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Efficacy of some plant extracts on larval mortality of *Culex quinquefasciatus* (Say) (Diptera: Culicidae) in Peshawar

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Abstract
Culex quinquefasciatus vectors *Wuchereria bancrofti,* which causes Lymphatic filariasis, a hurting and extremely disfiguring disease, in millions of people in tropical and subtropical areas of the world each year. Synthetic insecticides have been mainly used for the control of the insect vector. In the present research efficacy of some plant extracts in ethanol solvent on larval mortality of *C. quinquefasciatus* after 24 hrs was tested at the Nuclear Institute for Food and Agriculture (NIFA), Peshawar during 2013. LC_{50} and LC_{95} values of the plant extracts were also determined. The experiment was laid out in CR Design with 6 treatments, *i.e.* lemon juice, lemon grass, basil, thyme, fruit of bitter gourd and control, each replicated three times. The plant extracts were tested each in five concentrations of 200, 300, 500, 700 and 1000 ppm. The results indicated significance differences in *C. quinquefasciatus* mortalities caused by different treatments and control. Thyme and bitter gourd gave 100% mortalities of the insect at all the concentrations in ethanol extract. LC_{50} value was highest for lemon juice (694.004) and LC_{95} value was highest for basil (7102.726) after 24 hrs in ethanol extract. The study recommended that the plant extracts should be tested at lower concentrations as many of the extracts yielded 100% mortalities at higher concentrations.

Keywords: *C. quinquefasciatus,* Ethanol solvent extract, LC_{50}, LC_{95}, Mortality.

1. Introduction
Culex quinquefasciatus (Say) (Diptera: Culicidae) is a cosmopolitan mosquito species found in tropical, subtropical, and warm temperate regions of the world. It is one of the most successful mosquito species because it can breed in almost all type of habitats such as ponds, stagnant water, roadside ditches, freshwater ponds, banks of rivers and natural streams, etc. [1].
In Pakistan, it is found in abundance everywhere except the northern colder areas where temperature goes below zero ºC. In southern parts of the country diverse variety of the mosquitoes can be found. In Khyber Pakhtunkhwa due to suitable environmental conditions throughout the province and the ability of mosquito adaptation to diverse environmental conditions has led it to survive everywhere [2].
C. quinquefasciatus acts as a vector of *Wuchereria bancrofti* which causes Lymphatic filariasis, commonly known as elephantiasis which is a hurting and extremely disfiguring disease [3]. 120 million people in tropical and subtropical areas of the world suffered from lymphatic filariasis. Among these infected people, about 25 million men suffered with genital disease most commonly hydrocele, and 15 million (mostly women) suffered with lymphoedema or elephantiasis of leg [4]. In 2001, confirmed cases of Tropical Pulmonary Eosinophilia (TPE) were reported in indigenous patients; however the disease is rare in Pakistan [5].
Mosquito control is effective in larval stage. Larviciding is one approach to vector control, which is carried out at breeding sites of the vectors before they emerge as adults. Larval stages breed in water and can be more easily dealt with in this habitat; therefore, they are attractive targets for pesticides [6].
Chemical control is an effective control for pests used mostly in daily life. Synthetic pesticides are mostly used in the world for controlling pests including mosquitoes. But there are many draw backs of using synthetic pesticides such as these have residual effects and they also kill non- harmful insects so most of the synthetic pesticides have environmental issues. The mosquitoes also get resistance to insecticides with passage of time.

Many researchers and scholars have reported the use of essential oils and plants extracts to control mosquito larvae. The effect of crude latex produced from green parts of the plant was tested against egg hatching and larval development of mosquitoes. The methanolic extract and fresh aqueous leaf extracts showed good larvicidal properties against mosquitoes [7].

Keeping in view the importance of plant extracts as safe and major alternative to synthetic insecticides, the present study aimed to test larvicidal efficacy of some plant extracts in water solvent against *C. quinquefasciatus* under laboratory conditions.

2. Materials and Methods

The experiment on the efficacy of some plant extracts on larval mortality of *C. quinquefasciatus* was carried out at the Nuclear Institute for Food and Agriculture (NIFA), Peshawar during 2013. In the present study, five plant extracts, i.e., *Cymbopogo nictratus* (Lemon grass), *Thymus vulgaris* (Thyme), *Citrus lemon* (lemon), *Ocimum basilicum* (basil) and *Momordica charantia* (Bitter gourd) were used against 3rd instar *C. quinquefasciatus* larvae, for studying their efficacy in controlling this pest species.

2.1 Preparation of plant extracts

Green leaves of *C. citratus*, *T. vulgaris*, *C. lemon*, *O. basilicum* and *M. charantia* of selected plants were collected from Pakistan Forest Institute, Peshawar and washed with sterile distilled water. Leaves were dried under shadow at room temperature except in case of bitter gourd in which fruit was ground into powder and stored in dark sterile glass bottles. Measured amount (10 grams) of dry plant material was mixed in 100 ml ethanol (C_2H_5OH) separately to make a homogenous mixture. The mixtures were kept sealed for three days at room temperature in dark.

After three days the mixture was filtered through Whatman No. 41 filter paper in a Buchner funnel. A measured amount of filtrate obtained was taken in China dishes and incubated in vacuum dry oven at 45 ℃ until the solvent evaporated completely.

