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Larvicidal effectiveness of three slow-release formulations against *Aedes aegypti*, the vector of dangue fever in Jeddah Governorate, Saudi Arabia

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ABSTRACT

The effectiveness of slow-release formulations (SRF) of Altosid XR-briquets, Du-Dim tablets and Bactimos briquets on the larval stages and pupae until adult emergence of *Aedes aegypti* was studies. The records showed that the test SRF provided continuous effective control against the present mosquitoes for several weeks. Excellent control with 90-100% inhibition of adult emergence was achieved for 96, 73 and 35 days posttreatment by using Altosid XR-briquets, Du-Dim tablets and Bactimos briquets, respectively. Variations in the duration of effective control among the test formulations may reflect differences in their active ingredients and mode of action.

On the other hand, larval treatments with the present SRF proved to be relatively safe to the nontarget organisms associated with mosquito breeding sites such as Odonata naiads, aquatic bugs and diving beetles.

Key words: *Aedes aegypti*, Slow-Release Formulations, mosquito larvae.

INTRODUCTION

More attention has been recently paid to the use of slow-release formulations (SRF) of insecticides for the control of mosquito larvae in different parts of the world (Saleh *et al*., 2003; Zaharan, 2006; Seng *et al*., 2008). Such formulations are likely to extend the effectiveness of less- persistent mosquito larvicides and to reduce environmental pollution (WHO, 2005).

The present work was planned in part to evaluate the effectiveness of slow-release formuations (SRF) of Altosid XR-briquets, Du-Dim tablets and Bactimos briquets against mosquito larvae of *Aedes aegypti*, the primary vector of dengue fever in Jeddah governorate, Saudi Arabia. The side effect of larval treatments with SRF on some nontarget organisms associated with mosquito breeding sites was also conducted.

MATERIAL AND METHODS

Mosquito strain

Tests were performed on a field strain of *Aedes aegypti* (L.), collected from Jeddah governorate, Saudi Arabia, and had maintained in the laboratory under controlled conditions of 27±1°C and 70±5% R.H., with 14:10 (L:D) photoperiod.

SRF tested

Three slow release formulations (SRF) were used: Altoside XR-briquets (methoprene 2.1%), kindly provided by zoecon, USA; Du-Dim tablets (diflubenzuron 2%), kindly supplied by Chemtura Europe Limited, UK and Bactimos briquets (*Bacillus thuringiensis* H-14, 7000 ITU), kindly provided by Summit Chem. Co., USA.

Test experiments

Experiments were carried out in suitable

glass pools (30× 50× 19 cm) containing 10 liters of tap water. Each pool received 25 second instar larvae of *A. aegypti* and the tested formulations. The amount of each formulation (0.64gm Altosid XR-briquet; 0.07gm Du-Dim tablet; 0.2 gm Bactimos briquet) required for treating mosquito larvae was determined by calculating the total surface of water in the pool as well as accordingly to the recommended dosages for field trials. The larvae were given the usual larval food during these tests. All trials and controls were replicated four times. Water was slowly added to the pools daily to compensate evaporation. Larval mortalities were recorded daily until all larvae either died or pupated. The live pupae were transferred to untreated water in clean glass beakers for emergence. When complete larval mortality occurred, new live larvae were added to the test pools. This procedure was continued sequentially until the effectiveness of each formulation reached a low level (less than 50% inhibition of adult emergence).

Additional tests were also conducted to study the side effects of the above SRF on some nontarget organisms associated with mosquito breeding habitats. These nontarget organisms were Odonata naiads, aquatic hemipterans and diving beetle adults. The test individuals were held in new plastic pots containing 100 ml of water, in which the test formulations had been previously immersed for 10 days. Individual motilities were recorded after 48 hr and compared with control ones.

RESULTS AND DISCUSSION

Results with the tests of SRF of Altoside XR-briquets, Du-Dim tablets and Bactimos briquets on the larval stages and pupae until adult emergence of *A. aegypti* are shown in Tables (1-3). For purpose of this study, effective control was defined as 90-100% inhibition of adult emergence (Saleh *et al*., 1981). The records showed that the test SRF provided effective control against the present mosquitoes for several weeks.

As shown in Table (1), effective control with 90-100 inhibition of adult emergence was achieved for 96 days post-treatment by using SRF of Altosid XR-briquets. In the case of Du-Dim tablets the records indicated that larval treatments began to lose their effectiveness toward *A. aegypti* larvae after 73 days (Table 2). On the other hand, larval treatments with Bactimos briquets showed ineffective control for 7 days and then it began to give continuous excellent control with 90-100% inhibition of adult emergence for 35 days (Table 3).

