ISSN : 0974 - 7508 Volume 9 Issue 1

Trade Science Inc.

Natural Products

An Indian Journal

Full Paper

NPAIJ, 9(1), 2013 [26-29]

Mosquito control potentiality of plants based mosquito coils

Someshwar Singha, Utpal Adhikari, Goutam Chandra*

Department of Zoology, Mosquito and Microbiology Research Units, The University of Burdwan, Golapbag, Burdwan 713104, West Bengal, (INDIA)

E-mail: goutamchandra63@yahoo.co.in

ABSTRACT

Present study was carried out to establish the smoke toxicity effect of mosquito coils prepared from shade dried leaves of *Rauvolfia serpentina*, *Cestrum diurnum*, *Polyalthia longifolia* and seeds of *Cestrum diurnum*, against filarial vector *Culex quinquefasciatus* adult mosquitoes. Powder of the respective plant part, sawdust and charcoal powder were mixed with distilled water to form a semi-solid paste and 4 cm thickness mosquito coils were prepared. Smoke toxicity test of above mentioned plants were conducted in a glass chamber.

The results of mortality were recorded in the following sequences: *Cestrum diurnum* seeds > *Cestrum diurnum* leaves > *Polyalthia longifolia* leaves > *Rauvolfia serpentina* leaves. Cent percent mortalities were recorded when adult mosquitoes were exposed to the smoke of *Cestrum diurnum* leaves and *Cestrum diurnum* seeds after 2-h of exposure whereas 51% and 43% mortalities were recorded at *Polyalthia longifolia* and *Rauvolfia serpentina* leaves respectively. In conclusion smokes from the leaves of *Rauvolfia serpentina*, *Cestrum diurnum*, *Polyalthia longifolia* and seeds of *Cestrum diurnum*, can be used effectively against mosquito control programmes and mosquito coil of those respective plant can play an important role in the interruption of transmission of those diseases where mosquitoes act as vector at the individual level.

KEYWORDS

Cestrum diurnum;
Polyalthia longifolia;
Rauvolfia serpentine;
Smoke toxicity;
Culex quinquefasciatus.

INTRODUCTION

Mosquitoes create the greatest menace to mankind. Mosquitoes transmit a number of diseases, such as malaria, filariasis, dengue, Japanese encephalitis etc which cause millions of death every year. *Wuchereria bancrofti*, the causative agent of lymphatic filariasis is transmitted by *Cx. quinquefasciatus* mosquito in Indian subcontinent[1]. Lymphatic filariasis is a widely distributed tropical disease with around 120 million people infected worldwide[2]. The solution to the problem of mosquito borne diseases lies with effective anti-mosquito measures. Anti-mosquito measures include elimination of breeding sites, killing of mosquito larvae, destruction of adult mosquitoes and prevention of man vector contact. However, controls of adult mosquitoes are to be considered either by adulticiding or by prevention methods such as repellency or burning of mosquito coils. Common people in their residences are often protected from disease bearing mosquito bites by different types of residential insecticides such as aerosol, mosquito coil, liquid vaporizer and vaporizing mat

etc. Out of those insecticides, mosquito coils are preferred as anti mosquito products in low income communities[3], especially in East Asia and limited extent to other parts of the world. The most common active ingredients in mosquito coil are various pyrethroids and frequently contain octa-chlorodipropyl ether or bis-(chloromethl) ether. The smoke of complex mosquito coil containing small particles (<1μm), metal fume or vapor[4]. It is reported that bis-(chloromethl)-ether is realized during combustion of mosquito coil and it may act as lung carcinogen[5]. Volatile constituents of octa-chlorodipropyl ether include undefined genotoxic agents and it may cause various genetic diseases of exposed human[6].

The aim of the present study was to evaluate the smoke repellent potentialities, adulticidal activity and effect on fecundity of some interested plants against the filarial vector *Cx. quinquefasciatus* adult mosquitoes.

In conclusion, mosquito coils containing plants (*Rauvolfia serpentina, Cestrum diurnum, Polyalthia longifolia* leaves and seeds of *Cestrum diurnum*) can be used effectively against adult mosquito control programmes. Smoke exposed to gravid female mosquitoes oviposited less numbers of eggs than non exposed female mosquitoes. Further studies were needed to know the chemical structures of the active principal involve in adulticidal activity.

MATERIALS AND METHODS

Collection of plants and preparation of plant extract

Fresh mature, green leaves and seeds of *Rauvolfia serpentina, Cestrum diurnum, Polyalthia longifolia* were randomly harvested from plants growing on the outskirts of Burdwan and the voucher specimen (voucher NO:120, 121, 122 respectively) were deposited in the department of zoology, the University of Burdwan, West Bengal, India. All the materials were initially washed with tap water and then dried in shade at room temperature. Dried plant parts were crushed by an electric blender to form powder for the preparation of mosquito coils.

