Larvicidal activity of plant extracts against *Culex quinque- fasciatus* say

S. Binu Kumari

ABSTRACT

Petroleum ether extract (1000, 500, 250, 125 ppm) of *Toddalia asiatica* L., *Aegle mermelos* Corr., *Murraya koengili* Spreng., leaves and seed extracts of *Alocasia indica* Schott., were tested for their larvicidal activity on fourth instar larvae of *Culex quinquefasciatus* Say results showed that tested plant extracts possessed insecticidal activity. The synergetic effect of mixture of methanol extracts of *T. asiatica* seeds and the leaves of *A. indica* (1:1) at 10.265 ppm concentration showed larval mortality, pupal mortality, half ecdysed organisms, larval-pupal intermediates and colour changes during fourth instar stage. It is suggested that all the plants possess larvicidal properties that could be developed and used as natural insecticides for mosquito control.

Key Words: *Culex quinquefasciatus*, LC_{50}, LC_{90}, Botanicals

INTRODUCTION

Plants are rich sources of bioactive compounds and some of them are alternative sources for mosquito control. Much effort has been focused on plants having such property to develop potential chemicals that serve as commercial mosquito control agents (Wink, 1993) because of the development of resistance among mosquitoes to chemical pesticides. Plant extracts are capable of producing multiple effects in insects such as antifeedancy, growth regulation, fecundity suppression, sterilization, ovipositional changes, repellency or attractancy and change in the biological fitness. Change in biological fitness include reduced life span, loss of flying ability, low absorption of nutrients, high mortality, imunodepression, enzyme inhibition and disruption of biological synthesis (Samidurai *et al.*, 2009). The harmful effects of chemical pesticides upon the environment have also caused concern among scientists to search for ecofriendly alternative for pest management. Several plants have been already screened for larvicidal property (Karmegam *et al.*, 1997 and Anuradha *et al.*, 1999) against *Culex quinquefasciatus*. Say Mosquitoes constitute a major public health menace, serves as a vector for transmitting diseases to humans. Control of such mosquito-borne diseases is becoming more and more difficult because of increasing resistance to pesticides, lack of effective vaccines and drugs against disease causing mosquitoes. Hence, an atternative approach for mosquito control is the use of extracts of plant origin (Goplesh Khanna *et al.*, 2007). Search for natural insecticides, which do not have any ill effects on the non-target population and are easily degradable remains to be one of the top priority issues for the tropical countries (Rodwane *et al.*, 2005). In the present study an attempt has been made to find out the larvicidal property of certain locally available plant species from Rutaceae and Araceae family for the control of *C. quinquefasciatus* larvae.

MATERIALS AND METHODS

Fresh leaves of *Toddalia asiatica*, *Aegle marmelos*, *Murraya koengili* and the seeds of *Alocasia indica* and *T. asiatica* were collected, thoroughly washed, shade dried at room temperature and powdered using domestic blender. The powder was separately subjected to petroleum ether extraction in Soxhlet apparatus for 24 hours. The crude extracts were separated concentrated using rotatory evaporator and stored in glass ampules for experimental use. Petroleum ether was used as dissolving agent to dissolve the crude extract before mixing them with distilled water for the preparation of test solutions. From this one gm of the extract was dissolved on 1 ml of distilled water and kept as a stock solution. From this concentration further dilutions were made as 1000, 500, 250, 125 and 10.265 ppm for all the five plants selected. Plant extracts and twenty early fourth instar larvae of *Culex quinquefasciatus* cultured in the laboratory were subject to 24 hour bioassay study in the test solutions. Five replicates for each concentration were maintained. In another experiment, the seed powder of *T. asiatica* and the leaf powder of *A. indica* were subjected to further extraction with methanol and extracts were mixed in 1 : 1

Table 1. Impact of botanicals (in ppm) on the larval mortality (in %) of *Culex quinquefasciatus*