2.2 Mosquito larvae collection and bioassay procedures

C. quinquefasciatus larvae were collected from different breeding places, i.e. irrigation channels, pits, pools, drainage channels, river banks, etc. The collected samples were brought to the Medical Laboratory at Entomology Division of NIFA, separated *C. quinquefasciatus* on external morphological basis and were placed in plastic tubs with 1L water to establish their culture. Twenty five early 3rd instar larvae of *C. quinquefasciatus* were piped out from the stock culture established at laboratory and transferred to the plastic cup having 100 ml water. Different concentrations (from 200 ppm to 1000 ppm) of plant extracts of *C. citratus*, *T. vulgaris*, *C. lemon*, *O. basilicum* and *M. charantia* were prepared and added to each plastic cup. Mortality was recorded after 24 hrs for each concentration.

2.3 Statistical analysis

The experiment was laid out in two factorial arrangements with three replications. LC_{50} and LC_{95} were calculated using PoloPlus version 2.0 and SPSS version 2007 [8].

3. Results and Discussion

3.1 Efficacy of plant extracts in ethanol solvent on *C. quinquefasciatus* larval mortality after 24hrs

Table 1 showed that after 24 hrs of treatment, mortality of *C. Quinquefasciatus* larvae at 200 and 300 ppm of the plant extracts was significantly higher with thyme (100%) as well as bitter gourd (100%) and lower with lemon juice (8% and 26.66%). Mortality of the larvae was significantly higher in all the treatments than in control (1.3% and 8.66%). At 500 and 700 ppm mortality of the larvae was significantly higher with thyme and bitter gourd (100% each) and lower with lemon grass (41.33%, 54.66%), basil (46.66%, 50.66%) and lemon juice (42.66%, 54.66%). Mortality of the larvae was significantly higher in all the treatments than in control (1.66% and 9.33%). At 1000 ppm highest mortality of the larvae was recorded with thyme (100%) and bitter gourd (100%) while lowest with basil (56.67%) and lemon juice (56.0%). Mortality of the larvae was significantly higher in all the treatments than in control (17.33%). Mean mortality of the larvae was significantly higher with thyme (100%) and bitter gourd (100%) and lower with lemon juice (37.60%). In control lowest mean mortality (7.46%) of the larvae was recorded. These results were in accordance with those of some earlier researchers. They recorded more than 60% mortality of *C. quinquefasciatus* after 24 hours exposure to thyme in ethanol extract at 1.8mg/l [9].

Table 1: Efficacy of plant extracts in ethanol solvent on *C. quinquefasciatus* larval mortality after 24 hrs during 2013.

Treatment	Mortality (%) of *C. quinquefasciatus* larvae at different concentrations (ppm) of plant extracts					
	200 ppm	300 ppm	500 ppm	700 ppm	1000 ppm	Mean
Lemon grass	12hi	33.33f	41.33e	54.66c	70.66b	42.40b
Thyme	100a	100a	100a	100a	100a	100a
Basil	14.66h	30.66fg	46.66de	50.66cd	56.67c	39.87bc
Lemon juice	8ij	26.66g	42.66e	54.66c	56c	37.60c
Bitter guard	100a	100a	100a	100a	100a	100a
Control	1.3k	8.66hi	1.66jk	9.33h	17.33g	7.46df
Mean	39.11d	50.22ca	55.11bc	61.56abc	66.78a	

Means within a column followed by different letters are significantly different at 5% level of significance (LSD Test).
LSD value for treatment= 3.29; LSD value for concentration = 7.27; LSD value for interaction means = 7.27

3.2 LC_{50} and LC_{95} values of plant extract in ethanol solvent against *C. quinquefasciatus* larvae after 24 hrs

Table 2 showed the LC_{50} and LC_{95} values at 5% level of significance for plant extracts in ethanol solvent against *C. quinquefasciatus* larvae after 24h. The results showed that LC_{50} values were highest for lemon juice (694.004) and basil (691.682) while lowest for lemon grass (421.31). The LC_{95} values were highest for basil (7102.726) and lemon grass (5269.642) while lowest for lemon juice (4341.70). The slope was highest of 2.066±0.293 for lemon juice and lowest of 0.000+333247 each for thyme and bitter gourd. The Chi-square value was highest for lemon juice with 5.13 and lowest for lemon grass with 1.89. These results were in accordance with that of [10]. According to them the LC_{50} and LC_{95} values of bitter gourd were 101.18 and 322.81ppm, respectively.

Table 2: LC_{50} and LC_{95} values of plant extracts in ethanol solvent against *C. quinquefasciatus* larvae after 24 hrs during 2013.

Treatment	LC_{50}	95% confidence interval		LC_{95}	95% confidence interval		Slope	Chi- square
		Lower bound	Upper bound		Lower bound	Upper bound		
Lemon grass	421.31	335.14	516.72	5269.64	2725.32	20398.35	1.499±.270	1.89
Thyme	*	*	*	*	*	*	.000±333247	
Basil	691.68	569.51	917.819	7102.726	3552.252	28110.610	1.666±.279	2.84
Lemon juice	694.00	503.40	1343.52	4341.70	1876.93	100661.35	2.066±.293	5.13
Bitter guard	*	*	*	*	*	*	.000±333247	

*LC_{50} and LC_{90} values for thyme and bitter guard cannot be calculated because it gave 100% mortalities of the larvae at all the concentrations.

3.3 Conclusion

Among the five plant extracts tested against *C. quinquefasciatus* larvae, thyme and bitter gourd gave 100% mortalities of the larvae at all the concentrations in ethanol extract. LC_{50} value was highest for lemon juice and LC_{95} value was highest for basil after 24 hrs in ethanol extract. The study recommends that the plant extracts should be tested at lower concentrations as many of the extracts yielded 100% mortalities at higher concentrations.

4. References

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