Preparation of mosquito coils

Mosquito coils were prepared following the method of Saini et al.[7] with minor modifications. Mosquito coils were prepared using 2g shade dried plant powder containing active ingredient, 1g sawdust as binding material of mosquito coils and 1g charcoal powder as burning material. All materials were thoroughly mixed with distilled water to form a semi-solid paste and 4 cm thickness mosquito coils were prepared with the paste. Prepared mosquito coils were dried in a shade and the weight of a mosquito coil was 2.3 g. Another mosquito coil was similarly prepared without any plant materials for control experiment.

Test mosquitoes

The study was conducted at Burdwan, (23°16', 87°54'), west Bengal, India. Pupae of *Cx. quinquefasciatus* were transferred from the tray to a cup containing tap water and were maintained in an insect cage (45×45×40cm) where adult mosquitoes were emerged. Adult mosquitoes were provided with 10%glucose solution for their glucose meal, soaked in a cotton ball. The adult mosquitoes were periodically blood fed from an immobilized, shaven belly pigeon, placed in the cage overnight. After blood feeding mosquito colonies were used for smoke toxicity test.

Smoke toxicity test

Smoke toxicity experiment by commercial mosquito coil, control mosquito coil and mosquito coil containing plants materials were conducted in a glass chamber measuring about (140 cm ×120 cm ×60 cm) and the result were compared. Each experiment was repeated three times on three successive days, on mosquitoes of same age. Hundred bloods fed adult mosquitoes were released into the experimental glass chamber for each experiment and were provided with 10% glucose solution, soaked in a cotton ball for feeding of mosquitoes. The data of mortality of adult mosquito at 15, 30, 45 min, 1 h and 2h were expressed by the addition of the mortality at 15 min, 30 min, 45min, 1 h respectively. Survived mosquitoes were reared in a mosquito cages, containing glass bowl for oviposition of blood fed adult mosquitoes. The eggs from the cage were collected daily until all the mosquitoes died to observe the effect of smoke on smoke exposed mosquitoes.

Statistical analysis

Percentage of mortality of *Cx. quinquefasciatus*

Full Paper

adult mosquitoes by different plant based mosquito coils were corrected using Abbott's formula[8]. Statistical analysis of the experimental data was performed by using the computer software MS Excel 2003 to find out mean mosquito mortality and standard error.

RESULTS

TABLE 1 provides the results of smoke toxicity effect of *Rauvolfia serpentina*, *Cestrum diurnum*, *Polyalthia longifolia* leaves and *Cestrum diurnum* seeds on *Cx quinquefasciatus*. The comparisons of positive control (commercial mosquito coil) with the plant product showed very high efficacy, but the plant products alone showed good smoke toxicity effect on *Cx quinquefasciatus*. TABLE 2 shows the result of smoke toxicity effect of *Rauvolfia serpentina*, *Cestrum diurnum*, *Polyalthia longifolia* leaf and *Cestrum diurnum* seeds on population of *Cx quinquefasciatus* at different period of exposure. TABLE 3 provides the numbers of eggs laid by the alive, fed females *Cx quinquefasciatus* mosquitoes and the hatchability of eggs either greatly reduced or affected by the exposure of smoke from *Rauvolfia serpentina*, *Polyalthia longifolia* leaf and control experiment were shown.

TABLE 1 : Smoke toxicity effect of commercial mosquito coils, mosquito coils without any plant materials and mosquito coils containing leaves of *Cestrum diurnum*, *Rauvolfia serpentina*, *Polyalthia longifolia* and seeds of *Cestrum diurnum* against adult *Cx. quinquefasciatus* mosquitoes.

Name of plants used for smoke toxicity test	After 1 h	After 12 h	After 12 h	After 1 h
	No of mosquitoes died by mosquito coils containing plant materials	No of mosquitoes died by mosquito coils containing plant materials	No of mosquitoes died by control mosquito coil*	No of mosquitoes died by Commercial mosquito coil
Cestrum diurnum seeds	42.67±1.76	100±0	3.33±0.33	100±0
Cestrm diurnum leaves	37.67±0.88	100±0	3.33±0.33	100±0
Rauvolfia serpentina leaves	17.33±0.88	45.33±2.85	3.33±0.33	100±0
Ploylthia longifolia leaves	20.67±1.20	51.33±2.60	3.33±0.33	100±0

***Control mosquito coils without any plant materials.**

TABLE 2 : Smoke toxicity effects of *Cestrum diurnum* leaves, *Cestrum diurnum* seeds, *Rauvolfia serpentina* leaves and *Ploylthia longifolia* leaves containing mosquito coils against filarial vector *Cx. quinquefasciatus* adult mosquitoes.

