FIELD TRIAL OF *Bacillus thuringiensis var israelensis* PELLET FORMULATION IN THE CONTROL OF MOSQUITOES

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ABSTRACT

In a simulated field trial *Bacillus thuringiensis var israelensis* (BTI) pellet formulation exhibited an enhanced efficacy with increasing dose. A dosage of 1.0 and 1.5 ppm was most effective under simulated field conditions. In field trials persistence of BTI pellet (1.0 ppm) was observed for 35 days in moderately polluted water collection as compared to 21 days in highly polluted water bodies.

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KEY WORDS : *Bacillus thuringiensis*; Malaria; Mosquito control.

Introduction

The biocide, *Bacillus thuringiensis var israelensis* (BTI) has endured many technical modifications and advancements since its discovery, and remains widely applicable, acceptable, specific and efficacious in the control of mosquitoes and other vectors [1]. Absence of persistence in the bio-environment has been its greatest limitation and efforts have been directed towards improvement of its formulations. The development of slow-release formulations has addressed the problem considerably, yet further bio-technological advancements are also being attempted [1,2]. The present study evaluates a slow-release formulation of BTI pellets in the control of mosquitoes under field conditions.

Material and Methods

A BTI pellet formulation of 33 per cent w/w was evaluated in water bodies in and around the Armed Forces Medical College, Pune. The pellets were activated by 15-minute treatment with 3 per cent sodium chloride solution prior to its application. A simulated field trial was conducted before the actual field trial to determine the dosage for field application. The three dosages tested were 0.5, 1.0 and 1.5 ppm. The water samples and the larval population tested (second stage culicines) were collected and tested in drums (80 L capacity) in the laboratory. Three replicates and concurrent controls were considered for estimation of per cent larval reduction and the control mortality was corrected with Abbot's formula when required [3].

During the field trial, 12 selected sites were examined for pretreatment larval density for a fortnight. The larval density was estimated by larval-dip method and 5 dips per site were considered ideal as none of the sites were more than 5 m^2 in area. The water from these trial sites was chemically analyzed and the degree of pollution estimated. The water collections in septic tanks were found to be highly polluted whereas seepage collections from effluent tanks and soak wells were found to be moderately polluted. Hence these two types of water collections were included in the study for evaluating the influence of water pollution on the efficacy and persistence of BTI in the aquatic environment. The sites were grouped into moderately and highly polluted water bodies and three of each were considered for treatment and concurrent control. The sites were treated with 1.0 ppm BTI pellets and the per cent larval reduction estimated. The observations were recorded for seven successive days followed by weekly observations till the population build-up was 50 per cent of the pre-treatment density.

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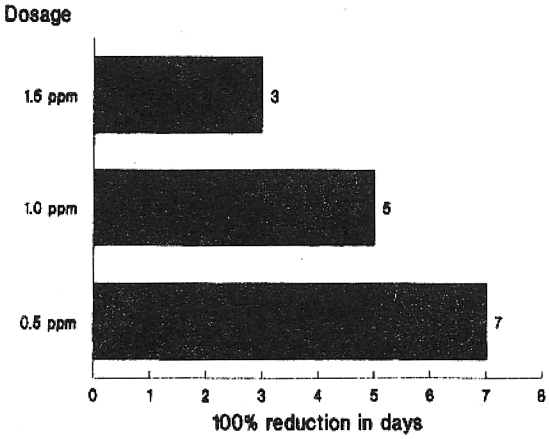

Fig. 1 : Simulated field trial of BTI pellets against Culicine larvae.

Results

The differential dosage efficacy under simulated field conditions with second stage field-collected culicine larvae is presented in Fig 1. A faster response was observed with 1.5 ppm which caused 100 per cent larval mortality within 3 days of treatment, whereas 1.0 ppm produced the same result in 5 days. At a dosage level of 0.5 ppm, BTI pellets produced 100 per cent mortality only after 7 days of treatment. The data from the field study in moderately and highly polluted water collections is graphically presented in Fig 2 and 3. In moderately polluted water 1 ppm BTI pellet maintained a mean larval reduction of 90 per cent for a period of 35 days, whereas, the same degree of reduction was maintained only till 21 days after treatment of highly polluted water collections.

Discussion

Biological control is a safe and effective adjunct in vector control. The mainstays of this control are the promising bacterial agents *B. thuringiensis* and *B. sphaericus*. Their efficacy can be enhanced by changing the nature of their formulation, and today several formulations are vying for attention and trying to establish their supremacy. The efficacy and persistence of slow-release pellet formulation of BTI in the control of mosquitoes has been reported by Aly et al [4] and our findings reinforce theirs.

