

FIELD TRIAL OF THE INSECT GROWTH REGULATOR, DIMILIN, FOR CONTROL OF *ANOPHELES PHAROENSIS* IN GEZIRA, SUDAN

SALAH H. EL SAFI<sup>1</sup> AND A. M. HARIDI<sup>2</sup>

Blue Nile Health Project, P. O. Box 101, Wad Medani, Sudan.

In earlier studies the insect growth regulator (IGR) Dimilin® showed exceptional biological activity against larvae and pupae of asynchronous *Culex* and *Anopheles* mosquitoes (Mulla et al. 1974, Mulla and Darwazeh 1975). At an application rate of 11.34 g/acre, this IGR produced complete inhibition of emergence of *Culex tarsalis* Coquillett for 11–13 days (Mulla et al. 1975). *Aedes nigromaculis* (Ludlow) and *Ae. melanimon* Dyar were also successfully controlled with 11.34 g/acre of this IGR (Schaefer et al. 1975).

*Anopheles pharoensis* Theobald is an important pest species in the Gezira irrigated area of Sudan where it causes a great deal of discomfort by biting humans. It has not been incriminated as a malaria vector in this area (El Gaddel et al. 1985). The preference of this species for resting by day in vegetation rather than houses was demonstrated by Lewis (1948). In Gezira, *An. pharoensis* breeds on the banks of irrigation canals in association with vegetation (Evans 1938). Reported here are the results of studies on the efficacy of Dimilin under field conditions against *An. pharoensis* larvae and pupae in the Gezira area of the Sudan during March 1983.

Three earthen irrigation ditches (1, 2 and 3) containing *An. pharoensis* larvae were selected for trial. Each ditch was 1 m wide, 0.5 m deep and carried water for a distance of 1 km

irrigating 90 acres of land. Water was fed into the ditches by one minor canal which carried water through a network of canals from the reservoir at the Blue Nile. All 3 ditches contained moderately dense vegetation consisting of *Cyperus alopecuroides* and the creeping *Cyanodon dactylon*. Vegetation was denser in ditch 2 than the other two ditches.

Dimilin was applied in two ditches (1 and 2) utilizing Hudson X-pert® sprayers at a rate of 15.2 g AI/acre. This was attained by dissolving 15 g of 25% W.P. in 10 liters of water to spray a water surface of 1,000 m<sup>2</sup>. The third ditch was left untreated as a check.

Assessment of effectiveness was similar to the method described by Mulla and Darwazeh (1976). Immature mosquitoes were sampled with a dip-net (consisting of a small mesh bag sewn to a rim 30 cm in diameter, and 20 cm in depth, at the tip of a 120 cm wooden handle) by taking 10 dips every 10 m prior to, and 2, 5, 7, 9 and 11 days after treatment. Reduction in the immature population was calculated for the last sampling time, utilizing posttreatment and pre-treatment counts. The second method consisted of isolating 20 surviving larvae and pupae from 10 different sites in each ditch, 24 hr after treatment. The isolated larvae and pupae were washed in aluminum cups containing 200 ml of tap water and then transferred to the laboratory maintained at a constant temperature of 16 ± 1°C for further observations on their development. Mortality of larvae, pupae and newly emerged adults in the cups was recorded.

Dimilin proved highly effective when larvae of *An. pharoensis* in irrigation ditches were treated at the rate of 15.2 g AI/acre (Tables 1 and 2). At this treatment level there was a marked reduction in the immature population of *An. pharoensis*. In both treated ditches, a higher mortality of larvae occurred within 2–7 days after treatment, but activity decreased 11 days after treatment.

<sup>1</sup> Entomologist, Blue Nile Health Project, Sudan.  
<sup>2</sup> Former Director, Biology Unit, Blue Nile Health Project.

Table 1. Evaluation of Dimilin applied at 15.2 g AI/acre against *Anopheles pharoensis* breeding in irrigation ditches in Gezira during March, 1983.

Days after treatment	Average number of larvae and pupae/10 dips and percent reduction due to treatment*								
	Ditch 1			Ditch 2			Ditch 3 (control)		
	Larvae	Pupae	% red	Larvae	Pupae	% red	Larvae	Pupae	% red
Pre-	17	2	—	93	16	—	55	12	—
2	1	1	89	17	3	82	62	6	0
5	1	0	95	8	2	91	55	16	0
7	2	0	89	11	1	89	52	16	0
9	6	1	63	36	4	63	62	12	0
11	8	0	58	39	8	57	58	10	0

\* Percent reduction calculated from the density of immatures in the pre- and posttreatment samples.

