of mosquitoes towards the bait. In the present note we present data on the densities of males which suggest that, despite the relatively small numbers trapped, the flight pattern of this sex is also influenced by the presence of the bait.

Details of the technique are given in the original publication. Four radial lines of ramp-traps (Gillies, 1969) were set up in open farmland in the Gambia at intervals of 7.5 m, extending from 7.5 to 60 m from the center. Catches were done in 3 series in which the center of the area was either baited with 2 man-sized calves or with carbon dioxide released from a cylinder, or was left unbaited. The 2 sets of traps nearest to the bait (at 7.5 and 15 m) provided 45.3% of the total catch of males (53 mosquitoes) when calves were present, 16.1% when the center was baited with carbon dioxide (106 mosquitoes) and 27% when there was no bait (37 mosquitoes). A chi-square test for the difference between the calf-baited catches and others showed high significance ($p < 0.005$).

This shows that the presence of animals had a concentrating effect on males while still at some distance from the bait, suggesting that they were being guided towards it by either olfactory or visual stimuli. It might be suggested that males were orienting not to stimuli from the hosts but to female mosquitoes already concentrated at the bait or intercepted by the traps as they approached it. However, no such concentration of males was detected when the center was baited with carbon dioxide even though it was shown that this had a similar, if less marked, aggregating effect on females as animal baits. The results, therefore, lend support to the idea that, although males and females may mate in the absence of baits (Gillies, 1975) orienting responses to warm-blooded animals by both sexes may also operate to bring them together.

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THE EFFECTS OF ABATE 2G® MOSQUITO LARVICIDE ON SELECTED NON-TARGET ORGANISMS COLLECTED FROM FORESTED TEMPORARY POOLS

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Over the years the South Cook County Mosquito Abatement District has found that one of the most effective means of controlling *Aedes vexans* (Meigen) and *Culex pipiens* Linnaeus in forest preserve areas has been larviciding with 2% granular Abate 2G insecticide (O, O, O′, O′-tetramethyl O, O′ thiodi-p-phenylene phosphorothioate) applied at a rate of 2.5–5.0 lbs/acre to temporary and permanent standing water. Such larviciding practices have necessarily conflicted with the established goals of the Forest Preserve District. In the past 2 years questions have arisen regarding the effects of this larviciding practice on the non-target organisms occupying the same habitat as the mosquito larvae.

The non-target organisms which were found to be most abundant in the Thornton Division of the Cook County Forest Preserve District were cladocerans, copepods, ostracods, midge larvae, hydrophilids, and snails. To evaluate the effects of Abate 2G on these non-target organisms, the following experimental procedures were carried out.

Simulated natural conditions were prepared in six 10-gallon aquaria by the addition of 1.2 liters of debris and approximately 40 liters of pond water per aquarium. The following populations of test organisms were then introduced into each aquarium: Non-target—Order Cladocera, *Simocephalus* sp., and *Ceriodaphnia* sp. [number added per aquarium (NPA), approximately 530,000]; Order Copepoda, *Cyclops* sp., *Ectocyclops* sp., and *Eucyclops* sp., (NPA, 1,500); Order Ostracoda, 1 species (NPA 328,000); Order Coleoptera, Family Hydrophilidae, 1 species (NPA 5); Order Diptera, Family Chironomidae, 1 species (NPA 20); Family Chaoboridae, *Chaoborus* sp. (NPA 20); and 1 species of snail, Order Gastropoda, *Physa* sp. (NPA 10). The target organism used was *Culex pipiens* (NPA 200).

To facilitate the introduction of the populations, it was necessary to remove first all organisms originally collected with the debris and pond water. This was accomplished by multiple washings of the debris and by filtering the pond water through a plankton net. Once the populations were introduced into the 6 aquaria, aeration was provided at a similar rate for each. Organisms

were given a 24-hour acclimatization period preceding the initial experimental treatment.

