sites.

Aedes vexans (Meigen) breeding sites in Laketown township of Carver County, Minnesota were treated by the Metropolitan Mosquito Control District (MMCD) in early April from 1983 to 1985. Sites were treated with experimental controlled release briquets containing methoprene (Altosid SR-10™). These briquets differed from standard Altosid™ briquets commercially available from Zoecon Industries (Dallas, TX) in that they were designed to release Altosid SR-10 over 150 days compared to the standard 30 days. Each experimental briquet weighed 50 gm and contained 3.0% Altosid SR-10 compared to the standard 5.4 gm briquet with 7.9% AI. The longer duration experimental briquet was designed so sites did not have to be retreated every 30 days. Experimental use of this new packaging of Altosid SR-10 was approved by the U.S. Environmental Protection Agency (EPA), and the new formulation has been submitted to the EPA by Zoecon Industries for approval for general use.

Briquets were placed in a grid pattern of one briquet per 20 m^2, which maintained a methoprene level of 1.5 ppb in the water of a pool averaging 30 cm in depth. Sites in the township of Waconia, which is adjacent to Laketown, had no known treatments. This provided an opportunity to compare treated and untreated areas in close proximity for effects of methoprene on fairy shrimp.

Some problems exist in a retrospective study of this nature. Sites surveyed will not have been treated or left untreated in a random fashion. Similarities of fairy shrimp populations in both areas before initial treatments cannot be documented. Although some potentially dangerous assumptions will be made, this design addresses the question in a reasonable manner.

Two adjacent 20.6 km^2 portions of untreated Waconia and treated Laketown townships were selected in April 1985. The MMCD treats small (< 2.0 acres) temporary wetlands that fill following rains or spring snow melt, so such sites in each area were identified. From April 22 to 24, 1985, these sites were sampled for *E. bundyi* with three standardized sweeps of 2.0 m with a D-frame net of 0.5 mm mesh at locations trisecting a randomly selected transect. Fairy shrimp numbers and individual lengths were determined for samples. Average lengths of shrimp in treated and untreated sites were compared using Student's *t*-test. Densities of untreated and treated sites were compared using a Wilcoxon Rank Sum Test (Sokal and Rohlf 1969). Ratios of sites supporting fairy shrimp and sites not supporting shrimp in both areas were compared using chi-square.

Fairy shrimp were collected in 6.4% of the sites (n = 78) in the untreated Waconia area. Shrimp were present in 9.3% of the sites (n = 183) in the treated Laketown area. Comparing ratios of sites positive and negative for shrimp in both areas yielded a nonsignificant chi-square of 0.2736 ($P = 0.6$). Thus the probability of finding fairy shrimp was similar in both treated or untreated sites.

Mean shrimp density in treated sites containing shrimp was 20.7 per sweep (SD = 22.4, range 1.7–84.3). Mean density in untreated sites was 41.7 per sweep (SD = 48.8, range 8.7–127.3). The mean density in untreated sites appeared higher but it was skewed because the density in one site (127.3) was 4 times larger than any other untreated site. A *t*-test of the Log 10(X+1) transformed data was nonsignificant. The nonparametric Wilcoxon rank sum test was considered more appropriate to compare densities, but still no significant differences in shrimp densities between treated or untreated sites were evident ($p = 0.22$).

Mean sizes of shrimp in treated sites (10.07 mm, SD = 2.2) and untreated sites (11.8 mm, SD = 2.3) were not significantly different (*t*-test, $p = 0.14$). Many shrimp were in the 10–18 mm size range of mature *E. bundyi* (Daborn 1976, Pennak 1978) and egg sacs were commonly found indicating that populations surveyed were near maturation. Developmental differences, if present, should have been most pronounced in shrimp in these late stages.

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No significant differences in presence, density or size of fairy shrimp populations were evident between sites treated for 3 years with methoprene and untreated sites. The population dynamics of *E. bundyi* are notoriously unpredictable (Daborn 1976) and it could be argued that trends of reduced size and density in treated sites existed in this study, so more research should be done.

References Cited

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PREDICTING THE SPRING EMERGENCE OF *COQUILLETTIDIA PERTURBANS*[1]

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Many models have been developed to describe the influence of temperature on insect growth rates (Logan et al. 1979). Although a number of these are non-linear (Hilbert and Logan 1983), linear degree-day (DD) models are still often employed successfully (Pruess 1983).

The majority of predictive models have been used with agricultural pests, although some have been applied to biting insects such as black flies (Ross and Merritt 1978) and mosquitoes (Clarke and Wray 1967). A simple, or historical DD model was used in the current study to predict the emergence of hibernating *Coquillettidia perturbans* (Walker) in central Florida. The species is a nuisance in much of North America and hibernates in the larval stage attached to the roots of aquatic plants (Allan et al. 1981).

Investigations were carried out from February through April in 1984 and from February through June in 1985. During 1984, samples were taken at 2 sites where thick mats of floating vegetation were known to harbor *Cq. perturbans* larvae (Lounibos and Escher 1983). Observations made prior to the current study indicated that the water temperature was extremely stable, and in the interest of making the technique practical for an operational mosquito control agency, temperatures were recorded once a week. The degree weeks (DW) were calculated in the same manner as degree days, that is; DW = [Tmax + Tmin]/2 − threshold temperature (°C) × weeks (Ross and Merritt 1978). A threshold of 10°C was chosen an arbitrary baseline (Pruess 1983), and eclosion was noted using 2 emergence traps per site (Slaff et al. 1984).

During 1985, the study was repeated on a larger scale. Temperatures were taken at 2 stations within a single mat site, and 3 emergence traps were placed around each temperature station. Five additional temperature stations were established in 2 shallow maidencane (*Panicum hemitomon* Shult.) marshes. The maidencane habitat provided far greater temperature fluctuations for comparison to the stable mat site. Four traps per temperature station were employed to monitor *Cq. perturbans* emergence. The study began on the first of February each year.

The DW accumulations for 1984 are shown in Table 1. The total DWs were nearly identical at both sites when the first adult *Cq. perturbans* were captured in the emergence traps. Results from 1985 (Table 2) are very consistent between sites, but the DW totals are slightly higher than those seen the previous year. A possible explanation may be that water temperatures prior to the first samples were higher in 1984 than in 1985, and that an earlier starting date may be in order. Even so, the differences between years would still yield a predication accuracy within 2 weeks.

Collections were made beyond the initial surge of *Cq. perturbans* until what appeared to

Table 1. Degree-Week accumulation and the emergence of adult *Coquillettidia perturbans* during 1984.

Week	Site number 1	Site number 2
1	3.75	2.50
2	7.50	5.00
3	14.00	11.00
4	18.25	17.00
5	22.25	21.00
6	27.75*	27.25*
7	34.75	35.00

* First adult *Cq. perturbans* captured.

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