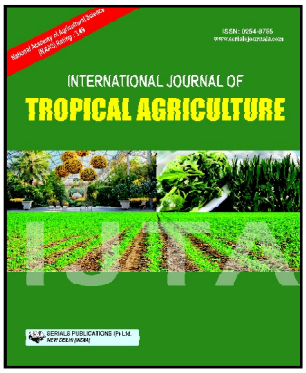

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Effect of Solvent Extracts of Pesticidal Plants for their Toxicity Against *Aedes aegypti* (L.)

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Abstract: Six plant's (*Tridaxprocumbens* Linn., *Jatropacurcas* L., *Annona squamosa* L., *Solanum xanthocarpum* Schrad & Wendl., *Citrus limon* (L.) Burm. and *Menthaarvensis* L.) were evaluated for their toxicity against *Aedes aegyptii* (L.) at different concentrations under laboratory conditions during 2013. The investigations resulted that *S. xanthocarpum* acetone extract exhibited higher level of larval mortality which registered the lower LC_{50} value (227.28 ppm) within the 148.95-346.80ppm (UCL and UCL) with the regression equation (Y = 2.2159x - 0.2206& R^2=0.9357) followed by *A. squamosa* and*J. curcas* with 350.18 and 445.12 ppm respectively. The minimum effect was registered by *T. procumbens* with the LC_{50} value of 905.81 ppm.

Key words: Acetone solvent extracts – Larvicidal action – Botanical plants – LC_{50} – *Aedes aegypti*

INTRODUCTION

Mosquitoes are ubiquitous and reported to transmit diseases like malaria, dengue, chickunguniya, filariasis etc. throughout Indian sub-continent (rural and urban). The large scale usage of pesticides in an indiscriminate manner over decades radically yielded numerous harmful effects on human health and also caused other problems viz., environmental degradation and pollution, development of insecticide resistant mosquitoes, residues in soil, plants, food grains and even traces of them in mother's milk and higher rate of biological magnification through ecosystem (Brown, 1986; Russell *et al.*, 2009).

Many plants with potential action against insects have co-evolved with insects and armed themselves with various secondary metabolites for protection against the harmful organisms (Arivoli*et al.,* 2012).

Several secondary metabolites *viz*., terpenoids, alkaloids and phenolics in plants are responsible for the repellency, antifeedancy, oviposition deterrency, growth inhibition,moulting and anti-moulting effect and juvenile hormone mimicson insect pests of crops (Champagne *et al*., 1986). Based on these observations, this study aimed at exploring the potential of six pesticidal plants was carried out against the larvae of *Aedes aegypti*.

MATERIALS AND METHODS

Preparation of plant extracts

Six plants *viz*., *T. procumbens*, *J. curcas*, *A. squamosa*, *S. xanthocarpum*, *Ci.limon* and H. *arvensis* L.) collected from different locations of study area were used in the experiment. The acetone solvent extract of these six plants was prepared following Nath *et al.* (2006) method. Collected plant parts materials were dried under shade to hold their active ingredient inside. Dried plant materials were powdered using electrical blender and 100g was soaked in 500 ml of acetone in a wide mouth conical flaskand was closed airtight by non-absorbent cotton covered with aluminium foil to avoid evaporation of solvents. The solvent extracts were kept under incubation for three days and were shakedthrice a day in the morning, afternoon and evening. The suspensions were filtered through Whatman filter paper No. 4 (Shivakumar*et al.,* 2013) and the filtered suspension was poured into open Petri dishes to allow the solvent evaporate at room temperature. After 2-3 days,solvents in the suspension completely evaporated and residues obtained from Petri dishes as plant crude extract was used for bioassay studies.

Preparation of stock solution

The standard stock solutions were prepared at 1.0 per cent by dissolving the residues (1.0 g) in 100 mldistilled water. Different concentrations (200, 400, 600, 800 and 1000ppm) were prepared for larvicidal experiments.

Bioassay for testing the solvent extract against mosquito larva

Larvicidal activity of selected plant's acetone solvent extracts against the *Aedes aegypti* was assessed by using the standard method (WHO, 1992) with slight modification. Ten numbers of late third instars larvae of *mosquitoes* were separately taken on a strainer with fine brush and transferred gently into 250 ml capacity of disposable plastic cup containing 100 ml of water to treat in various concentrations of respective plant extracts from 1% stock solution. Stock solutions of the extracts were mixed with Tween 80 (Polyoxyethylenesorbitan monooleate) to enable the dissolution of the material in water. The control experiments (1 ml distilled water and 1ml of Tween 80 in 100 ml of water) were also run parallel with each replicate. The larvae were provided with the treated and untreated food (control) during the experiments. The bioassay experiments were conducted at room temperature of 27±3^{0}C. Each test was replicated four times and the larval mortality was recorded after 24 hours of treatment. The corrected per cent larval mortality was calculated using Abbott's formula (Abbott, 1925). The LC_{50} and LC_{90} values were estimated based on the probit analysis (Finney, 1952).