Of the 6 aquaria prepared, 2 were left untreated and set aside as controls. The remaining 4 were treated with Abate 2G insecticide, 2 with 0.027g (equivalent to 2.5 lbs/acre) and 2 with 0.054g (equivalent to 5.0 lbs/acre).

Observations on the changes in the population sizes of each organism were recorded daily for a period of 10 days. These population estimates were determined by a stratified random sampling procedure (Snedecor and Cochran 1971) for cladocerans, copepods and ostracods, and actual counts for the remaining organisms.

Observations were also made on the residual effects of the Abate insecticide. This was done by periodically reintroducing populations of similar densities to the original populations when the latter reached zero.

The results of the experiments showed that the organisms most susceptible to the insecticide were the non-target species of the Order Cladocera, those of the Order Diptera, Family Chironomidae, and the target species *Culex pipiens*. The populations of the remaining non-target organisms sustained little or no mortality.

The Abate 2G at a concentration of 2.5 lbs/acre killed all cladocerans within 1 day. This mortality rate occurred for 2 consecutive days, when new populations were introduced. After the 2nd day, a total mortality was achieved in 2 days. After the 4th day a mortality of approximately 30% was achieved in 4 days. At the higher application rate of 5.0 lbs/acre, a total mortality was observed each day for 5 consecutive days. After the 5th day a total mortality occurred within 2 days, and after the 7th day, a mortality of approximately 30% occurred within 3 days.

The total mortality of the chironomid population caused by Abate 2G at an application rate of 2.5 lbs/acre occurred after 1 day for 5 consecutive days. After the 5th day decreasing mortality of reintroduced populations was observed. The application rate of 5.0 lbs/acre caused a total mortality after 1 day for 7 consecutive days. Decreasing mortality was observed after the 7th day.

In the case of *Culex pipiens*, both concentrations of Abate 2G caused a total mortality within 1 day for 2 consecutive days. After the 2nd day a reduction in mortality occurred.

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FIELD TESTS WITH REPELLENT TREATED WIDE-MESH NETTED JACKETS AGAINST THE VALLEY BLACK GNAT, *LEPTOCONOPS CARTERI* [1]

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Repellent-treated bed nets and net jackets have been shown to provide protection against many blood-feeding Diptera (Cherapanov and Gomoyunova 1963, Gouck et al. 1967, Catts 1968, Gouck and Moussa 1969, Grothaus et al. 1972, McDonald and Grothaus 1973, Grothaus et al. 1974). Since the treated net jacket appeared to have a broad repellency spectrum, we tested it against the valley black gnat, *Leptoconops carteri*. The black gnat is a serious biting pest in many areas of California, causing considerable problems for both civilian and military personnel.

The jackets were composed of polyester netting with cotton strands woven in for the repellent reservoir (Anonymous 1974). The jackets were treated with an acetone solution of technical grade n-n-diethyl-meta-toluamide (DEET) to obtain a dosage of 1/4 gram actual per gram of netting. Initial tests were conducted with freshly treated jackets. The same jackets were retested after 14 days aging. Aging was accomplished by hanging the jackets in a well ventilated room at ambient temperatures. Four men were used as test subjects during the study. Five replications were made, the first in T-shirts only for 5 minutes; the subjects then wore each of the treated jackets and the untreated control jacket for 15 minutes. Fresh T-shirts were used with each jacket change to prevent cross subject contamination. Exposed skin was also washed with 70% alcohol. The results are shown in Table 1. An acceptable level of protection is considered to be 90% or more.

The results show that adequate protection (96.6%) was provided by the freshly treated jackets. Most of the bites received by subjects while wearing the treated jackets were on the exposed face. Inadequate protection (68.7%) was obtained after 14 days of aging. This indicates that protection time, using jackets repackaged

[1] The opinions or assertions contained herein are the private ones of the authors and are not to be construed as official or reflecting the views of the Navy Department or the naval service at large.

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