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Research Article

Evaluation of mosquito ovitraps in different localities of Multan

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ABSTRACT

The objective of the study was to check the efficacy of ovitraps and assess whether variation in the breeding habitat type and water quality parameters can affect the abundance of larvae in an ovitrap. This study was conducted in different localities of Multan including Awami Nursery near High Court, Canal colony old Bahawalpur road, Nishter colony, Nishter hospital Multan, B-block MRI research area MNS-University of Agriculture Multan (MNS-UAM). A pair of ovitraps was placed in each locality. Data was collected on weekly basis to determine the presence of mosquito larvae; the collected specimens were brought to laboratory for identification purpose. The data so collected was analyzed statistically by using SPSS-16. Results of this study have shown that a total of 12,377 mosquito larvae including three species; *Culex quinquefasciatus, Cx. vagans, Cx. fuscocephala* were collected from the ovitraps out of which *Cx. quinquefasciatus* (5815) found most abundant. Highest number of larvae was recorded during the month of October. *Culex vagans, Cx. fuscocephala, Cx. quinquefasciatus* were found the most abundant species during the months of October and November. Among various water types in ovitraps, *Cx. quinquefasciatus* found in excessive quantity than *Cx. vagans* in ovitraps containing turbid water whereas *Cx. vagans* found more abundant in turbid foul. *Culex fuscocephala* was recorded in lesser number than *Cx. quinquefasciatus* in turbid foul water. It was concluded that ovitrap is a good surveillance technique to monitor mosquito population.

Keywords: ***Culex quinquefasciatus, Cx. vagans, Cx. fuscocephala,* turbid foul water**

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Introduction

Mosquitoes are the most important among other arthropod vectors of human disease in the tropic and are notoriously responsible for causing much greater depression to mankind than all other combined together (Qureshi et al., 2017). Mosquitoes are dipterous flies belonging to the family Culicidae and are currently the most extensively studied group of hematophagous insects. In the present scenario, mosquitoes are affecting the human life either through direct or indirect ways. Mosquitoes act as vector of protozoan, helminthes and viral agents. Besides they cause discomfort, annoyance and blood loss to the host. Immature stages of mosquitoes live in water and play vital role in aquatic food chain. Most species of mosquitoes suck blood from various species of animals including human, and many are vectors of various diseases of man including Malaria, Yellow fever, Dengue fever, West Nile Encephalitis, Chickungunya, Zika (Rueda, 2008) etc.

The development of mosquitoes from immature to adult needs aquatic habitats with varying chemical and physical properties which vary among species (Muturi et al., 2007). Around 3 billion individuals every year are basically infected by this viral malady (Guzman et al., 2010). Huge populace of mosquitoes can endure wherever under ideal biological conditions. Thereby, prevention and control ought to be focused by maintaining a

strategic distance from human interaction with mosquitoes, decline in adult mosquito populaces and removal of mosquito's larval habitats (Gubler, 1998). Most of studies assume the relation between habitat and increasing population of mosquito larvae (Muturi et al., 2007). Developing cities of the world are facing many problems including mosquito borne diseases, due to uncontrolled urbanization, poor sanitation and un-hygienic conditions. This problem is happening in rural areas with more severity, where undeveloped sewerage system and intensive agriculture using well irrigation support high population of mosquitoes (Pandian et al., 1997). The same situation is being faced by Multan which is located almost in center of the country and serves as hub of agriculture. Most species of mosquitoes prefer different habitats for egg laying and depend on physico-chemical properties of water body (Piyaratnea et al., 2005). Ovitrap surveillance is the most common sampling method to monitor mosquito population through their egg laying activities (Devi et al., 2013). Ovitraps represents a sampling procedure that is broadly used to assemble indirect indices of adult abundance of species breed in containers, got from the quantity of eggs laid, and to survey their spatial/temporal circulation. Ovitraps are dark containers loaded up with water and furnished with a hardboard paddle on which *Stegomyia* females lay eggs (Facchinelli et al., 2007). Mosquitoes of various species lay their eggs in various water sources that range from little containers to enormous fields of marsh. Basic breeding sites for mosquitoes are waste trench, parks, sewerage water, lakes, jars, leakage pool, tires and tree holes. The eggs of certain mosquitoes may dry out for over a year and rose out as larvae when flooded (Koehler, 1999). *Culex quinquefasciatus* is a typical urban mosquito with profoundly endophilic and anthropophilic behaviour. Its breeding sites are generally situated inside or close to houses. In Recife, territory of Pernambuco, Brazil, climatic elements and deficient sanitation add to high mosquito production all year, for the most part in cesspits and channels (Regis et al., 2008). *Cx. quinquefasciatus* is exclusively responsible for endemic status of lymphatic filariasis (Regis et al., 2008; Fontes et al., 2005). Monitoring of mosquitoes in ovitraps and to identify them to species level can give basic data to focusing on the control of mosquito endeavors as well as to appraise the possible activity of pathogen in particular region. Control of mosquito intercession needs information of mosquito reproducing action and its habitat (Muturi et al., 2007).

