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The efficacy of some plant extracts against *Culex quinquefasciatus* (Say) (Diptera: Culicidae)

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Abstract
Efficacy of some plant extracts on larval mortality of *Culex quinquefasciatus* in water solvent after 24 hr 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. Each plant extract was tested in five concentrations i.e. 200, 300, 500, 700 and 1000ppm. The results indicated significant differences in *Cx. quinquefasciatus* mortalities caused by treatments and control. Lemon juice in water extract yielded higher *Cx. quinquefasciatus* mortalities of 42% after 24 hours. LC_{50} value was highest for bitter gourd (1593.96) and lowest for lemon juice (630.50) while LC_{95} value was highest for bitter gourd (66749.45) and lowest for lemon grass (2535.34) after 24 hrs in water extract. The study recommends that the plant extracts should be tested at lower concentrations as they have shown mortalities on different doses but many of the extracts yielded 100% mortalities at higher concentrations.

Keywords: Water extracts, Mortality, LC_{50}, LC_{95}, *Cx. Quinquefasciatus*

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. [5].
In Pakistan it is found in abundance everywhere except the northern colder areas where temperature goes below zero. In southern parts of the country diverse variety of the mosquitoes can be found. Due to suitable environmental conditions throughout Khyber Pakhtunkhwa and the adaptation ability of mosquito to diverse environmental conditions, has led it to survive everywhere [6].
Cx. quinquefasciatus acts as a vector of *Wuchereria bancrofti* which causes Lymphatic filariasis, commonly known as elephantiasis is a hurting and extremely disfigure disease [4].
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. In 2001, confirmed cases of Tropical Pulmonary Eosinophilia (TPE) were reported in indigenous patients; however the disease is rare in Pakistan [2].
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 [3].
Keeping in view the importance of plant extracts as safe and major alternative to synthetic insecticides, the present study was aimed to test larvicidal efficacy of some plant extracts against *Cx. quinquefasciatus* under laboratory conditions.

2. Materials and methods
The present study on the efficacy of some plant extracts on larval mortality of *Cx. quinquefasciatus* was carried out at the Nuclear Institute for Food and Agriculture (NIFA), Peshawar during 2013. During the experiment 3rd instar *Cx. quinquefasciatus* larvae and five plant extracts, i.e *Cymbopogon citratus* (Lemon grass), *Thymus vulgaris* (Thyme), *Citrus lemon* (lemon), *Ocimum basilicum* (basil) and *Momordica charantia* (Bitter gourd) were used.

2.1 Preparation of Extracts

Green leaves of *Cymbopogon citratus* (Lemon grass), *Thymus vulgaris* (Thyme), *Citrus lemon* (lemon), *Ocimum basilicum* (basil) and *Momordica charantia* (Bitter gourd) 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 deionized distilled water (H_2O) and 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 45^0C until the solvent evaporated completely.

2.2 Mosquito larvae Collection and Bioassay Procedures

Cu.quinquefasciatus larvae were collected from different breeding places, i.e. irrigation channels, pits, pools, drainage channels, river banks, etc. The collection was brought to the Medical Laboratory at Entomology Division of NIFA, separated *Cx.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 *Cx.Quinquefasciatus* were piped out from the stock culture established at lab and transferred to the plastic cup having 100 ml water. Different concentrations (from 200ppm to 1000ppm) of plant extracts i.e *Cymbopogon citratus* (Lemon grass), *Thymus vulgaris* (Thyme), *Citrus lemon* (lemon), *Ocimum basilicum* (basil) and *Momordica charantia* (Bitter gourd) were prepared and added to each plastic cup. Mortality was recorded after 24 hours for each concentration. The experiment was laid out in two factorial arrangements with three replications. LC_{50} and $LC_{95}$was calculated using Polo Plus software and SPSS software.

3. Results

The results (table 1) shows that after 24h of treatment mortality of *Cx. quinquefasciatus* at 200 and 300 ppm of the plant extracts was significantly higher with lemon juice (26%and 26%) as well as lemon grass (2.66% and 26.66%) and lower with basil (0% and 16%). Mortality of the larvae was significantly higher in all the treatments than in control (3.33% and 10.67%). At 500ppm mortality of the larvae was significantly higher with lemon juice and bitter gourd (37.33% and 32%) and lower with thyme (24%). Mortality of the larvae was significantly higher in all the treatments than in control (0%). At 700ppm significantly highest mortality of the larvae was recorded with lemon grass (61.33%) and lemon juice (54.66%) while lowest with bitter gourd (36%). Mortality of the larvae was significantly higher in all the treatments than in control (9.33%). Lemon juice and lemon grass caused highest mortalities (66.66% and 65.33%) at 1000ppm, while bitter gourd lowest mortality (41%). In control lowest mortality (17.33%) of the larvae was recorded. Among the treatments lemon juice resulted in significantly higher mean mortality of 42.40% of the larvae while thyme in lowest mortality of 27.73%. Mean mortality of the larvae in control was significantly lower (8.13%) than all the treatments.

