RESEARCH PAPER | Medical Science | Volume : 6 | Issue : 5 | May 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

Calotropis Procera As Bio–Larvicide For The Control of Mosquito Vectors in Clean and Polluted Water Breeding Habitats

KEYWORDS: *Calotropis procera*, larvicidal, mosquito vectors, clean & polluted water breeding habitats

Manju Singhi	Anil Purohit	AK Dixit
Desert Medicine Research Centre (ICMR) New Pali Road, Jodhpur, Rajasthan , 342 005	Desert Medicine Research Centre (ICMR) New Pali Road, Jodhpur, Rajasthan , 342 005	Desert Medicine Research Centre (ICMR) New Pali Road, Jodhpur, Rajasthan, 342 005

ABSTRACT *The larvicidal potential of crude and extracted latex of Calotropis procera was tested against mosquito vectors in clean and polluted water breeding habitats. Insecticide susceptibility tests was carried out using WHO standard . Analysis of Variance showed that extracted latex have good larvicidal effect as compared to acqous latex at 100 ppm concentration. Statistically significant result (P<.01) was observed when we compared methanol extract versus acqous latex (t=5.2782,df= 8) and acetonitrile extract with acqous latex (t=5.9758,df=8), similarly when efficacy of both the extract was compared it showed non-significant difference (P>.01) and these two being comparable (t=0.2558,df=8) .This showed that both the extract is effective to control mosquito breeding in domestic & peri-domestic breeding containers as compare to acqous latex. The finding of the study revealed that extracted latex of C. procera can be used as an alternative approach for the control of mosquito vectors in all breeding sites .The study would be of great importance in planning vector control strategy based on alternative plant derived insecticides.*

Introduction

Mosquito control is essential to prevent transmission of vector borne diseases and to improve quality of public health and environment. Mosquito borne diseases are prevalent in more than 100 countries, infecting 300-500 million people and causing about 1 million deaths every year[1].Targeting the breeding sites of mosquitoes is an efficient and effective approach for the control of mosquitoes. During larval stages mosquitoes are less mobile and concentrated within smaller area as compared to much larger area required for targeting adult stage[2] .Use of synthetic insecticides is one of the methods available for controlling the mosquitoes.Temephos and Bacillus thuringiensis israelensis (Bti) are commnly used for clean water habitats while Fenthion and Pirimiphos methyl are used for polluted water breeding habitates. Owing to development of genetic resistance to synthetic insecticides[3] and to bio-pesticides such as Bacillus thuringiensis and its adverse affect on environment have been reported . Recently attention have been given to search plant based herbal composition for managing mosquito population by human communities . Bio-compounds are known to possess several advantages over the synthetic chemical insecticides such as cost effective, highly potent, less toxic and biodegradable[4&5] . Calotropis procera R. Br. (Asclepiadaceae) is one of the important weed plant used for the preparation of traditional medicines and its milky sap is used by folk healers to cure many diseases. Latex of the plant was reported to possess analgesic activity[6], anti-inflammatory activity[7], antimicrobial activity[8] , anti- diarrhoeal activity[9&10] , antinociceptive activity and anti-malarial activity[11]. The latex in the green parts of the plant is produced and accumulated as a defense strategy against organisms such as virus, fungi, and insects . C.procera is known to contains several phyto-chemical compounds such calotropin, calotropagenin, calotoxin, calactin, uscharin, amyrin, amyrin esters, uscharidin, coroglaucigenin, frugoside, corotoxigenin, calotropagenin and voruscharine used in many therapeutic applications[12]The present study was carried out to demonstrate the utility of Calotropis procera extracted latex for the control of mosquito population in clean as well as polluted water breeding habitats.

Material and Methods

Naturally grown plant was used for the collection of the latex (Fig-1, A) and was identified by Botanical Survey of India and deposited at National Bureau of Plant Genetic Resources with accession no IC-0597244 seeds, Pusa Campus, New Delhi. The latex was manually collected directly from plant (fig.1B) and extracted by organic solvants (AR grade) as per protocol developed [13] .The latex volume was measured and extraction solvent was added to it in 1:1 ratio (v/v). After 1 hour the mixture was filtered through Whatman filter paper no.1. The clear filtrate is collected in Petri dishes and left for air drying in a cool and dry place at room temperature till a dried layer of extract is left on the plates (Fig .1C) . The dried extract were made into powder and stored at 4°C in refrigerator. Polluted water has been collected from different sources such as industrial waste, biological water from ponds and textile water.

