EVALUATION OF REPELLENT AND LARVICIDAL ACTIVITY OF *OCIMUM BASILICUM* L. AND *CYMBOPOGON CITRATUS* DC. AGAINST *CULEX QUINQUEFASCIATUS*

Mawada Aidaross3, Waleed Kokob and M. Galalb *"Faculty of Science and Technology, Elneelain University P.* O. *Box 12702 Khartoum, Sudan. bMedicinal and Aromatic Plants Research Institute, P.* O. *Box 2404, Khartoum, Sudan.*

ABSTRACT: *Ocimum basilicum* and *Cymbopogon citratus* water extracts were investigated for their larvicidal activity against *Culex quinquefasciatus* mosquito larvae (L3). *Ocimum basilicum* extract gave 50% mortality within the concentration 1000 - 10000 ppm, while the C. *citratus* had shown negative activity. The oil of these plants has also investigated for their repellent activity against adult mosquito insects of five minutes exposure. The percentages of repellent activities of C. *citratus*, O. *basilicum* and Soffell (reference repellent ointment) were 100,58 and 91% respectively.

KEY WORDS: *Ocimum basilicum, Cymbopogon citratus*, larvicidal, repellent activity *Culex quinquefasciatus.*

INTRODUCTION

It is well known that mosquitoes are vectors of many protozoal, bacterial and viral diseases (Service, 1996). The earlier attempts to control mosquitoes were directed towards drainage and treatment of breeding sites with suffocating agents like mineral and other substances such as paris green and chemical emulsions (Haridi, 1972; EI-Safi, 1984), hence the importance of natural insecticides becomes in need in comparison to the new synthetic ones, due to the presence of some drawbacks such as toxicity to non target organisms, development of insect resistance, destruction of natural enemies and environmental contamination that could affect the entire food chain. Some of the natural substances were used as poisons and reflected a reasonable advantage over synthetic molecules in term of ecological safety (Metacalf, 1962). The development of natural substances as successful pests and vector control agents can also be economically feasible, especially if the sources of materials are abundant plants e.g. common weeds, prolific herbs, shrubs and trees having a wide and rich distribution (Sharma, 1981). Some plant extracts were reported to have repellent as well as insecticidal activity such as those of *Xanthium strumarium* L (Ali and Meta, 1998). Extracts from many medicinal plants such as *Phytolacca dodencandra* aerial part possess a potent larvicidal activity against mosquitos' larvae (Dahlman and Hibb, 1967).

Ocimum bascilicum L. belongs to the family Lamiaceae vernacularly called Rehan, chemically it contains low percent of essential oils as well as volatile oils, linalool, lineol, geraniol and polyphenolic acids. It is used in the traditional medicine to sooth pain, treat vomiting and stress and commomly as insect repent, (Chatterjee and Pakrashi, 1977; EIGazali, *et ai.,* 1998). *Cymbopogon citratus* DC. Staps also. known as the lemon grass belongs to the family Poaceae chemically it contains an essential oils, citral, limonene, geranium acid and a-camphorene. The plant used as antiseptic, antifebrile, against stomach pain and the essential oils are used as insecticidal against mosquitoes and as deodorant (EI-Gazali, *et ai.,* 1998; WHO, 1990). The present study was carried out to investigate the larvicide's activity of the aerial part by using aqueous extracts and insect repellent of the extracted essential oils from the above-mentioned medicinal plants.

EXPERIMENTAL

Plant material: The aerial parts of C. *citratus* and O. *basilicum* were collected from the farm of the Medicinal and Aromatic Plants Research Institute (MAPRI) in April, 2003. The plants were identifieed by W.E. Abdalla, H. Abdelgadir and Y. Suliman and the voucher specimens were deposited at the herbarium of the institute. The plant tissues were dried in the shade, ground and extracted with water immediately before the start of the experiments. Both plants were also extracted by heat distillation to collect fixed oil.

Larvicidal assessment:

50 ml water extract in concentrations of 10000, 1000, 500 and 250 ppm from each plant were put in 100 ml-beakers and 5 mosquito larvae (third larval stage) collected from stagnant water in Khartoum State were added to each beaker. The mortality of mosquito larvae was recorded after 1, 2, 3, 4 and 24 hours post exposure post exposure. Triplicates of the tests were made.

