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TOXICITY OF DIFFERENT PESTICIDAL PLANTS' ACETONE SOLVENT EXTRACT ON *CULEX QUINQUEFASCIATUS* SAY.

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Abstract

The six pesticidal plant's (*Tridax procumbens* Linn., *Jatropa curcas* L., *Annona squamosa* L., *Solanum xanthocarpum* Schrad & Wendl., *Citrus limon* (L.) Burm. and *Mentha arvensis* L.) acetone solvent extract at different concentrations (0-1000ppm) were explored for their effect on larvicidal activity on *Culex quinquefasciatus* Say. Under laboratory conditions during 20013. The evaluation carried out with the laboratory reared host and the results revealed that the *S. xanthocarpum* acetone extract exhibited higher level of larval mortality which registered the lower LC_{50} value (224.70 ppm) within the 151.35-333.61 ppm (UCL and UCL) with the regression equation (Y = 2.4534 x - 0.7680 & R^2=0.9455) followed by *J. curcas* and *A. squamosa* with 330.32 and 440.42ppm respectively. The minimum effect was registered by *T. procumbens* with the LC_{50} value of 816.29ppm.

Key words : Acetone solvent extracts, Larvicidal action, Botanical plants, LC_{50}, *Culex quinquefasciatus*

Introduction

Mosquitoes as vectors of many diseases transmitting malaria, dengue, chickunguniya, filariasis etc. and found to be existing everywhere in Indian sub-continent from rural to urban environment. The large scale and indiscriminate usage of insecticides for controlling the different species of mosquitoes over decades turned the events to cause numerous hazardous effects *viz*., harmful effect on human health, 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).

Insects have co-evolved with plants and the later have armed with numerous secondary metabolites to fight against (Arivoli *et al.,* 2012). The secondary metabolites *viz*., terpenoids, alkaloids and phenolics in plants functioning as repellents, antifeedants, oviposition deterrents, growth inhibitors, moulting hormones, anti-moulting hormones and juvenile hormone mimics against crop pests (Champagne *et al*., 1986). In this view to explore the presence of insecticidal activity in plants, solvent extracts of six different plants were explored in this study to find out their larvicidal action on the larvae of *Cu. quinquefasciatus*.

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Materials and methods

Preparation of plant extracts

The pesticidal plants *viz*., *T. procumbens*, *J. curcas*, *A. squamosa*, *S. xanthocarpum*, *Ci. limon* (L.) Burm. and Mentha arvensis L.) were collected from in and around the study area. Solvent extracts of plants were prepared by according to 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 flask and was closed airtight by non-absorbent cotton covered with aluminium foil sheet to avoid evaporation of solvents. The solvent extracts were kept under incubation for three days and were shaked thrice 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 ml distilled 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 three species of mosquitoes 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 (Polyoxyethylene sorbitan 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 *Cu. quinquefasciatus* 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, 77.50, and 60.00 per cent mortality respectively. Among the tested plants, *A. squamosa* and *S. xanthocarpum* pronounced the maximum larval mortality (100 per 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 @ 500 ppm concentration wherein no mortality was recorded in control treatment in all the six experiments (Table 1). The calculated toxicity values expressed as LC50 values did not follow the same pattern of larvicidal action wherein *S. xanthocarpum* acetone extract registered the minimum value (224.70ppm) followed by *A. squamosa* (330.32), *J. curcas* (440.42), *M. arvensis* (650.16ppm), *Ci. limon* (700.87) and *T. procumbens* (816.29ppm) and their corresponding regression equations were also mentioned in Table 2.

Botanical plants possess secondary metabolites which would serve as a mean of defence against continuous selection pressure from pests, diseases and other environmental factors. Hartzell and Wilcoxon (1941) found that among the 150 species of plants tested for their toxicity to mosquitoes, several flora are very effective. Campbell *et al.* (1933), who found that alkaloids *viz*., nicotine, anabasine, methyl anabasine and Iupinine which were extracted from the Russian weed, *Anabasis aphylla*, killed the larvae of *Cu. pipiens* Linn., *Cu.*

Table 1: Larvicidal action of acetone extract of botanical plants on *Culex quinquefasciatus.*