This study was planned to check the efficacy of ovitraps and assess whether variation in the breeding habitat type and water quality parameters can affect the larvae abundance in an ovitrap. The result of this study is vital, as it enables us to monitor the larval mosquito occurrence for efficient mosquito control.

Materials and methods

Research was conducted in urban and rural areas of Multan city which is situated in the center of Punjab at latitude of 30.1984 N° and longitude 71.4687°E. Highest and lowest average temperature is approximately 45°C and 1°C, in months of June and December, respectively. The average rainfall is approximately 186 mm per year. Multan features an arid climate with very hot summers and mild winters. Various locations in rural and urban areas of Multan were selected for installing ovitraps including Awami Nursery near High Court (Community A), Canal colony, old Bahawalpur road (Community B), Nishter colony, Nishter Hospital Multan (Community C), B-block Mango Research Institute (MRI), research area MNS-University of Agriculture (MNS-UAM) (Community D). Traps were placed in parks, nurseries, houses and near agriculture fields in the above mentioned locations. Ovitrap had a detachable paddle / filter, a thin strip of hard-board (10-12.5 cm x 2.5 cm) for mosquitoes to lay eggs on them (Qureshi et al., 2017). Two holes on both sides of trap were made for the overflow of water.

A pair of ovitraps was placed in each location. Immature stages especially larvae of mosquitoes were collected weekly for 14

weeks from September to December 2018. After collection of immature stages, fresh water was added to traps and the ovitraps were washed thoroughly to remove any leftover living form (Qureshi et al., 2017). Immature were sieved out with the help of muslin cloth from the ovitrap and were transferred into plastic bottles containing fresh water. Collected larvae were taken in 250 ml plastic bottles and were given hot water treatment to avoid denaturation and then preserved in 75% ethyl alcohol in Ecology Lab MNS-UAM. Physico-Chemical properties of water were measured before removing it from the trap. Among these, water quality characteristics of trap water like clear, clear foul, turbid foul, turbid etc. were noted. Moreover, pH, Electrical Conductivity dS/m (EC), Total Dissolved Solids ppm (TDS) and Temperature ºC (T) of trap water were recorded with the help of hand-held measuring devices. Relative Humidity (RH) of surrounding was also recorded. Larvae were identified with the help of microscope up to species level by using the taxonomic keys (Christopher 1933; Barraud 1934; Harbach, 1985; Darsie and Pradhan, 1990; Rueda, 2004). The data so collected was analyzed statistically by using SPSS 16. Association between ovitrap positivity and environmental and climatic factors was found out by chi-square test. $P<0.5$ was considered significant.

Results

A total of 13273 larvae were collected during the study period from ovitraps but only three species were identified belonging to genera *Culex*. All the identified specimens were preserved in Ecology Lab Department of Entomology MNS-UAM, Multan, for future reference.

Among the recorded species, *Cx. quinquefasciatus* was the most dominating species (47%) followed by *Cx. vagans* (27%) and *Cx. fuscocephala* (26%), respectively (Fig. 1). The results show that *Cx. vagans* was more abundant in Community A and was also present in the other sites whereas, *Cx. fuscocephala* was more abundant in Community B and Community D. Similarly, *Cx. quinquefasciatus* was found to be most abundant in Community C.

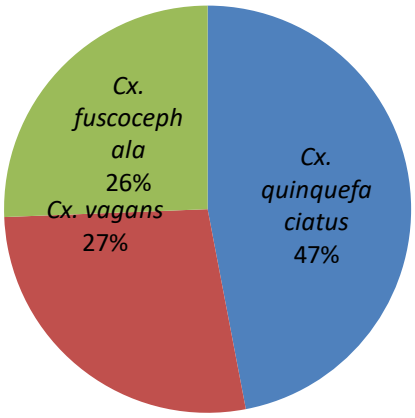

Fig. 1. %age of identified species

Water quality parameters were also recorded and species preference was related to the quality of water. It was observed that all the three species were abundant in Turbid water followed by turbid foul, whereas minimum population of all three species was recorded from clear foul type of water. A detailed description of the preferred water types is given in Fig. 2.

