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Larvicidal activity of essential oils of *Cinnamomum travancoricum* barks against *Anopheles stephensi* and *Culex quinquefasciatus*

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Abstract
To determine lethal concentrations of essential oils extracted from the barks of *Cinnamomum travancoricum* against the larvicidal activity of *Anopheles stephensi* and *Culex quinquefasciatus* under laboratory conditions. The maximum mortality of essential oils of *C. travancoricum* barks on the larvicidal activity aginst the larvae of *Culex quinquefasciatus* and *Anopheles stephens* was 90% and 80% respectively.

Keywords: *Cinnamomum travancoricum, Anopheles stephensi, Culex quinquefasciatus*.

Globally, the malaria situation is serious and still deteriorating. Malaria predominantly affects the poor and underprivileged. About 90% of all malaria deaths in the world today occur in Africa and south of the Sahara. An estimation of 1 million people in Africa die on malaria in each year and most of these are children under 5 years old (WHO, 2002). Mosquitoes have become the most important single group of insects well known for their public health importance, since they act as the vector for many tropical and subtropical diseases such as dengue fever, yellow fever, malaria, filariasis and encephalitis of different types including, *Japanese encephalitis* (Hubalek and Haluzka, 1999). *Anopheles stephensi*, *Aedes aegypti* and *Culex quinquefasciatus* are the major urban vectors of malaria, dengue and lymphatic filariasis, respectively. Thus, one of the approaches for control of these mosquito-borne diseases is the interruption of disease transmission by killing or preventing mosquitoes from biting human beings (Egunyomi *et al*.,2010).
A large number of plant essential oils may be potential sources of mosquito larvicides, because they constitute a rich source of bioactive components (Lahlou *et al*., 2001; Cetin *et al*., 2004). Oils extracted from certain plants are also repellents of adult mosquitoes (Apiwat Tawatsin *et al*., 2006). *Anopheles stephensi* and *Culex quinquefasciatus* are two major human-biting mosquitoes in India.

The genus *Cinnamomum* Schaeffer (Lauraceae) comprises about 250 species which are distributed in tropics and sub-tropics. In India it is represented by 26 species of which12 species are recorded from South India. *Cinnamomum travancoricum* (Lauraceae), aromatic tree up to 9m tall is distributed mainly in the Southern Western Chats (Tirunelveli, Nilgiris, Mysore and Anamalais) of India. Perusal of available literature indicated that not much has been done on the bioactivity studies of the tree *Cinnamomum travancoricum*. The objective of this study was to evaluate the larvicidal activity of the essential oils isolated from the *C. travancoricum* to identify the larvicidal compounds from this oil against *Anopheles stephensi* and *Culex quinquefasciatus.*

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Materials and Methods

Plant material

Fresh barks of *Cinnamomum travancoricum* were collected from Karaiyar area of southern Western Ghats, Tirunelveli, Tamil Nadu, India.

Isolation of essential oils

Fresh *Cinnamomum travancoricum* barks were subjected to hydrodistillation for 6 hr using a Clevenger-type apparatus to obtain the oils. Essential oil was dried over anhydrous sodium sulfate prior to analysis.

Larvicidal assay against *Anopheles stephensi* and *Culex quinquefasciatus*

Third instar larvae of *Anopheles stephensi* and *Culex quinquefasciatus* were obtained from mosquito colony being maintained in laboratory conditions. For the bioassay, the essential oil isolated from the *Cinnamomum travancoricum* barks were placed in a 50ml beaker and DMSO (0.3ml) and water (19.7ml) was used to solubilize the oil concentrations of 0.50, 0.100, 0.200, and 0.400ppm doses were used in bioassays against *Anopheles stephensi* and *Culex quinquefasciatus* (third instar). With each experiment, a set of controls using 1% DMSO and untreated sets of larvae in tap water, were also run for comparison. Mortality was recorded after 24h of exposure during which no nutritional supplement was added. Data were evaluated through regression analysis. From the regression line, the LC_{50} values were read representing the lethal concentration for 50% larval mortality of *Anopheles stephensi* and *Culex quinquefasciatus.*

Statistical analysis

LC_{50} and regression values were calculated using the regression analysis program of Microsoft - Excel. Percentage mortalities were compared by a paired *t*- test (P>0.05).

Results and Discussion

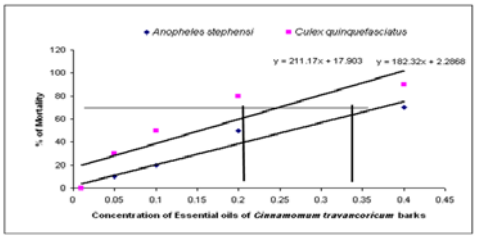
The essential oils from *Cinnamomum travancoricum* barks were brown in colour with an yield of 0.59 %. The mortality percentage of both the larvae *Anopheles stephensi* and *Culex quinquefasciatus* against different concentrations of essential oils of *Cinnamomum travancoricum* barks were presented in Table 1. Maximum percentage of mortality were observed on larvae of *C. quinquefasciatus* at different concentrations of oils was recorded in Fig.1. The maximum mortality of essential oils of *C. travancoricum* barks on the larvicidal activity of both the larvae of *Culex quinquefasciatus* and *Anopheles stephens* was 90% and 80% respectively.

