

Potential of *Bacillus thuringiensis* by using some natural products: Novel preparations against dengue vector *Aedes aegypti* larvae

Chandrakant P Narkhede¹, Sunil H Koli¹, Rahul K Suryawanshi¹, Chandrashekhar D Patil¹,
Hemant P Borase¹, Satish V Patil^{1,2*}

¹School of Life Sciences, ²North Maharashtra Microbial Culture Collection Centre (NMCC), North Maharashtra University,
Post Box 80, Jalgaon 425001, Maharashtra, India

Received 15 June 2016; Revised 06 August 2016

Dengue fever is the fastest emerging arboviral infection causing millions of deaths all over the world. The eradication of vector *Aedes aegypti*, is an effective method of dengue control. Although various vector control agents like chemical pesticides are available, *Bacillus thuringiensis* (Bt) is of major choice as a biocontrol agent due to its ecofriendly nature. In the present investigation, curcumin, plumbagin, camphor, rutin, quercetin, karanjin, and pongamal were used as Bt SV2 potentiating agents. It was observed that curcumin and rutin had very high LC₅₀ values for fourth instar larvae of *Ae. aegypti* that indicates lower activity. Karanjin caused significantly high mortality at comparatively low dose (LC₅₀ - 44.59 ppm). At the same time pongamal, plumbagin, and camphor caused significant mortality at low doses of LC₅₀ 61.18, 59.23, and 71.59 ppm, respectively.

Keywords: *Aedes aegypti*, Bti, Camphor, Combination, Natural product, Plumbagin, Potentiation.

IPC code; Int. cl. (2015.01)– A01N 25/00, A61K 36/00

Introduction

Dengue fever is the fastest emerging arboviral infection spread by major insect vector *Aedes aegypti*, which leads to major public health consequences in over 100 tropical and sub-tropical countries in South-East Asia, Western Pacific as well as South and Central America¹. As per WHO report, worldwide 2.5 billion people live under the threat of dengue fever including dengue hemorrhagic fever (DHF) or dengue shock syndrome (DSS). It was estimated that out of 50 million cases of dengue fever, half a million people suffering from hemorrhagic fever require hospitalization each year and about 2.5 % of dengue infected population die¹.

Due to lack of specific drugs or vaccines for prevention and treatment of dengue infection, eradication of insect vector namely *Ae. aegypti*, may be considered as the prime method to control dengue infection. Besides the chemical pesticides, current use of biocontrol agents *Bacillus thuringiensis* (Bt) and *Bacillus sphaericus* (Bs), are reported to be effective larvicide. They do not affect the non-target organisms and have eco friendly nature. Bt has been found to

show very low mammalian toxicity and therefore, been recommended for household use to control mosquitoes^{2,3}. Dengue vector control programs majorly advocates the use of larvicide rather than the space spraying because of its drawbacks like need of specific operations, photo inactivation possibility, and its economical feasibility. Spraying of larvicides also has limited success due to public unacceptability and variable degree of compliance by the communities¹. Besides these challenges, insecticide resistance to Bt is one of the major threats to the effectiveness of vector control programs.

To achieve sustainability in dengue vector control programme, it is essential to focus on the development of new multi target formulations for the reduction of larval population. In the present investigation, potentiation of Bt SV2 with some natural products is proposed. These natural products include i) Rutin (3,3',4',5,7-pentahydroxyflavone-3-rhamnoglucoside), ii) Quercetin (2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxy-4H-chromen-4-one), iii) Curcumin, iv) Plumbagin, v) Camphor, vi) Pongamol, and vii) Karanjin (Fig. 1). Rutin and quercetin categorized as flavonoids are reported for their pharmacological properties like antioxidative, antimicrobial, antifungal, and anti allergic⁴. Rutin has potent

*Correspondent author
Email: satish.patil7@gmail.com