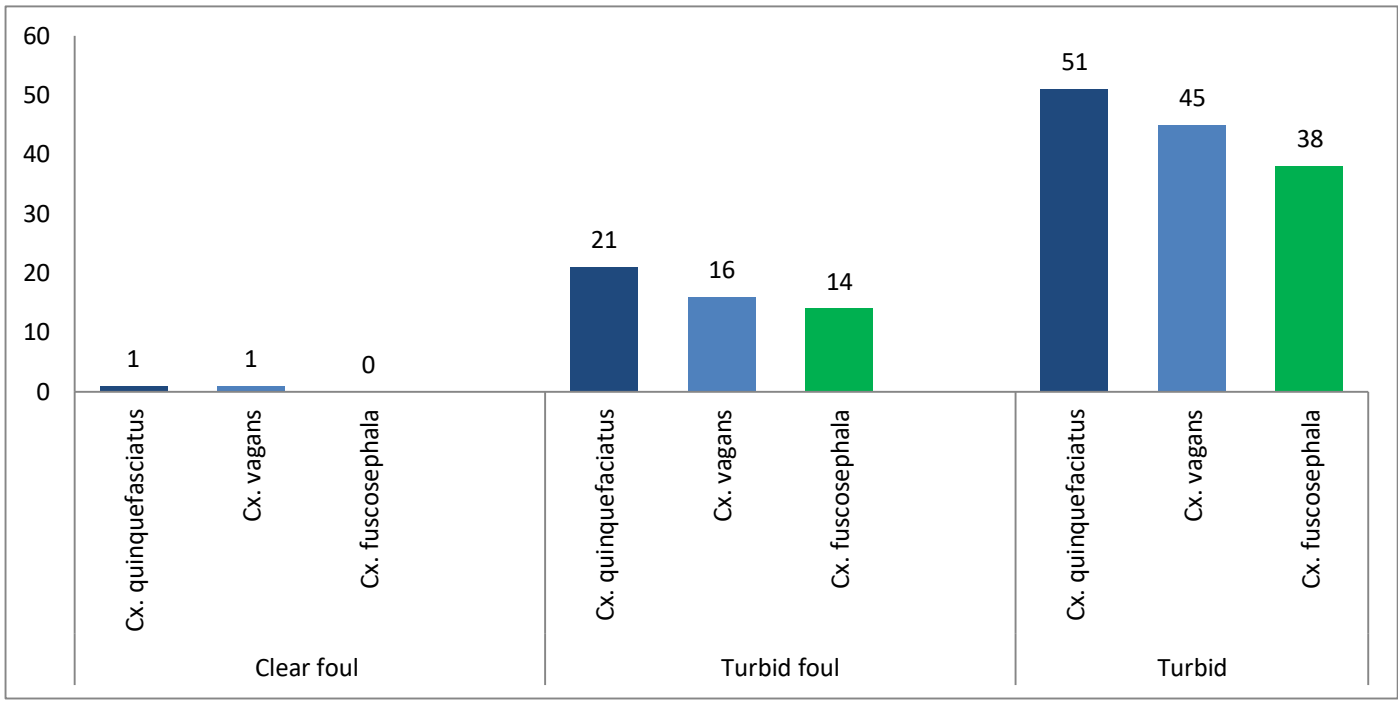

Fig. 2. Occurrence of Species in relation to water quality

Considering the physico-morphic characters of water including EC, pH and TDS, the recorded values were divided into quadrates and each parameter was related to the species in terms of the most suitable value for the occurrence of different species (Table. 1). The lowest and highest values for EC, pH and TDS were 623 - 847, 6.3 - 7.2 and 324 - 459 respectively.

