Antimicrobial Activity of Anti-Mosquito Repellent Plant Chloroxylon Swietenia

Mamta S Wagh[1], Smita kharkale[2] Sandhya Moghe[3], Sarita Tiwari[3], Ashok D Gharde[4]

[1]*Department of Chemistry, Kamla Nehru Mahavidyalaya, Sakkardara Square, Nagpur, Maharashtra, India*
[2]*Department of Chemistry, Lemdeo Patil College, Kuhi (Mandal), Maharashtra, India*
[3]*Department of Chemistry, Kamla Nehru Mahavidyalaya, Sakkardara Square, Nagpur, Maharashtra, India*
[4]*Department of Chemistry, Nutan Adarsh College,Umred, Nagpur, Maharashtra, India*
mamtawagh2@gmail.com

***Abstract*—The mission to make humans less attractive to mosquitoes has fuelled decades of scientific research on mosquito behaviour and control. The search for the perfect topical insect repellent/killer continues. This analysis was conducted to review and explore the scientific information on toxicity produced by the ingredients/contents of a herbal product. In this process of systemic review the following methodology was applied. By doing a MEDLINE search with key words of selected plants, plant based insect repellents/killers pertinent articles published in journals and authentic books were reviewed. The World Wide Web and the Extension Toxicity Network database (IPCS-ITOX) were also searched for toxicology data and other pertinent information. Repellents do not all share a single mode of action and surprisingly little is known about how repellents act on their target insects. Moreover, different mosquito species may react differently to the same repellent. After analysis of available data and information on the ingredient, of the product in relation to medicinal uses, acute and chronic toxicity of the selected medicinal plants, it can be concluded that the ingredients included in the herbal product can be used as active agents against mosquitoes. If the product which contains the powder of the above said plants is applied with care and safety, it is suitable for use as a mosquito repellent/killer. *Chloroxylonswieteniaor* commonly known as East Indian Satinwood is a tropical, medium-sized deciduous tree native to southern India, Madagascar, and Sri Lanka. Most plants parts are used in traditional medicines in India. Essential oil obtained from the leaves and stems have anti-bacterial and anti-fungal properties. Dried leaves can be used for paints while crushed leaves for the treatment of wounds, snake bites, and rheumatism. Leaves and roots can be made into paste then taken internally or applied externally as relieve from headache.**

Keywords* : Mosquito repellent, Herbal, *Chloroxylonswietenia, Staphylococcus aureus

I. INTRODUCTION

Plants are able to produce a large number of small-molecular-weight compounds with very complex structures known as "secondary metabolites". Besides important for the plant itself, for the resistance against pests and diseases, attraction of pollinators and interaction with symbiotic microorganisms these secondary metabolites are of great commercial interest as industrial feedstocks, important products of societal use, and determine the colour, taste, aroma, coloration and smell. A number of plant secondary metabolites are commercially important fine chemicals, for use as drugs, dyes, flavours, fragrances and pesticides. Various disease-preventing activities of secondary metabolites are being rediscovered, such as anti-oxidative, antimetastatic-lowering properties (e.g., vinblastine, taxol), cytotoxic (colchicines) etc. Insecticides of botanical origin may serve as suitable alternative biocontrol techniques in the future [7].

According to International Union for Conservation of Nature (IUCN) version 2014 Chloroxylonswietenia is a susceptible species been categorized as endangered which requires attention with respect to its survival and reproduction. It is sluggish growing species which day by day is getting rare in most areas because of its high demand in timber. Such Vulnerable species need to be monitored and preserved. C. swietenia is a small to medium – sized tree, distributed in India, Sri Lanka and Malaysia. In India it is distributed in Andhra Pradesh, Karnataka, Madhya Pradesh, Orissa, Tamil Nadu and Kerala. It is

commonly grown in poor literate soils and also occurs in tropical dry evergreen forests. East Indian satinwood belonging to the family Rutaceae occurs in dry mixed evergreen forest. The other names of C. swieteniaare Satinwood, Billu, Mashwal, Mududad, and Purasu, etc. It is native to India (Andhra Pradesh, Kerala, and Tamil Nadu), Madagascar, and Sri Lanka [1]. Chloroxylonswieteniahas been used in folkloric medicine (Venkataswam et al. 2010). Themosquito larvicidal efficacy of C. swietenia leaf crude extracts and leaf essential oil [2][3] have shown promising results. But yet antimicrobial activity of leaf extract has to be analysed. Based on literature survey, the present study was an endeavour to ratify the antimicrobial activity of the ethanolic extract of the leaves of C. swietenia.