Table 1: Comparative mortality of mosquito larvae exposed to O. *basilicum* and C. *citratus* water extracts for 24 hours

Plant aqueous extract (concentration)		Larval mortality (%)				
		1 hr	2hr	3 hr	4 hr	24 hr
O. *basilicwn*	10000 ppm	20 + O.Oa	30 + 8.3a	50 + 8.3a	50 + 8.3a	60 + 0.0
C. *citratus*		0	0	0	0	62 + 4.0
O. *basilicum*	1000 ppm	0	0	10 + 8.3a	10 + 8.3a	26 + 5.4
C. *citratus*		0	0	0	0	16:t..17.0
O. *basilicum*	500 ppm	0	0	0	0	0
C. *citratus*		0	0	0	0	0
O. *basilicum*	250 ppm	0	0	0	0	0
C. *citratus*		0	0	0	0	0

Values are mean j: SO; a = P < 0.05

Table 2: N b f landed d 11 f

Treatment	Total number of landed mosquitoes	Mean numbers of mosquitoes landed! volunteer	Repellent% from the total	% of repellent activity in comparison with control
O. *basilicum*	10	2.5 + 2.081	90	58
C. *citratus*	0	0 j: 0	100	100
Soffel	2	0.5 + 0.578	98	91
Control	24	6.0 + 2.94	76	0

Repellent assessment

Four volunteers washed their forearms thoroughly with unscented detergent dried, rubbed a thin layer of oil and inserted in the mosquito cages containing about 100 adult mosquitoes. The number of mosquitoes landed during a 5-minutes interval was recorded. The repellency of oil was calculated as follows:

$$\frac{R=NC - NT}{NC} \text{XIOO}$$

Where:

R = repellency %

NC = Number of mosquitoes landing in untreated forearms (control).

NT = Number of mosquitoes landing in the tested oil.

The percentages of repellent activities of the plant extracts and reference repellent ointment (soffel) were recorded.

Statistical analysis:

Laboratory data were subjected to one-way ANOV A using the SPSS (Zagumny, 2001). Differences were considered significant at P < 0.05.

RESULTS

Table (1) summarizes the effect of the water extract from O. *basilicum* and C. *citratus* on the survival time of mosquito larvae. The lower concentrations (250 and 500 ppm) from both plants had no larvicidal. There was no larvicidal activity within the first two hours. The higher concentration 10000 ppm of O. *basilicum* aqueous extract after exposure caused mortality 20%, 30%, 50%, and 60% after 1 - 24 hours post-exposure while the plant concentration in 1000 ppm produced mortality at 10%, 10%, and 26% between 3 and 24 hours of exposure. The mortality percent of larvae examined to 10000 ppm aqueous extract from C. *citratus* occurred at 62%, 24 hours post-exposure while the plant water extracted at 1000 ppm caused larval mortality (16%) after 24 hours from the exposure.

The C. *citratus* oil showed a 100% repellent activity i.e. zero landed mosquitoes for all exposed volunteers arms which is more better than reference repellent soffel of 91 % repellent activity whereas O. *basilicum* gave only 58% repellent activity Table (2).

ANOVA

reppellent %

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1424.000	3	474.667	8.900	.002
Within Groups	640.000	12	53.333		
Total	2064.000	15			

Multiple Comparisons

Dependent Variable: reppellent %

LSD (I) Treatment	(J) Treatment	Mean Difference (I-J)	Std. Error	Sig.
O. bacilicum	C. citratus	-10.0000	5.1640	.077
	saffel	-8.0000	5.1640	.147
	cntral negative	14.0000*	5.1640	.019
C. citratus	O. bacilicum	10.0000	5.1640	.077
	saffel	2.0000	5.1640	.705
	cntrol negative	24.0000*	5.1640	.001
saffel	O. bacilicum	8.0000	5.1640	.147
	C. citratus	-2.0000	5.1640	.705
	cntral negative	22.0000*	5.1640	.001
cntral negative	O. bacilicum	-14.0000*	5.1640	.019
	C. citratus	-24.0000*	5.1640	.001
	saffel	-22.0000*	5.1640	.001

*. The mean difference is significant at the .05 level.

