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# EFFECTS OF AROSURF® MSF ON MICROCRUSTACEA ASSOCIATED WITH THE CATTAIL MOSQUITO, *COQUILLETTIDIA PERTURBANS*

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ABSTRACT. In a study on the effectiveness of Arosurf® (a monomolecular surface film) MSF for the control of *Coquillettidia perturbans*, we surveyed microcrustacean populations to determine whether they were being impacted and whether species of potential use in mosquito control were present. Impacts on the microcrustacean populations were not detected. Among the copepods identified were *Acanthocyclops vernalis*, a mosquito predator and a host to at least 2 mosquito parasites, and 2 species of *Macrocyclops*, one of which, *Macrocyclops albidus*, is also a known mosquito predator.

Recently, we studied the effectiveness of Arosurf® MSF[1] (a monomolecular surface film) for the control of *Coquillettidia perturbans* (Walker) (Kenny and Ruber 1992). In the course of the study we surveyed for mermithid parasites of the mosquito (Kenny and Ruber 1991) and for microcrustaceans. Microcrustaceans were examined in 2 contexts: first to determine whether any known as predators of mosquito larvae or intermediate hosts of parasites of larval mosquitoes were present, and second, to determine whether applications of the pupicide had any deleterious effects on them.

Arosurf® MSF in water at 0.5 gallons per acre (4.67 liters/ha) was applied by aircraft on 4 dates in the summer of 1990. This is the maximum recommended dosage (Sherex Technical Bulletin, 1984). The first aerial application, on June 28, was carried out by a helicopter that contained equipment for shear agitation of the Arosurf–water emulsion. We were unable to obtain the helicopter again, but had available to us a fixed-wing aircraft belonging to the Plymouth County Mosquito Control Project, which lacked a mixing apparatus. We tested the stability of shear-agitated Arosurf–water emulsion, and found it to be greater than 45 min. Consequently, we premixed at the airfield, and delivered the Arosurf without on-board shear agitation on July 7, 18, and August 2, 1990. The habitat was an emergent cattail marsh that became more overgrown as the summer progressed.

Copepods were collected by bailing 2 liters of water through a plankton net, then preserved in formaldehyde solution containing Rose Bengal dye to facilitate their later isolation. Ten replicates were taken from a control area, and 5 from a treated area on each date. Actually, more samples were taken from presumptively treated areas, but due to logistical difficulties (Kenny and Ruber 1992) it was not clear whether the Arosurf had reached certain sites; therefore these were eliminated from the analysis.

Microcrustacean numbers were compared between treated and control areas on 4 dates during the season of Arosurf application, each time 2 to 3 days after application. They were also compared on 4 dates at approximately the same date 1 year later (Table 1). The groups were divided only into the major taxa Copepoda and Cladocera for this purpose, and means and standard errors were calculated for each date. The criterion of statistical significance was a difference between samples of greater than one standard error of the mean.

During the season of applications on 4 comparison dates, copepods in the treated sites were never significantly less abundant than those in the controls. One year later, there was no significant difference on 3 dates, and a slight but significant reduction in the treated area on one date. Because there were no significant effects during the months of treatment it is unlikely that this single sample differed because of the treatments 1 year previously. During the season of treatments, cladocerans were significantly lower in the treated sites on one of 4 dates; this was also the case 1 year later. Overall then, copepod abundances were significantly reduced in the treated areas on one out of 8 dates and cladocerans on 2 out of 8 dates. Copepods and cladocerans in treated samples also exceeded controls on one occasion for each.

The combined data suggest that the treatments had no significant effects. This was not unexpected because the greatest effect of Arosurf should occur on the water surface. Because some microcrustaceans associate closely with the underside of the surface film to gather food, they could have come in contact with the Arosurf and been affected.

[1] Arosurf MSF is a surfactant. The active ingredient (100%) is poly(oxy-1,2-ethanediyl),α-isooctadecyl-ω-hydroxy. Early in 1993 the Sherex Chemical Company (Dublin, OH 43017) stopped supplying this material. At present, a new source has not been identified.

Table 1. Zooplankton abundances at the Hanson, MA, experimental site during 1989 and 1990.

| | Copepoda | | Cladocera | |
|---|---|---|---|---|
| | Control | Treated[1] | Control | Treated |
| July 1, 1989 | 39.0 (9.4)[2] | 84.0 (29.0) | 5.1 (2.1) | 16.2 (8.8) |
| June 26, 1990 | 40.6 (2.8) | 21.2 (4.2) | 26.6 (2.1) | 9.8 (1.6) |
| July 20, 1989 | 125.1 (30.0) | 155.0 (59.3) | 20.3 (6.8) | 59.0 (27.6) |
| July 12, 1990 | 56.8 (3.6) | 59.4 (8.4) | 25.5 (2.2) | 32.6 (3.8) |
| July 27, 1989 | 151.7 (23.5) | 120.4 (16.6) | 43.8 (11.9) | 6.0 (1.0) |
| July 30, 1990 | 43.7 (17.0) | 24.0 (2.2) | 13.8 (4.5) | 12.2 (1.5) |
| Aug. 4, 1989 | 79.3 (6.5) | 84.8 (5.5) | 28.3 (2.8) | 21.6 (2.2) |
| Aug. 30, 1990 | 73.0 (31.9) | 58.2 (6.5) | 29.1 (4.6) | 26.2 (4.9) |

[1] Application dates were June 28, July 18, July 25, and August 2, 1989.
[2] Mean ± SE based upon 10 control and 5 treated area samples each from 2 liters of water strained through a plankton net.

Selected samples were identified to species level from the Hanson marsh. The Copepoda included *Acanthocyclops vernalis, Ectocyclops phaleratus, Ectocyclops polyspinosus, Eucyclops serrulatus, Macrocyclops albidus, Macrocyclops fuscus* and *Orthocyclops modestus*; the Cladocera included *Simocephalus expinosus, Scapholeberis* sp., *Ceriodaphnia* sp. and *Bosmina* sp.

Among the microcrustaceans found, *A. vernalis* is an intermediate host of 2 mosquito parasites, the fungus *Coelomomyces dodgei* (Federici 1980) and the protozoan microsporidian *Amblyospora connecticus* (Andreadis 1983, 1985) and it is also a known mosquito predator (Reid 1989). We did not attempt to detect parasties in the copepods. The genus *Macrocyclops,* of which 2 species were found, contains very large, predatory cyclopoids. *Macrocyclops albidus* has been used successfully to control *Aedes albopictus* (Skuse) larvae in the tire piles (Marten 1990a, 1990b). Nasci et al. (1987) found *A. vernalis* in all 3 mosquito habitats that they sampled, and *M. albidus* in 2 of 3. Ruber (1965[2]) found *A. vernalis* to be commonly associated with fresher portions of marshes containing *Aedes sollicitans* (Walker). The widespread distribution of these cyclopoid species makes them a possible tool in mosquito control. Muller (1959) described a method for growing *A. vernalis* while avoiding cannibalism upon the naupliar stages, and more recently, Suarez et al. (1992) reported on a method for the cultivation of *M. albidus.*

The cladocerans found are not predatory nor are they known hosts of mosquito parasites. They are important food sources for fish and sometimes other aquatic animals.

[2] Ruber, E. 1965. The effect of chemical and physical methods of mosquito control upon salt marsh microcrustacea. Ph.D. dissertation. Rutgers—The State University, New Brunswick, NJ.

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