



4 VECTOR CONTROL

4.1. Development of a mosquito repellent from *Cymbopogon* spp.

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 Duration : 3 years
 Funding Agency : Intramural, ICMR

Detailed Description

A mosquito repellent, *MosTyag*, has been invented/developed, and submitted for patentship through ICMR, as suggested by the 16th SAC.

Therefore, only a brief account of results are offered here. Repellent effect of *MosTyag* and some other formulations have been carried out in laboratory, simulated field conditions and field, against vector species such as *Aedes aegypti*, *Ae. albopictus*, *Armigeres subalbatus* and *Culex quinquefasciatus*, and an appreciable protection was obtained up to nearly four hours.

Besides, *MosTyag*, other effective formulation(s) are being formulated with complete chemical and toxicological spectrum, in collaboration of DRDE, Gwalior and a new research project has been proposed in this context by approval of 16th SAC of the Centre.

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4.2. Laboratory evaluation of a flowable formulation (VCRC – PFFC) against immatures of *Aedes aegypti* and *Culex quinquefasciatus*.

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An emulsifiable concentrate (EC) formulation developed from the metabolites of *Pseudomonas fluorescens* was screened against *Ae. aegypti* and *Cx. quinquefasciatus* for its larvicidal and pupicidal activity. Lethal concentrations for 50 and 90 percent mortality levels confirmed the larvicidal and pupicidal action of this microbial formulation against the two vector species. The dosage requirement for pupal mortality of *Ae. aegypti* was ten times less than required for larval mortality. Whereas in *Cx. quinquefasciatus*, the dosage requirement for pupal mortality was three times more than required for larval mortality.



Background

Fluorescent pseudomonads are ubiquitous bacteria of the genus *Pseudomonas*. Some species of *Pseudomonas*, including *Pseudomonas fluorescens* are used for the control of soil-borne or foliar pathogens. Exotoxins of fluorescent pseudomonads are known to be toxic to insects. Recently, a natural strain of *P. fluorescens* was isolated from a soil sample and a mosquitocidal emulsifiable concentrate formulation (VCRC – PFFC) was developed from the metabolite(s) of it by Vector Control Research Centre, Pondicherry. The formulation was tested against the larvae and pupae of 3 species of vector mosquitoes, *Anopheles stephensi*, *Culex quinquefasciatus* and *Aedes aegypti* and found to be active against them. In the subsequent field evaluation, it was found to be effective in bringing down the pupal density of *Cx. quinquefasciatus* by 80% and the effect of a single application lasted for about 12 days. However, more field trials under different geo-climatic locations involving different Centres by following a common protocol was planned to be ascertain the mosquitocidal potential of VCRC – PFFC formulation. The Centre for Research in Medical Entomology, Madurai was identified as one such Centre and as part of the multi-centric evaluation, the laboratory evaluation results of *Ae. aegypti*, the vector of dengue and *Cx. quinquefasciatus*, the vector of bancroftian filariasis are reported in this report.

Laboratory bioassay

Laboratory bioassays, following standard methods of WHO for testing of larval susceptibility, were conducted to determine the efficacy of the flowable formulation (VCRC-PFFC) of the metabolite of *P. fluorescens* against immatures of *Ae. aegypti* and *Cx. quinquefasciatus*. One-tenth dilution (v/v) of the formulation was prepared in distilled water and then homogenized by using a shaker. From this homogenate, desired test dosages were added in disposable wax paper cups containing 200 ml distilled water. The laboratory reared strains of *Ae. aegypti* and *Cx. quinquefasciatus* were used and twenty five late third instar larvae or pupae of each species were introduced in each cup and mortality was scored at 24 hours after treatment. Bioassays in each test concentration were replicated and repeated thrice with appropriate untreated controls.

Results from 3 independent replicates were pooled and subjected to dosage mortality probit analysis and lethal concentrations (LC) for 50 and 90 percent mortality levels and 95% Confidence Intervals of LC_{50} and LC_{90} values obtained for each species are tabulated below (Table 4.2.1).



Table 4.2.1. Larvicidal and pupicidal efficacy of flowable formulation of *P. fluorescens*

Species	Immature stage	LC ₅₀	Fiducial Limits with 95% Confidence Intervals		LC ₉₀	Fiducial Limits with 95% Confidence Intervals	
		(µg/ml)	Upper	Lower	(µg/ml)	Upper	Lower
<i>Ae. aegypti</i>	Larvae	0.417	0.464	0.375	0.992	1.155	0.851
	Pupae	0.043	0.047	0.039	0.086	0.097	0.076
<i>Cx. quinquefasciatus</i>	Larvae	0.107	0.123	0.009	0.383	0.471	0.314
	Pupae	0.366	0.447	0.300	0.867	1.237	0.607

From this study it is evident that both the vector species, *Ae. aegypti* and *Cx. quinquefasciatus*, are sensitive to *P. fluorescens* and its larvicidal and pupicidal action against them is also confirmed. A comparison of the median lethal concentration (LC₅₀) values of the bioassay results showed that the larvae of *Cx. quinquefasciatus* are about 3 times more sensitive to the formulation than the larvae of *Ae. aegypti* (0.107 vs. 0.417 µg/ml). Contrarily, the pupae of *Cx. quinquefasciatus* are about 8 times less sensitive (0.366 vs. 0.043 µg/ml) than the pupae of *Ae. aegypti*. The formulation showed a high degree of activity against the pupae of *Ae. aegypti* as the dosage requirement for pupal mortality is 10 times less than that required for larval mortality (0.043 vs. 0.417 µg/ml). Whereas, the dosage requirement for pupal mortality in *Cx. quinquefasciatus* is 3 times more than that required for larval mortality (0.366 vs. 0.107 µg/ml). Further experiments are in progress to evaluate the efficacy of the formulation against other vector mosquito species.