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	67.5 ± 5.00
	600	30.0 ± 8.16		600	87.5 ± 5.00
	800	50.0 ± 8.16		800	100.0 ± 0.0
	1000	55.0 ± 12.91		1000	100.0 ± 0.0
	Control	0.0 ± 0.00		Control	0.0 ± 0.0
Jatropa curcas	200	25.0 ± 5.77	***Citrus limon***	200	17.5 ± 5.00
	400	35.0 ± 5.77		400	27.5 ± 5.00
	600	47.5 ± 5.00		600	35.0 ± 5.77
	800	80.0 ± 8.16		800	55.0 ± 5.77
	1000	90.0 ± 8.16		1000	77.5 ± 5.00
	Control	0.0 ± 0.00		Control	0.0 ± 0.0
Annona squamosa	200	27.5 ± 5.00	***Mentha arvensis***	200	22.5 ± 5.00
	400	55.0 ± 5.77		400	35.0 ± 5.77
	600	80.0 ± 8.16		600	40.0 ± 8.16
	800	100.0 ± 0.00		800	57.5 ± 5.00
	1000	100.0 ± 0.00		1000	60.0 ± 8.16
	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 *Culex quinquefasciatus*

Acetone solvent extract of	LC_{50} (LCL-UCL) (95 % CL)	LC_{90} (LCL-UCL) (95 % CL)	X^2	Regression Equation	R^2
Tridax procumbens	816.29 (627.99-1061.05)	1934.18 (1488.00-2514.14)	0.459*	Y=3.5681x-5.4036	0.9067
Jatropa curcas	440.42 (320.85-604.56)	1335.54 (972.95-1833.25)	0.498*	Y=2.7583x-2.2938	0.8406
Annona squamosa	330.32 (241.28-452.22)	899.82 (657.26-1231.89)	0.649*	Y=2.9507x-2.4319	0.9785
Solanum xanthocarpum	224.70 (151.35-333.61)	753.04 (507.22 – 1118.01)	0.735*	Y=2.4534x-0.7680	0.9455
Citrus limon	700.87 (401.17-1224.46)	5183.87 (2967.19-9056.55)	0.966*	Y=1.4762x+0.7991	0.9456
Mentha arvensis	650.16 (442.77-954.69)	2569.09 (1749.59-3772.45)	0.645*	Y=2.2019x-1.1897	0.8438

territans Walker and *Cu. quinquefasciatus* Say.

Govindarajan *et al.* (2011) studied about the larvicidal, ovicidal properties of certain plant extracts against the mosquitoes *viz*., *An. stephensi, Ae. aegypti* and *Cu. quinquefasciatus*. The leaf extracts of *Ervatamia coronia* and *Caesalpina pulcherrima* are used as larvicidal and ovicidal agents against mosquitoes. The benzene extract of E. *coronia* showed highest larvicidal effects to *Ae. aegypti, An. stephensi* and *Cu. quinquefasciatus*.

Selvakumar *et al.* (2015) investigated the larvicidal, ovicidal and pupicidal activities of solvent extracts of *Annona reticulata* against *Ae. Aegypti, An. stephensi* and *Cu. quinquefasciatus* and found that these plant extracts exerted strong ovicidal action against the eggs of *Ae. aegyptus*. *An. stephensi* and *Cu. quinquefasciatus* which didn't show any hatchability, therefore 200ppm concentration level was considered the best against the mosquitoes. Govindarajan *et al.* (2012) opined that the larvicidal and ovicidal efficacy of *Pithecellobium dulce* Benth are considered as the best alternate of chemical insecticides against the mosquito species *An. stephensi* and *Ae. aegypti*.

The study conducted by Shivakumar *et al.* (2013) with some extracts from Indian medicinal plants *viz., Blepharis maderaspatensis, Memecylon edule, Phyllanthus wighianus, Maesa indica and Elaeagnus indica* the against *Ae. aegypti* demonstrated that the better larvicidal activity was found in acetone extract of *E. indica* and then followed by *M. edule* acetone extract. In preliminary screening 90 per cent larval mortality was noticed in insects treated with acetone extract of *E. indica.* The efficiency of the phytochemicals against mosquitoes mainly depend on the plant species, parts used, age of plant parts, solvent selection and also the host insect on which it would be tested (Ghosh *et al.,* 2012 ; Sukumar *et al*., 1991).

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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