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Larvicidal Activity of Grass Weed *Setaria viridis* Extracts

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Abstract: Mosquito-borne diseases are one of the major contributors to human mortality and morbidity, both in the tropics and in semi-tropics. The synthetic pesticides are being used for the control of vectors of these diseases, although there are cases where their continuous use can cause permanent debris and incidents that affect health of humans as well as animals. Aqueous, chloroform, methanol and ethanol extracts of grass weed *Setaria viridis* caused mortality against larvae of the genus *Anopheles stephensi* and *Culex quinquefasciatus*. Mortality was recorded after 24 h of exposure. For *Anopheles stephensi* 24 h LC₅₀ for aqueous, chloroform, ethanol and methanol extracts of *S. viridis* has been recorded as 39.538, 38.586, 35.531 and 37.797 ppm, respectively. For *Culex quinquefasciatus* 24 h LC₅₀ for aqueous, chloroform, ethanol and methanol extracts of *S. viridis* has been recorded as 53.471, 51.565, 48.103 and 49.787 ppm, respectively. It is inferred that extracts of *S. viridis* is more effective on *Anopheles stephensi* as compared to *Culex quinquefasciatus*.

Keywords: *Setaria viridis*, Larvicidal activity, Phytochemical, *Anopheles stephensi*, *Culex quinquefasciatus*

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Introduction

Mosquitoes play an important role in infecting many zoonotic diseases especially in the tropics and sub-tropics. These diseases are global as malaria and filariasis or viruses including jaundice, dengue (El-Bahnasawy *et al.*, 2013), West Nile Basin and Rift Valley fever (Aziz *et al.*, 2014). These infectious diseases were associated with the Middle East World (El-Bahnasawy *et al.*, 2010). It is not uncommon to supply mosquito nets and reduce mosquito-borne diseases in rural areas (Himeidan *et al.*, 2014). Therefore, control of mosquito larva prevents growing adult mosquito

thus preventing illness (Mackey *et al.*, 2014). Many plant species have been shown to be powerful against a variety of insect species including mosquitoes (Kobayashi *et al.*, 2008). Plants have rich contents of bioactive compounds (phytochemicals) including phenolics, terpenoids, coumarins and alkaloids. These phytochemicals contains compounds which are able to kill insects (Osorio *et al.*, 2014). We have evaluated the extracts of grass weed *Setaria viridis* for larvicidal activities against *Anopheles stephensi* and *Culex quinquefasciatus*. *Setaria viridis* is one of the oldest

plants in the world which is a small food crop in China and India, and is frequently grown for fodder or hen feeds, including in the USA, Canada and Australia. (Mansour *et al.*, 2004). *Setaria viridis* is drought tolerant, making them important plants in the arid region of northern China with annual rainfall of at least 100 to 400 mm (Doust *et al.*, 2009).

Materials and Methods

Grass weeds *Setaria viridis* were collected in and around Chennai district. The specimens were identified by Prof. P. Jayaraman, Plant Anatomy Research Center, Mudichur. The extracts (aqueous, chloroform, ethanol and methanol) were prepared and concentrated using rotary evaporation and the prepared extract was kept at 4 C until used.

4th instar mosquito larvae of *Anopheles stephensi* and *Culex quinquefasciatus* were selected

for the study. Mosquito larvae were procured from ERI. The experiment was done at Department of Microbiology and Biotechnology, BIHER, Tambaram. India.

S. viridis (aqueous, chloroform, ethanol and methanol) extracts were studied for its phytochemical profiling according to the methods of Diao (2005).

The larvae were exposed to various concentrations of aqueous, chloroform, ethanol and methanol extracts of *S. viridis* for 24 h. The mortality was recorded after 24 h and calculated using Abbott's formula (Diao, 2007). Probit analysis was used for calculating upper and lower limits.