Table 2. Average percent cumulative mortality and percent inhibition of emergence (EI) of *Anopheles pharoensis* larval and pupal isolates from Dimilin-treated ditches (15.2 AI/acre) in Gezira, Sudan.

Ditch	Larval isolates*				Pupal isolates*		
	Larvae	Pupae	Adults	(EI%)	Pupae	Adults	(EI%)
1	20	0	0	100	20	2	90
2	20	2	1	95	20	3	85
3 (control)	20	19	17	15	20	18	10

\* Based upon the average of 6 isolates, each containing 20 larvae or pupae in a cup.

Mortality of the surviving larvae and pupae isolated from the field was high. Additional mortality occurred in subsequent stages producing a very high overall percent emergence inhibition (Table 2). Similar findings were reported by Mulla et al. (1974), Mulla and Darwazeh (1975) and Schaefer et al. (1975) using Dimilin against various mosquito species.

Thus, Dimilin offers good potential for the control of various species of mosquitoes, showing a varying degree of efficacy against different species breeding in diverse habits. This compound exhibits little or no hazard to nontarget organisms in mosquito breeding sources (Miura and Takahashi 1975, Mulla et al. 1975, Steelman et al. 1975) and has the potential for rendering control of immature mosquitoes for 10 days at very low practical rates.

We would like to thank Dr. A. A. El Gaddal, Project Manager of the Blue Nile Health Project, for the encouragement and facilities he offered.

#### References Cited

- El Gaddal, A. A., A. M. Haridi, F. T. Hassan and H. Hussein, 1985. Malaria control in the Gezira-Managil Irrigated Scheme of the Sudan. *J. Trop. Med. Hyg.* 88:153-159.
- Evans, A. M. 1938. Mosquitoes of the Ethiopian Region II—Anophelini, adults and early stages. British Museum (Natural History), London.
- Lewis, D. J. 1948. The mosquitoes of Jebel Auliya reservoir on the White Nile. *Bull. Entomol. Res.* 39:133-157.
- Miura, T. and R. M. Takahashi, 1975. Effect of the IGR TH-6040 on non-target organisms when utilized as a mosquito control agent. *Mosq. News* 35:154-159.
- Mulla, M. S. and H. A. Darwazeh, 1975. Activity and longevity of insect growth regulators against mosquitoes. *J. Econ. Entomol.* 68:791-797.
- Mulla, M. S. and H. A. Darwazeh, 1976. The IGR Dimilin and its formulations against mosquitoes. *J. Econ. Entomol.* 69:309-312.
- Mulla, M. S., H. A. Darwazeh and R. L. Norland, 1974. Insect growth regulators: Evaluation procedures and activity against mosquitoes. *J. Econ. Entomol.* 67:329-332.
- Mulla, M. S., G. Majori and H. A. Darwazeh, 1975. Effect of insect growth regulator Dimilin® or TH-6040 on mosquitoes and non-target organisms. *Mosq. News* 35:211-216.
- Schaefer, C. H., W. H. Wilder and F. S. Mulligan III, 1975. A practical evaluation of TH-6040 as a mosquito control agent in California. *J. Econ. Entomol.* 68:183-185.
- Stelman, C. D., J. E. Farlow, T. P. Breaud and P. E. Schilling, 1975. Effects of growth regulators on *Psorophora columbiae* (Dyar and Knab) and non-target aquatic insect species in rice fields. *Mosq. News* 35:67-75.

#### THE USE OF MEPACRINE HYDROCHLORIDE TO CONTROL *VORTICELLA* ON MOSQUITO LARVAE

P. G. JUPP<sup>1</sup> AND A. N. SMITH<sup>1</sup>

One of our recent projects entailed the recovery of eggs of the flood-water mosquito *Aedes juppi* McIntosh from soil samples collected in the Orange Free State province, South Africa, and their subsequent rearing to adults. However, only 34% of the viable eggs which hatched were reared successfully to adulthood owing to mortality of the 3rd and 4th instar larvae. Examination of dying and recently dead larvae revealed a severe infestation with the ciliate *Vorticella* which appeared to be the main cause of death. No fungi or other parasitic Protozoa were seen at this time on the larvae and the possible existence of pathogenic bacteria or viruses was not investigated. It was therefore decided to carry out a series of experiments to find a chemical which could be incorporated in the water in the larval rearing trays to kill off the *Vorticella* encrustation without harming the larvae themselves. Metronidazole and chloroquine were each

<sup>1</sup> National Institute for Virology, Private Bag X4, Sandringham 2131, Johannesburg, and Department of Virology, University of the Witwatersrand, Johannesburg, South Africa.