Larvicidal bio-assay

The larvicidal efficacy of crude and extracted latex of C.procera was assayed by the WHO protocol[14] . 100 ppm dose has been tested and found effective in field breeding containers[15] Larvicidal bioassay were undertaken at optimized dose of 100 ppm of aqueous, methanol and acetonitrile extract against mosquito vectors in clean,

Volume : 6 | Issue : 5 | May 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

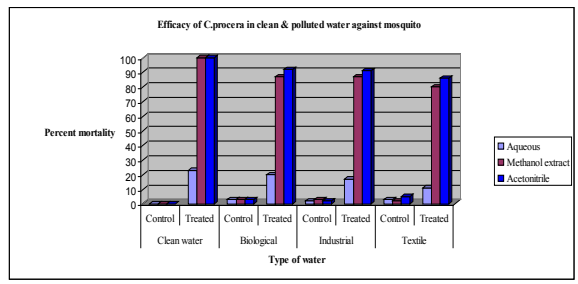
textile, biological and industrial water. Batches of 20 larvae (5 replicates), a total of 100 larvae and control group were taken for experiments. Mortality was observed after 24 hours exposures and dead larvae were counted and the percentage mortality was recorded from the average of five replicates.

Statistical analysis- Analysis of variance (ANOVA) was applied to study efficacy of acqous and extracted latex against mosquito vectors in clean and polluted water .

Results and Discussion

Methanol and acetonitrile extracted latex has shown good larvicidal effect as compared to acqous latex at optimized dose of 100 ppm concentration in clean as well as polluted water against mosquitoes . The highest mortality was observed against vectors in clean water (100%), followed by 88% in biological water,87% in industrial water and 80 % in textile water; whereas in crude latex percentage of mortality was in order 23 % in clean water, 20 % in biological water, 17 % in industrial water and 11 % in textile water as shown (Fig.2) . ANOVA analysis of extracts and acqous latex in clean and polluted water against mosquito vectors showed that extracted latex is more effective in all types of water as compared to crude latex.Statistically significant difference (P<.01) was observed when we compared methanol extract versus acqous latex (t=5.2782df= 8) and acetonitrile extract with acqous latex (t=5.9758,df=8). Efficacy of methanol & acetonitrile extracted latex in clean and polluted water showed non significant differences P>.01 and these two being comparable (t=0.2558,df=8) .It showed that both the extracts are effective to control mosquito breeding in both clean as well as polluted water habitates Effectiveness of extracted latex at 100ppm concentration against mosquitoes i.e Aedes , Anopheles and Culex vectors encourages its application in domestic & peri-domestic breeding containers of clean water as well as dirty water bodies containing polluted water to control mosquito breeding. The extraction of bio- chemical compound depends on the polarity of solvent used and thus effect chemo-profile of plant. C.procera is a common weed plant growing in arid and semi arid part of Rajasthan throughout the year . The latex can easily collected, extracted and applied to breeding places which do not require any special skill, instrument for its application . The result of our study has been supported by other workers as Girdhar et al[16] has shown the larvicidal potential of whole latex of C.proera for mosquito control at 10,000ppm . Singhi et.al[17-19] has shown larvicidal activity against three important vector causing dengue malaria and lymphatic filariasis and reported very important observations on refractoriness towards ovipositioning behavior of female mosquito up to 3 gonotrophic cycle. This behavioural change towards latex solution may help for the selection of bio-larvicide for mosquito control. Laboratory studies on methanol extract of leaf, seed and flower of C.procera as larvicde against An.stephesi , a vector of malaria has been studied. To improve quality of public health and environment, It becomes essential to search for alternatives to prevent transmission of vector borne diseases. Bioactive extracted chemical compounds from the plants could be used as alternatives to the currently used insecticides. The screening of locally available plants for mosquito control would reduce the dependence on expensive mosquito control devices and also stimulate local effort to enhance public health system. From the results, it can be concluded that C. procera extracts possess good larvicidal activity against mosquitoes in clean as well as polluted water breeding sites and more studies are indicated to extract the active compounds for future studies and use in mosquito control.