Table 1: Effectiveness of SRF of Altosid XR-briquets on developmental stages of the mosquito *A. aegypti*

No. of tests	Larval mortality[a] (%)		Pupae produced (%)	Adult emergence		Duration of effectiveness (in days)
	At 24 hr.	At the end of test		Total	Inhibition[c] (%)	
1	0.0	33 (11)[b]	67	0.0	100	96
2	1	54 (10)	46	0.0	100	
3	2	36 (10)	64	2	97.8	
4	0.0	51 (12)	49	0.0	100	
5	3	24 (10)	76	0.0	100	
6	0.0	12 (10)	88	5	94.6	
7	0.0	25 (12)	75	0.0	100	
8	4	21 (10)	79	0.0	100	
9	0.0	32 (11)	68	9	90.2	
10	3	23 (10)	77	31	69	
11	0.0	11 (9)	89	42	55.3	

[a]: Four replicates, 25 larvae each.

[b]: Days post-treatment until complete mortality or pupation.

[c]: Corrected for control mortalities (Abbott, 1925)

Variations in the duration of effective control among the test formulations may reflect differences in their components and mode of action.

Generally, taking the durations of effectiveness into consideration, the records indicated that Altosid XR-briquets (96 days) proved to be highly effective against *A. aegypti* larvae than Du-Dim tablets (73 days) and Bactimos briquets (35 days) by about 1.3 and 2.7 times, respectively. However, studies in this respect were carried out by several investigators using different SRF of

Table 2: Effectiveness of SRF of Du-Dim tablets on developmental stages of the mosquito *A. aegypti*

No. of tests	Larval mortality[a] (%)		Pupae produced (%)	Adult emergence		Duration of effectiveness (in days)
	At 24 hr.	At the end of test		Total	Inhibition[c] (%)	
1	0.0	21 (9)[b]	79	0.0	100	73
2	0.0	33 (8)	67	0.0	100	
3	0.0	19 (9)	81	0.0	100	
4	2	25 (7)	75	0.0	100	
5	0.0	18 (8)	82	0.0	100	
6	0.0	35 (8)	65	3	96.7	
7	1	24 (9)	76	4	97.8	
8	3	16 (8)	84	0.0	100	
9	0.0	18 (7)	82	6	94	
10	2	9 (7)	91	21	76.5	
11	0.0	12 (8)	88	36	60.8	

[a]: Four replicates, 25 larvae each.

[b]: Days post-treatment until complete mortality or pupation.

[c]: Corrected for control mortalities (Abbott, 1925)

Table 3: Effectiveness of SRF of Bactimos briquets on developmental stages of the mosquito *A. aegypti*

No. of tests	Larval mortality[a] (%)		Pupae produced (%)	Adult emergence		Duration of effectiveness (in days)
	At 24 hr.	At the end of test		Total	Inhibition[c] (%)	
1	2	32 (7)[b]	68	64	36	35
2	71	100 (6)	0.0	0.0	100	
3	83	100 (4)	0.0	0.0	100	
4	79	95 (6)	5	4	96	
5	80	100 (3)	0.0	0.0	100	
6	69	100 (5)	0.0	0.0	100	
7	42	93 (6)	7	5	94.5	
8	31	95 (5)	5	2	98	
9	33	67 (6)	33	29	71	
10	16	34 (6)	66	63	32.5	

[a]: Four replicates, 25 larvae each.

[b]: Days post-treatment until complete mortality or pupation.

[c]: Corrected for control mortalities (Abbott, 1925)

insecticides against many species of mosquito vectors (Saleh, 1989 using Bactimos briquets against *A. aegypti*; Cornel *et al*., 2000 using Altosid pellets toward *A. nigromaculis;* Thavara *et al*., 2007 using Dimilin tablets against *A. aegypti*).

On the other hand, it was observed that larval treatments with the test SRF did not exhibit any marked effect on nontarget aquatic organisms prevailing in mosquito breeding sites such as Odonata naiads, aquatic bugs and diving beetles. Similar findings were reported by other authors using different insecticide formulations against a wide spectrum of nontarget aquatic fauna such as Chironomidae, Amphipoda and Odonata (Szalay-Marzso and Gharib, 1982); Hydrophilidae and Mayfly naiads (Mulla and Darwazeh, '988); diving beetles, *Labeo niloticus* fish and tadpoles of *Bufo* spp. (Zahran, 2006).

Finally, the present results suggested that long-term effective control of *A. aegypti* can be achieved economically with a single application of the test formulations in mosquito breeding sites. Such slow-release formuations may be particularly useful for application in any location near the household where water collects and remains for long periods (i.e.: ditches, pond and artificial container).

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