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

Treatment	Mortality (%) of *Cx. quinquefasciatus* larvae at different concentration(ppm) of plant extracts					Mean
	200	300	500	700	1000	
Lemon grass	2.66pq	26.66hij	27.33hij	61.33ab	65.33a	36.67ab
Thyme	5.33opq	18.66kl	24ijk	40ef	50.66cd	27.73c
Basil	0p	16lm	30.66ghi	45.33de	53.33c	29.07bc
Lemon juice	26.67hij	26.67hij	37.33fg	54.66bc	66.66a	42.40ab
Bitter gourd	18.66kl	21.33jkl	32gh	36fg	41.33ef	29.87bc
Control	3.33opq	10.67mno	0q	9.33nop	17.33klm	8.13d
Mean	9.44d	20.00c	25.22c	41.11b	49.11a	

Means with in a column followed by different letters are significantly different at 5% level of significance (LSD Test)
LSD value for treatment = 8.02
LSD value for concentration = 7.81
LSD value for means = 7.81.

3.1 LC_{50} and LC_{95} values of plant extracts in water solvent against *Culex quinquefasciatus* after 24 hrs

Table 3.2 shows the LC_{50} and LC_{95} values at 5% level of significance for plant extracts in water solvent against *C. quinquefasciatus* larvae after 24h. The results showed that LC_{50} value was highest for bitter gourd (1593.96) and lowest for lemon juice (630.50) while LC_{95} value was highest for bitter gourd (66749.45) and lowest for lemon grass (2535.34). The slope was highest of 2.783±0.318 for lemon grass and lowest of 1.014+ 0.281 for bitter gourd. The Chi-square value for lemon grass and bitter gourd was 11.12 and 0.243.

Table 2: LC_{50} and LC_{95} values of plant extracts in water solvent against *Cx. quinquefasciatus* 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	650.27	443.494	1442.08	2535.33	1248.68	106993.73	2.78±.31	11.12
Thyme	966.29	795.662	1311.58	5823.40	3330.82	15972.57	2.10±0.31	2.22
Basil	825.62	608.845	1741.94	3180.60	1618.89	50868.92	2.74±0.34	6.85
Lemon juice	630.50	533.401	783.53	4833.92	2805.69	12928.11	1.85±0.28	1.34
Bitter gourd	1593.96	980.827	6924.42	66749.44	11648.69	23027356.23	1.01±0.28	.243

4. Discussion

Many studies have been conducted on plant extracts against various pests of crops and vegetables as well as pests of household man and animal. Our study revealed that lowest mortality was recorded at lowest concentration of the plant extracts. It indicated that increase in concentration of the plant extracts resulted increase in the mortality of the larvae. Significant differences among different treatments as well as control were recorded at each concentration. Lemon juice was observed with the highest overall mortality of the larvae while mortality rate of larvae in the control was noted to be lowest. It concluded that all the plant extracts were effective in the mortality of mosquito larvae. According to ([1]) C. citrates showed larvicidal activity against *Cx Quinquefasciatus* at concentration of 1000-10000ppm, whereas *Ocimum basilicum* extract gave 50% mortality within the same concentrations.

As indicated from the percent mortalities that lemon juice caused highest mortalities therefore LC_{50} value was recorded lowest showing the more toxic effect of lemon juice extract against *Cx. quinquefasciatus* larvae. LC_{95} value of lemon grass was less as compared to other treatments showing more toxicity against the mosquitoes larvae. The lower the LC_{50} and LC_{90} values the higher the toxic effect and vice versa.

5. Conclusion

Lemon juice in water extract caused significantly higher mortalities of 42% of *Culex quinquefasciatus* larvae after 24 hours as compared to other treatments. The recorded LC_{50} value was highest for bitter gourd (1593.96) and lowest for lemon juice (630.50) while LC_{95} value was highest for bitter gourd (66749.45) and lowest for lemon grass (2535.34) after 24 hrs in water extracts. Based on mentioned findings the study recommends that the plant extract should be tested at lower concentration as many of the extracts recorded 100% mortality at higher concentrations.

6. References

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