An evaluation of the dose-related efficacy indicated accelerated mortality of the culicine larvae to higher doses of BTI (1.5 ppm), in comparison to moderate and low doses of 1.0 ppm and 0.5 ppm respectively. Goettel et al [5] have reported comparable findings of proportionate increase in mor-

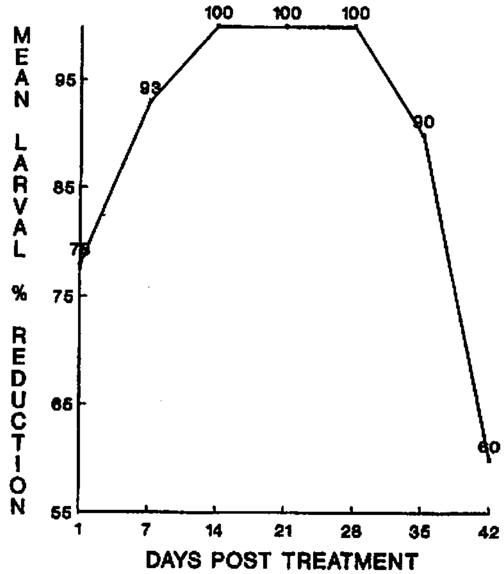

Fig. 2 : Persistence of BTI 1 ppm in moderately polluted water.

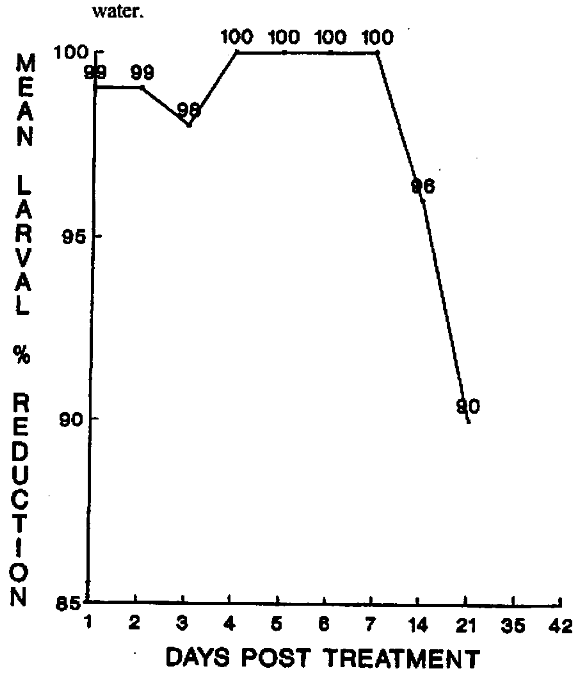

Fig. 3 : Persistence of BTI 1 ppm in highly polluted water.

tality of larvae with increasing doses of BTI in field studies on *Aedes* and *Culex* larvae.

The persistence of pellets for a period of 21 days and 35 days in highly and moderately polluted water bodies respectively is in conformity with the findings of Eldridge et al [6]. A persistence of BTI pellet formulation for over 2 months in less polluted water has been reported by Sulaiman et al [7], however their formulation was found to be less effective in highly polluted water bodies with control lasting for a little over a week only. This differs from the findings of our study.

The integration of biological control methods in disease vector management programmes has become a necessity. Therefore, it is recommended that it should be encouraged and implemented wherever feasible.

REFERENCES

1. Thanabalu T, Hindley J, Brenner S, Oei C, Berry C. Expression of the mosquitocidal toxins of *B. sphaericus* and *Bacillus thuringiensis* sub sp *israelensis* by recombinant *Caulobacter crescentus*, a vehicle for biological control of aquatic insect larvae. Appl Environ Microbiol 1992; 58: 905-10.
2. Murphy RC, Stevens SE Jr. Cloning and expression of the Cry IVD gene of BTI in the *Cyanobacterium agmenellum quadruplicatum* PR-6 and its resulting larvicidal activity. Appl Environ Microbiol 1992; 58: 1650-5.
3. Abbot WS. A method of computing the effectiveness of an insecticide. J Econ Entomol 1925; 18: 265-7.
4. Aly C, Mulla MS, Schnetter W, Zhaoxu BO. Floating bait formulations increase effectiveness of BTI against *Anopheles* larvae. Mosquito News 1987; 3: 583-8.
5. Goettel MS, Toohey MK, Ram RC, Pillai JS. Field evaluation of BTI against *Aedes vigilax* and *Culex sitiens* in Fiji. Mosquito News 1992; 42: 277-8.
6. Eldridge BF, Callicrate J. Efficacy of BTI de Barjac for mosquito control in a western Oregon log pond. Mosquito News 1982; 42: 102-4.
7. Sulaiman S, Jeffrey J, Sohadi AR, Yunus H, Busparani V, Majid R. Evaluation of Bactimos wettable powder, granules and briquettes against mosquito larvae in Malaysia. Acta Trop 1990; 47: 189-95.