DISCUSSION

The study showed that C. *quinquefasciatus* exhibited tolerance to most of the tested extracts at low dose. Future research should investigate the effect of higher doses and establish dose mortality response curves to show whether larvae are really tolerant to aqueous extract or not. Nevertheless, the results showed that O. *basilicum* was significantly ($P<0.05$) toxic to Culex mosquitoes rather than C. *citrates* at the same concentrations 10000 and 1000 ppm during the first day. This result more or less support Morsy, *et at.* (1998). The repellent activity obtained from this study indicated that C. *citratus* posses potent significant activity in comparison to other used oils and this result agrees with Oyedele, *et at.* (2002) who were reported that C. *citratus* oil had good repellent protection against mosquitoes bite. So we can conclude that O. *basilicum* even so toxic to mosquitoes larvae it is not sufficient enough to be used directly in mosquitoes control program a further study showed directed towards the best type of extraction and active ingredients identification, which may reveal better result at low concentrations those can be recommended for field application. Although, C. *citratus* oil showed very good and promising repellent insect activity it needs a comprehensive study for its allergic activity, which was observed in some of the volunteer.

ACKNOWLEDGEMENT

This work was supported by Medicinal and Aromatic Plants Research Institute, the authors are gratefully to all members of the institute, also thanks to Prof. Adam, S. E. I. EI-Neelian University.

REFERENCES

Ali, S., Meta, A. Investigations on repellent and insecticidal effects of *Xanthium strumarium* L. on Colorado Potato Beetle *Leptinotrasa decemlineata* Say (Col: Chrysomelidae) Tr. 1. Agric. Forest. 22: 543-552 (1998).

Chatterjee, A. and Pakrashi, S. C. The treatise on Indian medicinal plants. Vol. 5. National Institute of Science Communication, New Delhi (1997).

Dahlman, D., and Hibb, E. Plant extracts as larvicides. Ann. Entomol. Soc. Am., 2: 60-73 (1967).

EI Gazali, G., Khalid, H., Eltohami, M., Abdalla, W., Yagi, S. Medicinal Plants Commonly Used in Khartoum State. National Centre for Research, Khartoum, pp. 35, 65 (1998).

EI Safi, S. H. Efficiency of *Gambusia affinis* and *Oreochromis niloticus* as larvivorous fish in Gazira Irrigated Scheme. M.Sc. Thesis, University of Khartoum, Sudan (1984).

Haridi, A. M. Inheritance of DDT - resistance in species A and species B of *Anopheles gambiae* complex. Bull WHO, 47: 619-26 (1972).

Herm, W. B. Medical Entomology. Its Scope and Methods. Ann. Rev. Entomol., 6: 413-33 (1949).

Metacalf, C. 1. Insect control using organic compounds of plant origin. Destructive and useful insects. Their habits and control. 4th edn. p: 325 (1962).

Morsy, T. A., Mazyad, S., EI Sharkawy, I. The larvicidal activity of solvent extracts of three medicinal plants against third instar larvae of *Chrysomya albiceps.* J. Egyp. Soc. Parasitol. 28: 699- 709 (1998).

Oyedele, A., Gbolade, A., Sosan, M., Adewoyin, F., Soyelu, 0., Orafidiya, O. Formation of an effective mosquito repellent tropical product from Lemon grass oil. Phytomedicine, 9: 359-262 (2002).

Service, M. W. Medical Entomology for Studentsm Hapman and Hall, London, p: 278 (1996)

Sharma, R. Naagasampagi, B. Bhodale, A. Kulkarni, M., Tungikar, V. (1981) Neemrich: the concept of enriched fractions from neem behavioural and physiological control of insects. Proc. 1st. Neem. Conf. Rottach Egrn (1980).

WHO. Regional Publications Western Pacific Series No.3 Medicinal Plants in Viet Nam World Health Organization. Regional Office for the Western Pacific Manila and Institute of Materia Medica Hanoi (1989).

Zagumny, M. J. SPSS Student's Guide to Statistical Analysis, UCLA Academic Technology Services (2001).

Manuscript received 06 - 06 - 2005
Accepted for publication 13 - 11 - 2005