Samples	Result of smoke toxicity effect on adult *Cx. quinquefasciatus* mosquitoes									
	After 15 min		After 30 min		After 45 min		After 1 h		After 12 h	
	No of mosquitoes sat on floor	No of mosquitoes died	No of mosquitoes sat on floor	No of mosquitoes died	No of mosquitoes sat on floor	No of mosquitoes died	No of mosquitoes sat on floor	No of mosquitoes died	No of mosquitoes sat on floor	No of mosquitoes died
Cestrm diurnum seeds	41.33±0.67	0±0	59.67±1.20	17.33±0.89	75.67±1.20	24±1.52	93.33±1.20	42.67±1.76	100±0	100±0
Cestrm diurnum leaves	30.33±1.45	0±0	56.33±2.90	8.67±0.89	66±1.53	14±1.15	75.33±1.76	37.67±0.88	100±0	100±0
Rauvolfia serpentina leaves	26.67±2.19	0±0	30±2.64	0±0	40±1.73	4.67±0.89	50.33±2.18	17.33±0.88	70±3.60	45.33±2.85
Ploylthia longifolia leaves	23.67±1.76	0±0	31±0.58	0±0	41.33±2.96	7.33±0.89	55±1.15	20.67±1.20	82.67±2.03	51.33±2.60

TABLE 3 : Smoke toxicity effect of leaves of *Rauvolfia serpentina* and *Ploylthia longifolia* on reproduction and survival of *Cx. Quinquefasciatus*.

Samples	No of Mosquito used	Total no of eggs	Total no of Larvae hatched from the eggs	% of eggs hatching potentiality
Rauvolfia serpentine leaf	20	798	345	43.23
Ploylthia longifolia leaf	20	631	301	47.70
Negative control	20	1087	981	90.24

DISCUSSIONS

From early time smoke has been used to deter mosquitoes from biting to human. Mosquito coils provide us protection from the bites of mosquitoes. The desired quality of a mosquito coil includes having a long lasting repellent activity, being of low toxicity to human and must be non-irritating to human. Plant derived smoke contain an array of chemicals, which may kill adult mosquitoes at very low doses. Murugan et al.[9] studied

smoke toxicity effect of *Albizzia amara* and *ocimum basilicum* against *Ae.aegypti* adult mosquitoes. The smoke from plant will be targeting specific, cheap, self sustaining and highly toxic to adult mosquitoes.

During smoke toxicity test of commercial mosquito coil (positive control), mosquito coil without any plant material (negative control) and mosquito coil containing *Rauvolfia serpentina*, *Cestrum diurnum*, *Polyalthia longifolia* plant parts against adult *Cx quinquefasciatus* mosquitoes, the result showed the following sequence: commercial mosquito coil > mosquito coil containing interesting plant materials > mosquito coil without any plant material. Cent percent mortality of smoke exposed adult mosquitoes was recorded against commercial mosquito coil whereas three percent mortality was noticed against mosquito coil without any plant materials after 12-h of exposure.

When smoke from the leaves of *Cestrum diurnum*, *Polyalthia longifolia*, *Rauvolfia serpentina* and *Cestrum diurnum* seed containing mosquito coil were tested against adult *Cx quinquefasciatus* mosquitoes, cent percent mortalities were recorded with mosquito coils containing *Cestrum diurnum* leaves and *Cestrum diurnum* seeds after the exposure periods of 12-h. But 51% and 44%percent mortalities were recorded during experiment with coils containing *Polyalthia longifolia, Rauvolfia serpentina* leaves against same age group of mosquitoes and period of exposure. Mortality of four plants under study was recorded at the following sequence: *Cestrum diurnum* seeds > *Cestrum diurnum* leaves > *Polyalthia longifolia* leaves >*Rauvolfia serpentina* leaves.

All the mosquitoes were died after exposure of smoke from *Cestrum diurnum* seeds and *Cestrum diurnum* leaves. So it is impossible to us to observe the effect, on eggs lying and hatching potentiality of above mentioned smoke exposed blood fed mosquitoes. The percentage of egg hatching potentiality after exposure of smoke from leaves of *Rauvolfia serpentina* showed 43.23 % and from the leaves of *Polyalthia longifolia* showed 47.7%. The *Rauvolfia serpentina* leaves showed better effect on the egg hatching potentiality.

ACKNOWLEDGEMENTS

The authors are grateful to the Head, Department of Zoology, The University of Burdwan, for the facilities provided. The authors are also grateful to Department of Science and Technology, New Delhi for providing instruments through FIST programme.

REFERENCE

[1] S.Rajkumar, A.Jebanesan; Afr.J.Biomed Res., **8**, 31–33 **(2005)**.
[2] L.Bernhard, P.Bernhard, P.Magnussen; Physiotherapy, **89**, 743-749 **(2003)**.
[3] M.S.Mulla, U.Thavara, A.Tawatsin, W.Kong-Ngamsuk, J.Chompoosri; J.Am.Mosquito Control Assoc., **17**, 153-159 **(2001)**.
[4] W.K.Liu, S.E.Sun; Toxicol Lett., **41**, 145-147 **(1988)**.
[5] ATSDR; Toxicological profile for bis (chloromethyl) ether, atlanta, GA, agency for toxic substances and disease registry, **(1989)**.
[6] J.Pauluhn, U.Mohr; Toxicol Pathol, **28**, 734-753 **(2000)**.
[7] H.K.Saini, R.M.Sharma, H.L.Bami, K.S.Sidhu; Pesticides, **20**, 15-18 **(1986)**.
[8] W.S.Abbott's; J.Econ.Entomol, **18**, 265-266 **(1925)**.
[9] K.Murugan, P.Murugan, A.Noortheen; Bioresource Technology, **98(1)**, 198-201 **(2007)**.