II. MATERIALS & METHODS

A. *Collection, Identification and sample preparation*

Experimental Plant of Chloroxylonswietenia for present research was collected from local region, Nagpur district, Maharashtra, India. For further analysis dried and fresh leaves both were collected, washed and dried. The dried leaves were powdered in mechanical grinder and stored in dried container for further chemical analysis.

B. *Extraction of plants*

Leaf samples of medicinal plant (both dried and fresh) of Chloroxylonswietenia was taken for solvent extraction. About 25 gm of dried powder of Chloroxylonswietenia leaf powder was subjected for solvent extraction by using soxhletapparatus. The extraction was done using ethanol solvent. The extraction was carried out for 4 hours at 800C.The extract obtained was dark green in color which was further filtered with what man filter paper no. 1. The solvent was evaporated at room temperature until the volume was reduced to 150 ml. Extract of the leaf powder was stored in airtight bottle for further analysis.

i. *Pytochemical Analysis:*

Test for aldehyde: Schiff's Test: An extractant of experimental plant was taken and in that 1ml ethanol was added. Then 1ml Schiff's reagent was added and was mixed properly. A deep violet colour was obtained which indicated the presence of aldehyde group.

II. Fourier Transform Infrared Spectrophotometer (FTIR) analysis

Fourier Transform Infrared Spectroscopy (FTIR) is a technique which is used to obtain infrared spectrum of absorption, emission, photoconductivity or Raman scattering of solid, liquid or gas. An FTIR spectrometer simultaneously collects spectral data in a wide spectral range. It is the powerful technique for identification of chemical bonds in the compound. The wavelength of light absorbed is respective of chemical bond in the molecule. The IR spectrum gives the information of chemical bonds comprising in given molecule. Dried powder of alcohol solvent extract of the experimental plant was used for FTIR analysis. 10 mg of the dried extract powder was encapsulated in 100mg of KBr pellet. The powdered sample was placed in sample container in uniform layer and specimen was loaded in FTIR spectroscope (Shimazdu, IR Affinity, Japan) with a scan range from 400 to 4000cm-1 with a resolution of4 cm-1

A. Determination of Antimicrobial Activity

For determination of antimicrobial activity of plant extract, bacterial culture of E. Coli and Staphylococcus were taken. Fresh culture were inoculated in the broth and incubated in the shaking

incubator at 120 rpm. The bacterial growth was monitored spectrophotometrically by taking optical density at 640 nm at an interval of 2 hrs. Then bacterial culture with OD 0.5 was taken for antimicrobial study by the well diffusion method. In Well diffusion method the inhibition zone was measured to know the antimicrobial activity.

III. RESULTS AND DISCUSSION

A. Analysis of Antimicrobial Activity

Gram positive and gram negative bacterial and fungal strains are used to examine the antimicrobial activity of C. Swietenia leaf extract. Antimicrobial activity is identified by measuring the zone of inhibition. The antimicrobial activity was processed by agar well diffusion method. Ethanolic extract have shown antimicrobial activity against micro-organisms, but mainly on S. aureus. However, whether the antimicrobial activity is due to the individual or combined effect of the chemical groups presents in the plant. Table 1 highlights the effects of experimental plant extracts of leaves of C. Swieteniaon selected organism. Also Figure 1 showed the zone of inhibition of plant extract against selected micro organism. The ethanolic extracts of dry and wet leaves of C. Swietenia showed anti-microbial activity. However, [1] have also tried to analysed the content of *C. Swietenia* bark-extract for larvicidal activity and find out that methanol bark extract of *C. swietenia* has a promising larvicidal activity against the early fourth instar larvae after 24 h of exposure period.

