

Effect of Commonly Used Weedicides and Mosquito Larvicides on the Exotic Waterhyacinth Mite, *Orthogalumna terebrantis* Wallwork (Acarina : Galumnidae)

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ABSTRACT

The toxicity of mosquito larvicides and weedicides commonly used in waterhyacinth infested water ways, to exotic waterhyacinth mite, *Orthogalumna terebrantis* Wallwork was determined under laboratory conditions. Among the mosquito larvicides tested, Fenthion (0.0001%) and Fenitrothion (0.0002%) were found to be safe to adults. Chlorpyrifos (0.0001%), phenthoate (0.0001%) and temephos (0.0001%) were mildly toxic to adults, when exposed to sprayed leaf strips, immediately and 24 h after spraying respectively. None of the mosquito larvicides were toxic to the different developmental stages of *O. terebrantis*. Among the weedicides, 2,4D (0.6%) was found to cause significant mortality (24.63%) of *O. terebrantis* adults.

KEY WORDS : Waterhyacinth, *Orthogalumna terebrantis*, weedicides, mosquito larvicides, toxic effects

Orthogalumna terebrantis Wallwork (Acarina : Galumnidae) is one of the five potential biocontrol agents of waterhyacinth (Benett and Zwolfer, 1968; Coulson, 1971; Perkins, 1974) introduced to India, under the All India Co-ordinated Research Project on Biological Control of Crop pests and Weeds in 1982. Releases made in Bangalore resulted in their successful establishment causing complete browning of waterhyacinth leaves (Jayanth and Ganga Visalakshy, 1989).

One of the insidious problems caused by waterhyacinth to human welfare is that it creates an optimum environment for uncontrollable mosquito multiplication (Brij Gopal and Sharma, 1981; Townzen and Wilson, 1985), often necessitating frequent insecticidal and herbicidal applications without taking into consideration, the deleterious effects it may cause on the non-target beneficial organisms. Hence, a study was made to determine the toxicity of these chemicals to

O. terebrantis, whereby application programmes enhancing biocontrol strategies could be formulated for integrated control of waterhyacinth.

MATERIALS AND METHODS

Adult *O. terebrantis* (1-2 days old), which emerged from III instar inactive nymphs, kept in the laboratory were used for the experiment. The toxic effect of the mosquito larvicides at recommended dosages viz., Chlorpyrifos - 0.0001%, Temephos - 0.0001%, Phenthoate - 0.0001%, fenthion - 0.0001% and fenitrothion - 0.0002%, on the adults and immature stages of *O. terebrantis*, was studied under laboratory conditions.

Waterhyacinth plant, kept in a plastic trough (5 litres) filled with water, was sprayed uniformly with the mosquito larvicides, using a chromatographic sprayer and kept in the open air. Immediately after spra-

ying, the leaf strips were introduced into clean dry glass vials (5 x 2"). About 25 adults of *O. terebrantis*, exposed to insecticidal spray were introduced into the glass vials, containing leaf-strips sprayed with the respective larvicides. The adults after 6 h of exposure were transferred into clean dry glass vials containing fresh unsprayed leaf-strips. The mouth of the vials was closed with muslin cloth, held tight by rubber-bands and kept in plastic jars (10x7 cms), having moistened sponge at the base (RH-65-75%). Residual effect of the mosquito larvicides was determined by exposing adult mites for 6 h to leaf-strips after 24 and 48 h of spraying. After 6 h of exposure, the adults were transferred to unsprayed leaf strips taken in glass vials and kept in aerated plastic jars with moist sponge at the bottom. Control consisted of adults exposed to waterhyacinth leaf strips sprayed with tap water. The treatment was replicated four times, with 25 adults per treatment.

Effect of mosquito larvicides on the immature stages was determined by spraying waterhyacinth plants containing all stages (egg-III instar nymph) with the respective larvicides. After marking the leaves with particular stages, the plants were maintained in the open air, in a plastic trough (5 litres) with water. Random observation for 100 adult emergence holes, (which indicated normal adult development), was made for each stage, after 1-2 days of adult emergence.

Table 1. Effect of mosquito larvicides on *O. terebrantis* adults

Treatment	% mortality of adults at		
	6 h	24 h	48 h
Chlorpyrifos	18.46	0.00	0.00
Temephos	15.63	7.37	7.37
Phenthoate	12.68	8.99	7.37
Phenthion	7.37	0.00	0.00
Fenitrothion	5.31	0.00	0.00
Control	3.68	0.00	0.00
CD at 5%	14.29	8.62	7.60

The effect of selected weedicides, at the recommended dosage (Brij Gopal and Sharma, 1981). (2,4 D - 0.15%, 0.3 and 0.6%, paraquat- 0.25%, glyphosate-0.36%), on adult mites was studied. Adults were released into clean dry Petri-plates (10cm dia) and subjected to a thin uniform weedicide spraying from a chromatography sprayer and exposed to left strips, sprayed with the respective herbicides, for 6 h in glass vials, closed with muslin cloth. After 6 h, the exposed adults were transferred to fresh vials having unsprayed waterhyacinth leaf-strips. Adults sprayed with tap water and exposed to leaf-strips sprayed with water was kept as control. The treatments were replicated four times with 25 adults per replication. Observations on mortality of adults were made after 72 h. The data were subjected to analysis of variance.

RESULTS AND DISCUSSION

Chlorpyrifos caused significant mortality, when adults were exposed to leaf strips immediately after spraying (Table 1). Exposure of adults to leaf strip after 24 h of treatment caused no mortality, indicating that there was no residual toxicity. Phenthoate was found to cause 8.99% mortality of adults when exposed 24 h after treatment which could be considered relatively non-toxic. None of the larvicides caused significant mortality at 48 h. The low persistence of chlorpyrifos and the less injurious nature of fenitrothion and fenthion observed in the present study are in conformity with the earlier reports of Dabrowski (1970 a, 1970 b) and Cockfield and Potter (1983). The larvicides were found to cause no detrimental effects on the immature stages of *O. terebrantis*. Normal development and adult emergence were observed from all galleries, thus confirming the safety of mosquito larvicides to these stages.

Among the weedicides, only 2,4 D - 0.6% was found to cause 24.63% of adult mortality after 24 h, which was significant over control (Table 2). All the other herbicides were found to be non-toxic to adults. Glyphosate

Table 2. Effect of weedicides on *O. terebrantis*

Treatment	% mortality of adults at		
	24 h	48 h	72 h
2, 4 D - 0.6%	24.63	11.06	7.37
2, 4 D - 0.3%	11.95	7.37	5.31
2, 4 D - 0.15%	7.37	0.00	0.00
Paraquat	11.06	3.69	0.00
Glyphosate	14.31	8.99	7.37
Control	3.68	0.00	0.00
CD at 5%	14.74	11.56	9.31

and 2,4 D were reported to be relatively non-toxic to adults of *O. terebrantis* (Roodra *et al.*, 1978). Though the herbicides were found to be relatively safe to the adults, timing and patterns of application could be detrimental to the mites, as reported by Hilsenhoff (1986) and Marshall and Rutschky (1974) to aquatic insects and invertebrates respectively. Hence, in waterways where integrated management of waterhyacinth by biological control agents and herbicides are to be implemented, it is better to spray localised areas of weed mats (Haag, 1986) and congregate adults to unsprayed areas, whereby the inevitable loss of immobile and immature stages due to herbicide application could be minimised.

This study has demonstrated that none of the mosquito larvicides and herbicides (except 2,4 D - 0.6%) was toxic to *O. terebrantis*, thus recommending their incorporation in any integrated control programmes for management of waterhyacinth.

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