Fig.2



Conclusion

C.procera shown good larvicidal potential even at low concentration (100 ppm) against mosquitoes in clean as well as polluted water breeding habitats. The plant grows in nature across road sides without any care & cost throughout the year especially when the mosquito population is higher.Due to high cost of synthetic chemical pesticides, natural chemistry of plants can be used for sustainable pest management with minimum enviormental and health effect in future. In this regards latex of Calotropis procera act as promising bio larvicide .

Acknowledgment

The authors are grateful to Director, DMRC for providing all the facilities to undertake the study.

References

1. WHO fact sheet: Vector-borne diseases. Fact sheet 387, 2014 March. http://www.who.int/kobe_centre/mediacentre/vbdfactsheet.pdf
2. Rutledge CR,Clarke F,Curtis A,Sackett S.Larval mosquito control. Techn Bull Florida Mosq Control Assoc 2003; 4: 16-19.
3. Wattal BL, Joshi GC, Das M, Role of agriculture insecticides in precipitating vector resistance. J Communicable Diseases, 1981; 13: 71-73.
4. Isman MB. Botanical insecticides: for richer, for poorer. Pest Manag Sci. 2008; 64: 8-11
5. Govindarajan M, Mathivanan T, Elumalai K, Krishnappa K, Anandan A. Mosquito larvicidal, ovicidal, and repellent properties of botanical extracts against Anopheles stephensi,Aedes aegypti, and Culex quinquefasciatus (Diptera: Culicidae).Parasitol Res. 2011; 109: 353-67.
6. Dewan S, Sangraula H, Kumar VL. Preliminary studies on the analgesic activity of latex of Calotropris procera. J Ethnopharmacol 2000;73:307-11.
7. Oliveira JS, Ribeiro RA, Ramos MV. Anti-inflammatory effect of the latex from Calotropis procera in three different experimental models: Peritonitis, paw edema and hemorrhagic cystitis. Planta Medica 2004; 70: 1144–9.
8. Jain SC, Sharma R, Jain R, Sharma RA. Antimicrobial activity of Calotropis procera. Fitoterapia 1996; 67:275–7.
9. Kumar S, Dewan S, Sangraula H, Kumar VL. Anti-diarrhoeal activity of the latex of Calotropis procera. J Ethnopharmacol 2001;76:115-8.
10. Kumar VL, Shivkar YM. In vivo and in vitro effect of latex of Calotropis procera on gastrointestinal smooth muscles. J Ethnopharmacol 2004;93:377-9.
11. Sharma P, Sharma JD. Evaluation of in vitro schizontocidal activity of plant parts of Calotropis procera--an ethnobotanical approach. J Ethnopharmacol 1999;68:83-95.
12. J A Duke, Handbook of phytochemical constituents of GRAS herbs and other economic plants. Boca Raton, FL. CRC Press. (Dr. Duke's Phytochemical and Ethnobotanical Databases, 1992. [Online Database] (URL: http://www.arsgrin. gov/cgi-bin/duke/farmacy2 .pl).
13. Singhi manju and Joshi Vinod, Annual Report ,DMRC 2011
14. World Health Organization. Guidelines for laboratory and field testing of

Volume : 6 | Issue : 5 | May 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

mosquito larvicides. WHO/CDS/WHOPES/GCDPP/ 2005.13. Geneva: WHO, 2005; .

15. Singhi Manju , Purohit Anil and Chattopadhaya Sushmita. Effectiveness and feasibility of methanol extracted latex of C.procera as larvicide against dengue vectors of Western Rajasthan, India. J Vector Borne Dis.52,June 2015,pp 142-146
16. Giridhar G, Deval K, Mittal PK, Vasudevan P. Mosquito control by Calotropis procera latex. Pesticides 1984; 18:26–9.
17. Singhi M, Joshi V, Sharma RC, Sharma K. Ovipositioning behaviour of Aedes aegypti in different concentrations of latex of Calotropis procera: studies on refractory behaviour and its sustenance across gonotrophic cycles.Dengue Bull 2004; 28: 184–8.
18. Singhi M, Joshi V, Dam PK. Studies on Calotropis procera as larvicidal and repellent plant against vectors of dengue and DHF in Rajasthan, India. Annual Report 2005-06. Jodhpur: Desert Medicine Research Center 2006; p. 24–8.
19. Singhi M, Joshi V, Sharma RC, Adha Sandeep, Dixit AK. Larvicidal efficacy of Calotropis procera against vectors of dengue, malaria and lymphatic filariasis in arid zone of Rajasthan. Annals Arid Zone 2005; 44(2): 185–9.4.