TABLE I: ANTIMICROBIAL ACTIVITY OF LEAF EXTRACT OF *C. SWIETENIA*ON MICROORGANISM

Organism	Dry Leaves Extract	Fresh Leaves Extract
Staphylococcus aureus	0.3 cm	0.4 cm
E. coli	0.2 cm	0.2 cm

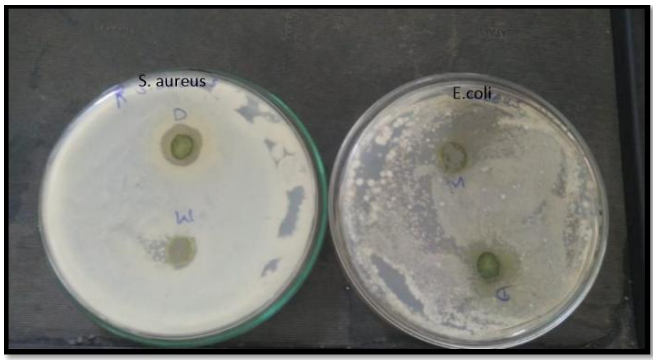

Fig. 1: Zone of Inhibition of Antimicrobial Activity of *Chloroxylonswietenia* Plant

B. FTIR Spectral Data Interpretation

The ethanol extract showed characteristics broad band in the region 1863.70, 1822.52 cm-1 may be assigned to the stretching vibration of carbonyl group (anhydride). The band obtained in the range 1467.54 cm^{-1} and 1434.43 cm^{-1} suggests the presence of substituted aromatic ring. The band appeared in the region 3477.62 cm^{-1} 3209.01 cm^{-1} may be assigned to the stretching vibration of phenolic hydroxyl (-OH) group exhibiting intermolecular hydrogen bonding. The band obtained at 3140.81 suggests the -NH stretching. The band obtained at 1381.49 cm^{-1} suggests the presence of methylene ($-CH_2$) group. The

1,2,3,5 substitution of aromatic ring recognized by the medium or weak absorption band appeared at 635-688.66 cm-1 , 800.41850.56 cm^{-1} , 906.78- 983.73 cm^{-1} and 1154.50 - 1088.75 cm^{-1} respectively. The IR spectra of C. swietenia are depicted in the figure 2 and IR spectral data are tabulated in the table 2.