Plant tested	Botanicals (in ppm)						LC_{50}	LC_{90}	Regression equation	Chi-Square
	1000	500	250	125	10.625	Control				
Aegle marmelos (Leaf)	100	90	75	55	-	0	82.68	146.92	Y = 1.52 + 2.55 X	13.82
Alocasia indica (Leaf)	100	100	100	100	-	0	64.04	155.56	Y = 0.93 + 2.24 X	1.10
Murraya koengii (Leaf)	100	85	45	25	-	0	89.50	350.40	Y = 2.33 + 3.64 X	1.29
Toddalia asiatica (Leaf)	100	100	40	25	-	0	132.06	483.50	Y = 1.85 + 2.58 X	10.51
Toddalia asiatica (Seed)	100	100	100	100	-	0	80.37	240.60	Y = 0.32 + 1.48 X	12.46

ratio and bioassay study was carried out for 100 first instar larvae at 10.265 ppm concentration in this mixture for 8 days to observe the synergistic effect (Carbel *et al.*, 2003) on the mortality of the larvae and pupae, the formation of the larval pupal intermediates, ecdysis and adult emergence. The corrected per cent mortality was calculated by applying Abbott's formula (Abbott, 1925). The data were subjected to probit analysis (Finney, 1971).

RESULTS AND DISCUSSION

The efficacy of petroleum ether extracts of four botanicals against the four instar larvae of *Culex quinquefasciatus* reveals that high percentage of larval mortality was observed at various concentrations of *T. asiatica* and *A. indica* followed by *T. asiatica* leaf extract, *A. marmelos* and *M. koengii* (Table 1).

The LC_{50} and LC_{90} values related parameters (Finney, 1971) presented in the table 1 shows that LC_{50} value was low for *A. indica* followed by *T. asiatica, A. marmelos, M. koengii* and *T. asiatica*. Hence the seeds of *T. asiatica* and the leaves of *A. indica* were selected for further studies. Based on the LC_{50} value, the leaf of *A. indica* and seed of *T. asiatica* were synergistic effect of methanol extracts on the metamorphosis and development of *C. quinquefasciatus*.

The larval mortality was high on the first day and the mortality of the larvae continued upto the 7^{th} day. Of the 36 per cent of the larvae which turned to pupae, 9 per cent died and 5 per cent showed half ecdysis. Only 10.4 $\pm$ 0.89 per cent of the organisms developed in to adults. The total mortality was 90 per cent in the 10.265 ppm concentration of the mixture of seed extract of *T. asiatica* and leaf extract of *A. indica* (1:1). Furthermore, combination of plant extracts caused larval mortality (45.2 $\pm$ 0.83%), larval - pupal intermediate (4.6 $\pm$ 0.58%) and only 25.44 $\pm$ 0.89 per cent larva attained into pupa and 14.4 $\pm$ 094 % of pupae were died. The larvae also suggested wagging movement, indicating the impact of the test solution on the nervous system. The formation of abnormalities and the half ecdysed organisms indicate hormonal imbalance. The larvae also turned from dark colour to pale white as observed by Sakthivadivel and Daniel (2003) and Saxena and Saxena (1992).

Results of the experiments envisaged larvicidal property in both leaf and seed extracts of various plant species. As the plants are distributed throughout the country and available most of the time, the larvicidal properties of these plant species can be well utilized while planning alternate vector control strategies, based on integrated vector control measures through community based approaches. The plants are easily available to the local people and multiple medicinal properties, it may be easily acceptable to them, since during application it would neither cause any toxic effect nor any additional economic burden. The study suggests that the active ingredients of the extract responsible for causing mortality in mosquito larvae should be identified and utilized, if possible the seeds of *T. asiatica* and the leaves of *A. indica* formulate a plant pesticide for the control of the larvae of *Culex quinquefasciatus*.

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S. Binu Kumari
Department of Zoology, Kongunadu Arts and Science College, Coimbatore – 641 029, Tamil Nadu, India, Phone: 97947 21285, E-mail: binukumari@rediffmail.com

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