ENTOMOLOGY

Synergistic effect of certain insecticides combined with *Bacillus thuringiensis* on mosquito larvae

C.P. Narkhede,[1] C.D. Patil,[1] R.K. Suryawanshi,[1] S.H. Koli,[1] B.V. Mohite,[1] S.V. Patil[1,2]

[1]School of Life Sciences, and [2]North Maharashtra Microbial Culture Collection Centre, North Maharashtra University, Maharashtra, India

Abstract

For effective vector control it is essential to formulate new preparations having multiple action against the vector pest. Developing combined formulation of biopesticide and chemical pesticide is one of the novel concept to fight against the vectors with new weapons; however, compatibility of biopesticide *i.e. Bacillus thuringiensis* (Bt) and chemical pesticide is a real hurdle. In this investigation, local isolate *Bacillus thuringiensis* SV2 (BtSV2) was tested for its compatibility with various available mosquito larvicides. Temephos was most compatible with BtSV2 than with other tested pesticides. These two compatible agents were tested for larvicidal potential. Our study revealed that the synergistic effect of both agents reduces LC_{50} value by 30.68 and 22.36% against the *Ae. aegypti* and *An. stephensi,* respectively. The larvicidal potential increased when compared to individual pesticides. It was also observed a biochemical change in larvae after the TBT (Temephos + Bacillus thuringiensis) combination treatment; it involves decreased level of alpha esterase, acetylcholine esterase and protein while level of beta esterase and acid phosphatase was unchanged and alkaline phosphatase activity was increased. Increased potential of combined formulation may be due to altered physiological condition.

Correspondence: Satish V. Patil, School of Life Sciences, North Maharashtra University, Post Box 80, Jalgaon 425001, Maharashtra, India
E-mail: satish.patil7@gmail.com

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Introduction

Vector-borne diseases affect two third of the world population as reported to kill millions of people every year; these diseases are directly associated with economic growth and costs limit of several undeveloped and developing countries.

Mosquitoes are still being the most important vectors spreading life-threatening human diseases. It is well documented that the synthetic insecticides dramatically reduce the risk of vector born diseases. However, the indiscriminate use of chemical pesticides like organophosphates and pyrethroids has led to the development of resistance in mosquito populations (McGaughey, 1985; Huang & Ottea, 2004).

Similarly, the eco-friendly and safe bioinsecticide *Bacillus thuringiensis* is being used worldwide as an effective mosquito control agent. The intensive use of *Bacillus thuringiensis* has led to the development of resistance in natural mosquito population (Boyer *et al*., 2012). However, some reports suggest a cross development against Bt, due to the increase in detoxifying activity of enzyme in xenobiotic reaction, decreasing activity of mid gut protease and a modification of specific receptor of mid gut (Jurat-Fuentes *et al*., 2004; Boyer *et al.,* 2007; Saengwiman *et al.,* 2011).

Despite that, majority of health and agriculture pest, which were brought under control by various pesticides, are now on rebound. The major vector pests-mosquitoes are well known for transferring dengue and malaria and are becoming resistant to most of the available pesticides.

To fight against the resistance problem, various methods were advocated like the use of different pesticides especially in combination with different chemical class/family that has a different mode of actions against the pest. This strategy definitely leads to prevent or to delay the development of resistance against pesticides.