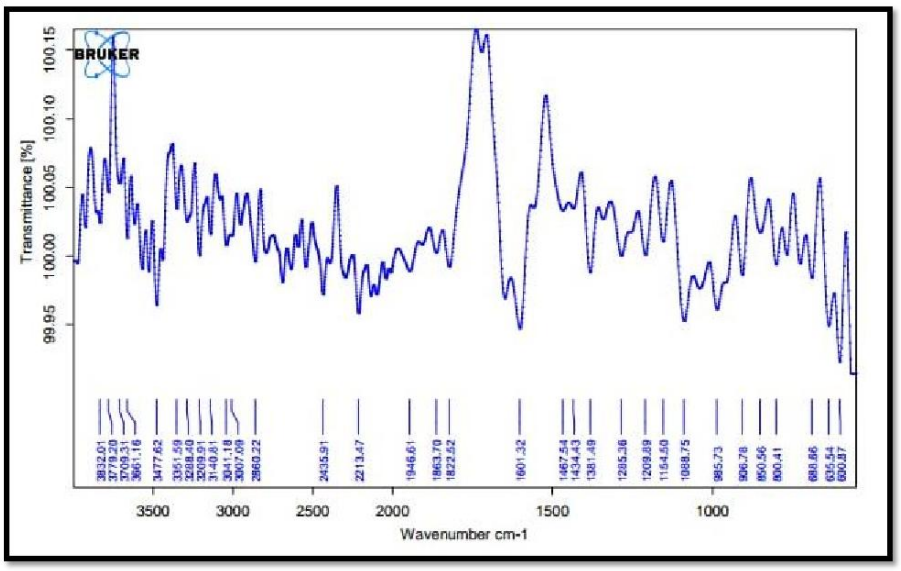

Fig. 2: IR Spectra of Extract of *Chloroxylonswietenia* Plant Leaves

Table : II

Observed Band Frequency	Expected Band Frequency (Cm^{-1})	Expected Band Frequency (Cm^{-1})
3477.62	-OH Phenolic	3400-3200
3351.59	Intermolecular Hydrogen	
3288.4	Bonding	
3209.01		
3140.81	NH- Stretching	3000-3400
3041.18	Aryl C-H Stretching	3000-2910
3007.09		
2860.22	-CH2 Linkage	2860-2950
1863.70, 1822.52	C=O Stretching	1800-1840
2435.91	-NH Stretching	2700-2250
2213.47		
1601.32	C=O Stretching	1700-1600
1467.54	Aromatic	1600-1450
1434.43	Ring(Substituted)	
1381.49	-CH2- Methylene Bridge	1390-1270
1285.36	CN- Stretching Aromatic	1200-1500
1209.89		
1154.5	1,2,3,5 Substitution in Benzene Ring	1050-1180

1088.75		800-990
983.73		600-700
906.78		
850.56		
800.41		
635		
600		
688.66		

IV. Conclusion

Plant products are easily degradable, less hazardous, and a rich reservoir of chemicals, having diverse biological activity for vector control; hence, the use of plant products is becoming more popular as compared to synthetic insecticides [5]. The present study describes, the antibacterial evaluation of ethanolic extract that were tested for in vitro antibacterial activity using the disc-diffusion method by measuring and the diameter of the zone of inhibition measured in mm. It was found that the extract was screened in vitro for their antibacterial activity against a variety of Gram-positive, Gram-negative bacterial strains, such as *E. coli and S. aureus* emerging pathogens responsible for gastrointestinal. The present finding supports the usage of the plant extract for the traditional treatment of diseases. In future further studies probing the plants laced with antimicrobial property more in depth. Identification of plants with antimicrobial effect is only a preliminary piece of data and should be followed by the identification of the active compounds by means of a bio-guided assay.

References

[1]. Balasubramanian J, Subramanian S, & Kaliyan V, Effect of Chloroxylonswietenia Dc Bark Extracts Against Culexquinquefasciatus, Aedesaegypti and Anophelesstephensi Larvae, *Parasitol Res*, 114(11):4219-23. DoI: 10.1007/s00436-015-4658-x. Epub 2015 Aug 7., 2015 Nov.

[2]. Kiran, S. Ravi, K. Bhavani, P. Sita Devi, B.R. Rajeswara Rao and K. Janardhan Reddy, "Composition and Larvicidal Activity of Leaves and Stem Essential Oils of Chloroxylonswietenia DC against Aedesaegypti and Anopheles Stephensi, *Bioresource Technology*-97, No. 18: 2481-2484, 2006.

[3]. Kiran S. Ravi, & P. S. Devi, "Evaluation of Mosquitocidal Activity of Essential Oil and Sesquiterpenes from Leaves of Chloroxylonswietenia DC", *Parasitology Research*, 101(2): 413-418, 2007.

[4]. K. Krishnappa, & K. Elumalai, "Larvicidal and Ovicidal Activities of Chloroxylonswietenia (Rutaceae) Essential Oils against Spodopteralitura (Lepidoptera: Noctuidae) and their Chemical Compositions", *International Journal of Current Research in Life Sciences*, *1*(1), 3-7, 2012.

[5]. O. Koul & S. Walia, "Comparing Impacts of Plant Extracts and Pure Allelochemicals and Implications for Pest Control", CAB Reviews: *Perspectives in Agriculture*, Veterinary Science, Nutrition and Natural Resources 49(4).1-30, 2009

[6]. R. Venkataswamy, H. Mohamad Mubarack, A Doss, TK. Ravi & M. Sukumar, "Ethnobotanical Study of Medicinal Plants Used by Malasar Tribals in Coimbatore District of Tamil Nadu (South India)", *Asian Journal of Experimental Biological Sciences*; 1(2): 387-392, 2010.

[7]. K. Veerakumar & M. Govindarajan, "Adulticidal Properties of Synthesized Silver Nanoparticles Using Leaf Extracts of Feronia Elephantum (Rutaceae) Against Filariasis, Malaria and Dengue Vector Mosquitoes", *Parasitol Res*, 113(11):4085-96, 2014.

.