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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Table 1. Effectiveness of DEET impregnated jackets against *Leptoconops carteri*.

Subjects	Freshly treated jackets			Controls		
	Treat 1 # bites/ 15 min	Treat 2 # bites/ 15 min	Treat 3 # bites/ 15 min	Untreated # bites/ 15 min	T-shirt * # bites/ 15 min	% Reduction in number of bites
A	0	1	0	15	6	97.1
B	5	9	7	87	99	92.5
C	0	4	1	54	60	97.1
D	0	0	0	27	69	100.0
			Aged Jackets (14 days)			
E**	2	7	16	31	12	61.3
F**	2	14	0	7	18	57.4
C	5	28	37	72	60	64.7
D	0	13	0	40	63	91.6

* Counts taken for 5 minutes and totals multiplied by 3.
** Subject not used with freshly treated jackets.

after each use, would be somewhat less than 325 hours.

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DRAGONFLY NYMPHS AS ACTIVE PREDATORS OF MOSQUITO LARVAE

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The significance of dragonfly nymphs as active predators of mosquito larvae was investigated using the dragonfly *Trithemis annulata scortecii* Nielsen. Nymphs were collected from various ponds in the grounds of the University of Khartoum. They were all full-grown individuals (1.6 to 1.8 cm in length).

Field work was carried out in irrigation channels surrounding the village of Tayiba (14° 29'N; 33° 25'E) in the cotton and dura growing region of Gezira Province, Sudan. Each channel is 280 m in length. Mosquitoes, most commonly *Anopheles pharoensis* Theo., breed in these channels where water stagnates as a result of blocking water flow during irrigation. Mosquito larvae were found to be evenly distributed along each channel. Some of these channels had rich vegetation.

Experiments were carried out in these channels which were divided so that each half measured 140 m (width of water 50–80; depth in middle 10–20 cm). The water was clear (turbidity 80–100 J.T.J.). One half of each channel, acting as a control, was left without predators, while the other was divided into sections, each approximately 1 m long. One dragonfly nymph was