RESULTS AND DISCUSSIONS

The acetone solvent extract of all the pesticidal plants at different concentrations (200 to 1000 ppm) influenced 2.50 to 100.00 per cent mortality of *A. aegyptii* larva. The maximum mortality was exerted by 1000 ppm of all the plant extracts (*T. procumbens, J.curcas, A. squamosa, S. xanthocarpum., Ci. limon* and *M. arvensis*) with 55.00, 90.00, 100, 100, 60.00, and 77.50 per cent mortality respectively. Among the tested plants, *A. squamosa* and *S. xanthocarpum* pronounced the maximum larval mortality (100 per

Table 1
Larvicidal action of acetone extract of botanical plants on *A. aegypti*

Acetone Solvent extract of	*Conc. (ppm)*	*% mortality ± SD*	*Acetone Solvent extract of*	*Conc. (ppm)*	*% mortality ± SD*
Tridax procumbens	200	2.5 ± 5.00	***Solanum xanthocarpum***	200	47.5± 5.00
	400	5.0 ± 5.77		400	65.0± 5.77
	600	30.0 ± 8.16		600	85.0± 5.77
	800	50.0 ± 8.16		800	100.0 ± 0.00
	1000	55.0 ± 12.91		1000	100.0 ± 0.00
	Control	0.0 ± 0.00		Control	0.0± 0.00
Jatropa curcas	200	25.0 ± 5.77	***Citrus limon***	200	20.0 ± 0.00
	400	35.0 ± 5.77		400	35.0 ± 5.77
	600	45.0 ± 5.77		600	37.5 ± 5.00
	800	80.0 ± 8.16		800	57.5 ± 5.00
	1000	90.0 ± 8.16		1000	60.0 ± 8.16
	Control	0.0 ± 0.00		Control	0.0 ± 0.00
Annona squamosa	200	25.0 ± 5.77	***Mentha arvensis***	200	17.5 ± 5.00
	400	52.5 ± 5.00		400	27.5 ± 5.00
	600	77.5 ± 5.00		600	35.0 ± 5.77
	800	100.0 ± 0.00		800	52.5 ± 5.00
	1000	100.0 ± 0.00		1000	77.5 ± 5.00
	Control	0.0 ± 0.00		Control	0.0 ± 0.00

Values are mean of four replicates: *Significant at P<0.05 ; SD=Standard deviation;

Table 2
Median lethal activity of different acetone solvent extracts of botanical plants against larvae of *A. aegypti*

Acetone solvent extract of	*LC_{50} (LCL-UCL) (95 % CL)*	*LC_{90} (LCL-UCL) (95 % CL)*	*X^2*	*Regression Equation*	*R^2*
Tridax procumbens	905.81 (681.11-1204.64)	2287.55 (1720.09-3042.23)	0.564*	Y = 3.3059x + 4.7824	0.9168
Jatropa curcas	445.12 (323.96-611.58)	1361.45 (990.89-1870.59)	0.458*	Y = 2.7456x - 2.272	0.8221
Annona squamosa	350.18 (256.51-478.06)	957.60 (701.44-1307.29)	0.611*	Y = 2.9379x –2.4744	0.9827
Solanum xanthocarpum	227.28 (148.95-346.80)	866.89 (568.13-1322.77)	0.680*	Y = 2.2159x - 0.2206	0.9357
Citrus limon	717.91 (425.22-1212.06)	4646.76 (2752.30-7845.22)	0.945*	Y = 1.5807x + 0.4849	0.9342
Mentha arvensis	662.72 (448.50-979.49)	2688.70 (1819.19-3973-82)	0.644*	Y = 2.1635x - 1.0978	0.8330

cent) followed *J. curcas* with 90.00 per cent mortality at the 500ppm concentration. The lowest larval mortality was exerted by *T. procumbens*with 55.00 per cent mortality @ 500ppm concentration wherein no mortality was recorded in control treatment in all the six experiments (Table 1). The calculated toxicity values expressed as LC50 values which did not follow the same pattern of larvicidal action wherein *S. xanthocarpum*acetone extract registered the minimum value (227.28ppm) followed by *A.squamosa* (350.18), *J. curcas* (445.12), *M. arvensis* (662.72ppm), *Ci. limon* (717.91) and *T. procumbens* (905.81ppm) and their corresponding regression equations were also mentioned in Table 2. The results obtained in this study was in accordance with the following reports by different researchers. Larvicidal, ovicidal properties of certainplant extracts against the mosquitoes *viz*.,*An. stephensi, Ae. aegypti* and *Cu. quinquefasciatus* was studies by Govindarajan *et al.* (2011) and they reported that the leaf extractsof *Ervatamiacoronia* and *Caesalpinapulcherrima*can be acted as larvicidal and ovicidal agents. The benzene extract of E. *coronia* showed highest larvicidal effects to *Ae. aegypti, An. stephensi*and *Cu. quinquefasciatus*.

Shivakumar *et al.* (2013) explored the pesticidal property of *Blepharismaderaspatensis, Memecylonedule, Phyllanthus wighianus, Maesaindica and Elaeagnus indica* against *Ae. aegypti*and revealed that the higher larvicidal activity was found in acetone extract of *E. indica*.The potentiality of the phytochemicals in the plants depend on the species, parts used, age and solvent used for extraction (Sukumar *et al.*, 1991)

Investigations for the larvicidal, ovicidal and pupicidal activities of solvent extracts of *Annona reticulata* against *Ae. Aegypti, An. stephensi* and *Cu. quinquefasciatus* demonstrated that *Ae. aegyptus*. *An. stephensi* and *Cu. quinquefasciatus* didn't show hatchability @ 200ppm concentration (Selvakumar *et al.* (2015))

The present study also emphasized the presence of larvicidal activity by the above-mentioned botanical plants. They exhibit differential response in exhibiting their efficacy. The differential responses may be induced by the phytochemicals in the species of plants which are to be explored further.

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