Table-1: Larvicidal activity of essential oils of *Cinnamomum travancoricum* bark against *Anopheles stephensi* and *Culex quinquefasciatus*

Essential oils of Concentrations	% of Mortality (3hr)	
	Anopheles stephensi	*Culex quinquefasciatus*
0.01(Control)	0	0
0.05	10	30
0.1	20	50
0.2	50	80
0.4	70	90

Table-2: LC_{50} regression values of essential oils of *Cinnamomum travancoricum* bark against *Anopheles stephensi* and *Culex quinquefasciatus*

Sl.No	*Anopheles stephensi*	*Culex quinquefasciatus*
LC_{50}	0.17	0.278
R^2	0.9492	0.8016
Regression Equation	y = 211.17x + 17.903	y = 182.32x + 2.2868



The oils were tested in different concentrations to establish LC_{50} values of *Anopheles stephensi* and *Culex quinquefasciatus* were shown in Table 2. In the present study the essential oils isolated from the barks of *Cinnamomum travancoricum* is possessing triterpenoids. Previously reported that essential oils isolated from the several aromatic plants such as tumeric (*Curcuma longa*), citronella grass (*Cymbopogon winterianus*), and hairy basil (*Ocimum americanum*), were effective in repelling both diurnal and nocturnal mosquitoes (Tawatsin et al. 2001). Furthermore, the protection against *Cx. tritaeniorhynchus* and *Cx. quinquefasciatus*, the vectors of Japanese B encephalitis (Bram, 1967; Tanaka et al., 1979) and filariasis (Guptavanij *et al*.,1971), respectively, is considered as satisfactory. These findings indicated that the higher concentration of the essential oils of *C. travancoricum* were suited against *A. stephensi* and lower concentrations against *C. quinquefasciatus*. Our study clearly shows that a substantial difference in repellency obtained during 3hr exposure period of the minimum protection time needed against *A. stephensi* and *C. quinquefasciatus* specified for mosquito repellents. Our results are very promising in creating new effective and affordable approaches to the control of *A. stephensi* and *C. quinquefasciatus* and, other vector diseases spread by mosquito. Further studies will be going on elucidation and identification of essential oils composition of *C. travancoricum* barks

References

Aflatuni, A. 2003. The use of plant origin substances against *Galerucella sagitaria*. Proceeding of the Nordic Association of Agricultural Scientists 22nd Congress "Nordic Agriculture in Global Perspective", July 1-4 2003, Turku, Finland. Available at www.njf.dk/njf/reports/njfreports.htm.

Apiwat Tawatsin, Preecha Asavadachanukorn, and Usavadee Thavara,2006. Repellency of essential oils extracted from Plants in thailand against four mosquito vectors (diptera: culicidae) and oviposition deterrent Effects against *Aedes aegyptl* (Diptera: culicidae). *South East Asian J.Trop.Med.Pub.Health*,37:5:915-931.

Bram, R.A. 1967. The Genus *Culex* in Thailand (Diptera: Culicidae). Contrib.Am. Entomol. Inst. 12: 272 pp.

Cetin, H., Erler, F. and Yanikoglu, A. 2004. Larvicidal activity of a botanical natural product, AkseBio2, against *Culex pipiens*. *Fitot*., 75: 724-728.

Guptavanij, P., Harinasuta, C., Vutikes, S. and Deesin, T. 1971. The vectors of periodic and subperiodic *Brugia malayi* in Thailand. *Southeast Asian J. Trop. Med. Public Health*, 2: 589-590.

Ibrahim, A.M., Kainulainen, P., Aflatuni, A., Tiilikkala, K. and Holopainen, J.2001. Insecticidal, repellent, antimicrobial activity and phytotoxicity of essential oils: With special reference to limonene and its suitability for control of insect pests. *Agricultural and Food Science in Finland*, 10: 243–259.

Lahlou, M., Berrada, R., Hmamouchi, M. and Lyagoubi, M. 2001. Effect of some Moroccan medicinal plants on mosquito larvae. *Thérapie*, 56: 193-196.

Pillmoor, J. B., Wright, K. and Terry, A.S.1993. Natural products as a source of agrochemicals and leads for chemical synthesis. *Pestic. Sci.*, 39:131-140.

Tanaka, K., K. Mizusawa, and Saugstad, E.1979. Mosquitoes of Japan and Korea. *Contrib. Am. Entomol. Inst*.,16: 987.

Tawatsin, A., Wratten, S.D., Scott, R.R., Thavara, U. and Techadamrongsin, Y. 2001. Repellency of volatile oils from plants against three mosquito vectors. *J. Vector Ecol*., 26: 76-82.

Traboulsi, A.F., Taoubi, K., El-Haj, S., Bessiere, J.M. and Rammal, S. 2002. Insecticidal properties of essential plant oils against the mosquito *Culex pipiens molestus* (Diptera: Culicidae). *Pest Manag. Sci*., 58: 491-495.

Wink, M. 2003. Evolution of secondary metabolites from an ecological and molecular phylogenetic perspective. *Phytochem.*,64: 3-19.

Egunyomi, A., Gbadamosi, I.T. and Osiname, K.O.2010. Comparative effectiveness of ethnobotanical mosquito repellents used in Ibadan, Nigeria. *J. of Applied Biosci*., 36: 2383-2388.