Results and Discussion

Phytochemical analysis showed that the *S. viridis* grass weed extracts compounds such as

Table 1: Larvicidal activity of *S. viridis* grass extracts for *A. stephensi*

Extracts	Concentration (ppm)	24 h % Mortality	LC ₅₀ (LCL-UCL) (ppm)	LC ₉₀ (LCL-UCL) (ppm)	Chi-Sq
Aqueous	20	19	39.538 21.162-55.414	87.511 61.220-270.885	21.815
	40	42			
	60	71			
	80	100			
	100	100			
Chloroform	20	21	38.586 20.949-53.649	85.477 60.208-245.829	17.858
	40	44			
	60	67			
	80	90			
	100	100			
Ethanol	20	20	35.531 9.155-55.816	74.332 48.646-688.333	18.671
	40	43			
	60	65			
	80	89			
	100	100			
Methanol	20	24	37.797 14.254-56.993	73.661 50.130-377.927	30.450
	40	47			
	60	70			
	80	100			
	100	100			

Table 2: Larvicidal activity of *S. viridis* grass extracts for *Culex quinquefasciatus*

Extracts	Concentration (ppm)	24 h % Mortality	LC ₅₀ (LCL-UCL) (ppm)	LC ₉₀ (LCL-UCL) (ppm)	Chi-Sq
Aqueous	20	15	53.471 33.322-80.382	138.731 88.600-874.306	15.235
	40	34			
	60	52			
	80	74			
	100	98			
Chloroform	20	14	51.665 31.475-75.905	124.635 82.267-649.810	16.856
	40	29			
	60	49			
	80	72			
	100	93			
Ethanol	20	14	48.103 23.787-74.218	112.621 73.333-946.409	22.336
	40	31			
	60	47			
	80	66			
	100	91			
Methanol	20	13	49.787 28.496-72.773	109.888 74.549-535.037	20.286
	40	27			
	60	56			
	80	74			
	100	97			

flavonoids, phenol, alkaloids, glycosides, terpenoids and triterpenoids etc.

Larvicidal activities of extracts of *S. viridis* against *A. stephensi* and *Culex quinquefasciatus* are presented in Tables 1 and 2, respectively. Mortality was not observed in untreated control. The extracts showed a dose-dependent toxicity to *A. stephensi* and *C. quinquefasciatus* larvae (Tables 1, 2). For *Anopheles stephensi* 24 h LC₅₀ for aqueous, chloroform, ethanol and methanol extracts of *S. viridis* has been recorded as 39.538, 38.586, 35.531 and 37.797 ppm, respectively (Table 1). For *Culex quinquefasciatus* 24 h LC₅₀ for aqueous, chloroform, ethanol and methanol extracts of *S. viridis* has been recorded as 53.471, 51.565, 48.103 and 49.787 ppm, respectively (Table 2). It is inferred that extracts of *S. viridis* is more effective on *Anopheles stephensi* as compared to *Culex quinquefasciatus*.

Lessening mosquito-borne infections pose a major challenge during present days (Gnanasekar and Alagarmalai, 2016). Mosquitoes in the larval stage are targets for pesticides in light of the fact that they are bound to water and their habitat is effectively treatable. Killing the larval stage is advantageous because the adult mosquitoes would not develop and thus can not produce illness in humans (Hardin and Jackson, 2009). The use of synthetic insecticides to control mosquitoes has caused many hazards to humans and other animals. Moreover, mosquitoes developed resistance to these insecticides (Lima *et al.*, 2011). The observations of the present study are similar with earlier reports describing larvicidal action of plant extracts against *Culex quinquefasciatus* (Tandon and Sirohi, 2010). The present study also derives support from studies of Rajmohan and Ramaswamy (2007) who have also noticed larvicidal activity of leaf extract of weed plant,

Ageratina adenophora against *Aedes aegyptii* and *Culex quinquefasciatus*. Nataya *et al.* (2010) have reported larvicidal effects of plant-derived essential oils against *Aedes aegyptii*. Larvicidal activity of medicinal plants has also been reported against *Anopheles subpictus* and *Culex tritaeniorhynchus* (Kamaraj *et al.*, 2011). In view of the larvicidal effects of *S. viridis*, it might be used as an insect sprays.

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