Table. 1. Relation of Physico-chemical properties of ovitraps water with species

	Cx. quinquefasciatus	***Cx. Vagans***	***Cx. fuscocephala***
EC (dS/m)	679 – 790	678 - 847	734 – 847
TDS (ppm)	357 – 459	357.8 -391.5	357 – 459
pH	6.76 - 6.97	6.76 - 6.79	6.76 - 6.97

Relative humidity and temperature were also recorded. The lowest value observed for R.H was 20% and for temperature it was 19 ^{o}C, and the highest values were recorded to be 80% and 38 ^{o}C respectively. It was observed that *Cx. quinquefasciatus* and *Cx. vagans* were most abundant at R.H. of 30-50 % whereas *Cx. fuscocephala* was found to be abundant at R.H of 40-50%. In terms of temperature most suitable temperature range for *Cx. quinquefasciatus, Cx. vagans* and *Cx. fuscocephala* was 30-40 C^{o}, 25-35 ^{o}C and 30-32 ^{o}C respectively.

Discussion

Temporary water habitats such as ditches, ponds, rain pools, irrigation channels and open pits are recorded as preferred habitats for mosquito breeding (Seid, et al., 2013). Yadav, et al., 1989, also discussed that temporary, river pools, permanent (pond, wells and river) semi-permanent (small channels, ovitraps and man-made containers) also serve as major breeding habitats of different mosquito species. Present study also depicts that *Culex* larvae were highly abundant in ovitraps, so these can also be referred as preferred habitat for *Culex*. Vinagradova, 2000, stated that improvements in human activities are causing fluctuation in the environmental factors governing the ecosystem that enhance the habitat of these species in the environment. In the current study three species of *Culex* were recorded from ovitraps, while *Cx. quinquefasciatus* being most abundant specie. The results depict that ovitraps are highly preferred by this species, while the results of (Seid, et al., 2013) showed that other temporary water bodies were recorded as preferred habitats for *Cx. quinquefasciatus* immature.

The larvae of *Cx. vagans* were mostly recorded from different types of water from ovitraps viz., clear water, turbid, turbid foul, clear foul and contaminated water habitats naturally as well as artificially contaminated by organic and artificially with the help of industrialization due to urbanization in the cities. In the present study *Cx. fuscocephala* was recorded in turbid foul water in ovitraps that is contaminated naturally or artificially.

Cx. quinquefasciatus was recorded as most common species in Turkey, it was mostly found in the months of May to September. According to the study of Bosgelmez, et al., in 1995 on species composition in turkey, it was found that the population of *Cx. quinquefasciatus* was low in June and July but population increased in August and September respectively. Current study also represents the positive relation to increase population fluctuation of this species. According to another study of (Alten, et al., 2000), it was revealed that this specie was abundant in rural area and they collected this species from ovitraps. While in the present study *Cx. quinquefasciatus* was recorded from urban areas from ovitraps.
Gupta, 1998, studied culicine species *viz., Cx. quinquefasciatus* was found at mostly all types of water habitat such as pools, parks, stagnant pools, ditches, water channels and agriculture fields. According to the study of Amala and Anuradha 2012, *Cx. quinquefasciatus* was found from most of the ovitraps and they showed that *Culex* is the most commonly found genera as compare to other genera in rural and urban habitats. While in current study *Culex* was the only genera recorded. Their study suggested that ovitraps provide greater attraction to the mosquito than other surveillance techniques, whereas diversity of mosquitoes changed at different places. In the current study *Cu. quinquefasciatus* were collected in abundance than others species.

According to the studies (Brothers, 2005; La-Pointe, 2007) the presence of CO_2 in the environment created the needed for a study about the habitats identification of mosquito to develop effective control strategies and it was suggested that permanent stagnant pools and drains with low diversified flora and high humidity in the air are favorable habitat for *Cx. vagans*.

Gautam et. al., studied in 2006 on mosquito habitat preference, his findings revealed that *Aedes* species are mostly found from tires, ovitraps, water container and tree holes. Another study represents some other habitats *viz.*, cemented water tank, water channels and air coolers as most preferred habitat for the both species *Aedes aegypti* and *Aedes albopictus.* Current study represents that ovitraps are not favorable for both species. In the current study *Culex* species was recorded highly abundant but not a single larva from *Aedes* species was recorded. The reason for this may be the unavailability of the species in the area.

Conclusions

Mosquitoes are growing day by day all over the world and spreading many diseases such as Malaria, Dengue fever, Chikungunya, Yellow fever, West Nile fever, Zika virus, Philariasis and Elephantiasis. Millions of the people get losses of their lives throughout the world. Many people are getting upset all over the world by these vectors that are spreading so many diseases including Multan. The current study will help to get a knowledge about the species present in the area and will be helpful for further mosquito control strategies.

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Conflict of Interest

There was no conflict of interest among authors.

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