Screening of the weed plant species, *Croton bonplandianum* Baill. for larvicidal activity of *Aedes aegypti.*

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ABSTRACT

In tropical countries, mosquitoes are the major problem for the health care of human being. Hence to control them in recent years number of plant products are being used. This is because of the pollution free nature of plant derivatives which do not produce any health hazard. Biologically active plant extracts have been well documented for evolving an ecologically sound and environmentally acceptable mosquito control programmes. In the present study, the level of larvicidal activity of methanolic leaf extract of the exotic plant species, *Croton bonplandianum* at different concentrations *viz.,* 25, 50, 100, 150 and 200 ppm has been investigated and it is known that the LC_{50} value obtained at 124 ppm is effective against the mosquito, *Aedes aegypti* with respect to larvicidal activity. The study revealed that the leaf extracts of *C. bonplandianum* at 124 ppm is better for mosquito control.

Keywords: *Aedes aegypti*, *Croton bonplandianum*, mosquito larvicidal activity

INTRODUCTION

Emergence of resistance among mosquitoes is a recent problem. Safe and ecofriendly agents from biological origins are the need of the hour. Mosquitoes are well known group of insects, which transmit many dreadful diseases causing serious health problems to human beings. Controlling of these vectors is being achieved for a long time, by using synthetic chemicals. But the chemicals may cause pollution problem and help to develop resistance in mosquito species (Das and Rajagopalan, 1981; Thangam and Kathiresan, 1990).

Aedes aegypti has been recorded round the year in different parts of the country. Biologically active plant extracts have been well documented for evolving an ecologically sound and environmentally acceptable mosquito control programme. A number of such plant products have been used for insect control for the time immemorial. About 2000 species of terrestrial plants have been reported for their insecticidal properties (Feinstein, 1952). More than 400 terrestrial plants have been screened for their mosquito larvicidal activity as per the records. The plant products like azadirachtin, pyrethrins, nicotines, rotenones are being used for pest control. Various studies showed the activity of plant extracts against different species of mosquitoes including *A. aegypti* (Gusmão *et al*., 2002). The exotic weed, *C. bonplandianum* (Euphorbiaceae) generally distributed in the wastelands of tropical and subtropical regions of Southern India is reported to have many medicinal uses including the repellent property against the insects (Nishanta *et al.,* 2002; Chaudhuri, 2007; Bhakat and Sen, 2008; Krebs and Ramiarantsoa, 1997; Maria *et al*., 2008). However, no studies are conducted so far about the repellent property of this species against the mosquito, *A. aegypti*. Hence, the present study was aimed to determine the larvicidal effect of methanolic extracts of *C.bonplandianum* leaves against fourth instar larvae of *A. aegypti*.

MATERIALS AND METHODS

Plant collection

C.bonplandianum plant materials were collected from Maruthamalai, Coimbatore District, Tamilnadu. Leaves were air dried in a shady place for 10 days to retain their active ingredients intact. Dried materials were powdered by using an electric blander. Powdered plant material (500g) was soaked in methanol in airtight wide mouth bottle and kept for 7 days. After that, the cold extracts from the bottle along with methanol were filtered and kept in Petri dishes for drying at room temperature (Kongkathip, 1994). Dried extracts were used for larvicidal activity of *A. aegypti*.

Collection of test animals

The eggs of *A. aegypti* were collected from National Institute of Communicable Disease Centre, Coimbatore. The larvae was cultured and maintained in the laboratory at 27 ± 1^0C and 85% relative humidity. Larval forms were

Table 1. Percentage of mortality using methanolic leaf extract of *Croton bonplandianum* against fourth instar larvae of the mosquito *A. aegypti*.

Concentrations (ppm)	No. of fourth instar larvae exposed	No. of mortality	Percentage of mortality	LC 50(ppm)	LC 90(ppm)	Y = a + bx
Control	89	0	0			
25	88	12	13.6			
50	90	38	42.2			
100	84	55	65.5	123.8	364.0	2.73x-.072
150	83	73	88.0			
200	88	85	96.6			

maintained in tray by providing dog biscuit and yeast powder in the ratio of 3:1. Adult mosquitoes were maintained in a net cage (90X90X90 cm) and were continuously supplied with 10 per cent sucrose solution with a cotton wick. For continuous culture selected number of mosquitoes were allowed to feed chicken blood every third day, there after moist filter paper was kept in beaker inside the cage for mosquitoes to lay their eggs. Eggs laid on the filter paper were immersed in larval basins containing water for the maintenance of the colony.

Bioassay

Test solutions were prepared with methanolic extracts at different concentrations ranging from 25 to 200ppm by diluting the stock solution using ethanol. Early fourth instar larvae of the species, *A.aegypti* were used for the study with control solution, with four replication for each concentration (WHO, 1970). The evaluation of mortality rate was performed 24 hours after the beginning of the experiment, verifying the number of dead larvae. The larvae were considered dead when they did not respond to stimulus with a Pasteur pipette. The environmental temperature and humidity were observed during the experiment, with variation between 27°C and 30°C. The control mortality was corrected by Abbott's formula (1925). Lc 50 and Lc 90 regressions and 95% confidence limit were calculated by using probit analysis (Finney, 1971).

RESULTS AND DISCUSSION

The results of the larval susceptibility of *A.aegypti* using methanolic leaf extracts of *C. bonplandianum* are presented in Table 1. The results of the study revealed that the methanolic leaf extract of plant material was effective against larvae of mosquito. Furthermore, the effect of larval mortality was depended on the concentration of leaf extract. The Lc 50 and Lc 90 of fourth instar of *A. aegypti* were determined to be 123.8ppm and 364.0ppm respectively. So leaf extracts of this plant at 124 ppm is suggested for better vector control. The larvicidal property of the leaf extract of the study species, *C. bonplandianum* may be due to the presence of phorbol derivatives, the secondary metabolites of diterpenoids category (Chandel *et al.*, 2005). Maria *et al.*(2006) reported that the essential oils present in four species of a genus, *Croton* are responsible for their larvicidal activity against the mosquito, *A. aegypti*. Nazer *et al.* (2009) reported that the stem extracts of *C. bonplandianum* was active and significantly lethal against the mosquito, *Culex quinquefasciatus* and he explained that the alkaloids present in the species has toxic effect on mosquito larvae. All these reports emphasized that the members of the genus, *Croton* are generally having lethal effects against various mosquitoes.

Early studies showed that the essential oils are readily biodegradable and less detrimental to non-target organisms as compared to synthetic pesticides (Baysal, 1997; Dubey *et al*, 2008). Plants are rich sources of bioactive organic chemicals and offer an advantage over synthetic pesticides as these are less toxic, less prone to development of resistance and easily biodegradable. It is known that most of the active compounds of essential oils are specific to particular insect group and not to mammals (Isman, 2000). It is evident from the present study that herbal extracts from *C. bonplandianum* might have promising larvicidal efficacy. Screening, purification and identification of effective compounds available in this species will certainly bring more success towards the control of mosquitoes. Hence the large biomass of the weed, *C. bonplandianum* available in the wastelands of southern India can be used as a bioresource to commercially produce mosquito (*A.aegypti*) repellent.

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