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Research Article

Assessing the linkage of mosquito diversity with tree holes in Multan

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ABSTRACT

Multan is a vast city expanding day by day by engulfing agricultural lands that leads to poor hygienic conditions. Tree holes are considered as one of preferred natural habitats for many species of mosquitoes. Different species of mosquitoes may prefer particular tree species for egg-laying. Artificial habitat destruction is considered most controlling activity, while natural sites especially tree holes are overlooked due to lack of knowledge. Considering this scenario, the present study was planned to check population of mosquitoes in tree holes at various habitats in urban and rural areas of Multan. A total 213 mature trees were visited on different selected sites and only 25 trees of different species with holes were found. Data was collected on fortnightly basis; the collected specimens were brought to laboratory for identification purpose. Results of this study have shown that a total of 1008 mosquito larvae of three species; Aedes albopictus, Culex quinquefasciatus and Culex vagans, were collected from the tree holes. Highest population of mosquitoes collected from mango tree holes which covered 40% of total mosquito population. Species Aedes albopictus comprises 51% of total collected population with highest numbers while Culex vagans found in least numbers and covered 16% of total mosquito population.

Keywords: *Natural Habitat, Mosquito Population, Hole Types, Multan*

1. INTRODUCTION

Mosquitoes are obnoxious insects belonging to order Diptera, and family Culicidae. They are found in all regions of the world i.e. tropical, subtropical, and temperate except Antarctica (Service, 2008). Family, Culicidae is subdivided further into three sub-families i.e., Anophelinae, Culicinae and Toxorhynchinae (Service, 2008). Till today more than 3500 identified species from 111 genera globally (Harbach, 2012). 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, various diseases such as Malaria, Yellow fever, Dengue fever, West Nile Encephalitus, Chickungunya and Zika virus are caused by the mosquitoes.,. (Rueda, 2008).

Mosquitoes are vectors of several human diseases, a total of forty million individuals in India suffer from mosquito borne diseases annually (Banerjee *et al.*, 2008). There are thirty thousand mosquito species belonging to thirty four genera in the world (Senthamarai and Jebanesan, 2014). According to WHO (World Health Organization) report, mosquito borne diseases caused approximately one million deaths and 247 million reported cases in tropical and subtropical areas of the world. In 2015, around the globe 50 to 200 million dengue incidences occurred with approximately 20,000 deaths (Wajiha *et al*., 2017).

Developing countries are facing many problems related mosquito borne

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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.

Small cavities in trees filled with water can cause of production of large number of mosquitoes by providing ovisites. Small tree holes (natural ovisites) are overlooked by controlling agencies which are responsible for the surveillance of mosquitoes. It is very necessary to take serious steps for the management of tree holes. These are neglected breeding sites of mosquitoes, so there is not much work done on the management of these sites. Mostly mosquitoes prefer to lay eggs on high places. According to a study most of the percentages of eggs were laid above than six feet from ground and this percentage was 75, while lowest percentages of eggs were laid on the ground level this figure was 4%. These are small holes which are natural habitat should be manage and prohibit to mature (Jenkins and Carpenter, 1946).

Rice fields, swamps and irrigated pastures are places which are favorable for mosquitoes breeding. But western tree holes mosquito *Aedes sierrensis* breeds naturally in water holding places. These places are filled by rains and melting of snow. Female mosquito lays eggs in these cavities, and newly hatched wrigglers feed on population of bacteria and microorganisms present. Control of mosquitoes is difficult because it requires time, and it is impossible, to find all the natural places where mosquitoes can lay eggs and can interbreed. These natural places may be 10-20 feet above the ground level (Anderson *et al*., 1980).

According to the whole scenario a research is conducted on these breeding sites, and the population of mosquitoes will be checked on these breeding sites. The study will help in identifying the preferred tree species for different mosquito species.

The challenge of understanding the population dynamics of mosquitoes in varying habitats is important; by this we will enable to predict their occurrence and can use strategies to control the mosquito population. There are limited studies that investigate the environmental conditions of breeding habitats and the relation of these habitats to the mosquito larval distribution. Most studies focus more on larval surveillance, but not relating the habitat conditions to the occurrence of larval mosquitoes in the environment.

So viewing above factors in mind, the current study was planned so that knowledge about various tree species serving ovisites, from different areas in Multan can be obtained, with the following objectives:

(i) Species of trees harboring maximum species of Mosquitoes

(ii) Assessment of tree holes preferred by Mosquitoes

2. MATERIALS AND METHODS

Research experiment was conducted in urban and rural areas of Multan from the month of June 2018 to December 2018. Multan city 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 50°C and 4.5°C, in months of June and December, respectively (Hussain *et al*., 2020). The average rainfall is approximately 186 mm. Multan features an arid climate with very hot summers and mild winters. Urban and rural sites were selected for sampling of mosquito larvae from three sites of Multan two sites were urban and one was rural *viz.,* Canal Colony, Nishter Hospital and B. Block Muhammad Nawaz Shareef University of Agriculture Multan (MNS-UAM).

All the trees were checked to locate and count number of holes on each site. The holes in trees were categorized in two types i.e. rot and pan holes and the height of hole from ground level was also measured with help of measuring tape. The monitoring

carried out in rainy season and dry season in dry season; however in dry season tree holes were manually filled with water. Data was collected on fortnightly basis Physico-Chemical properties of water before removing it from the hole, such as pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS), Temperature at the time of emptying the hole were recorded with the help of hand-held digital meter (TDS/pH/Temp meter by Yinaik). Relative Humidity (RH) of surrounding was also recorded.

Immature, larvae, were sieved out with the help of muslin cloth from the Tree Holes and were transferred into plastic bottles containing fresh water from different localities on fortnightly basis. Collected eggs were placed in Petri dishes in Ecological Lab, MNS-UAM to hatch into larvae. Larvae were identified up to species level by using the taxonomic keys with the help of Stereo Scope. (Christopher 1933; Barraud 1934; Harbach, 1985; Darsie and Pradhan, 1990; Rueda, 2004).

3. RESULTS

A total of 1008 larvae were collected during the study period from tree holes only three species were identified belonging to genera *Aedes* and *Culex*. All the identified specimens were preserved in Ecology Lab Department of Entomology MNS-UAM, Multan, for future reference.

Among the recorded species, *Ae.albopictus*was the most dominating species (51%) followed by *Cx. quiquefaciatus*(33%) and *Cx. vagans* (16%), respectively (Fig. 1).

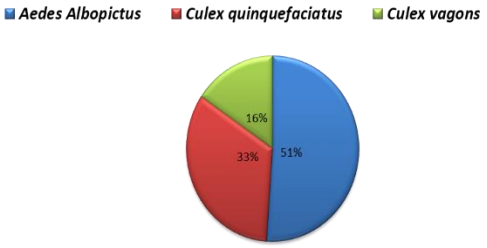

Fig.1. %age of identified species

Considering the physico-chemical characters of water including pH and TDS, the recorded values were divided into quartiles 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 pH and TDS were 5.88 - 9.5 and 2567 - 4789 respectively.

Table.1. Association of Physico-chemical properties of water in holes with mosquito species

	Pan Holes	Rot Holes
Ae. albopictus	55%	45%
Cx.quinquefasciatus	53%	47%
Cx. vagans	52%	48%

Relative humidity and temperature were also recorded. The lowest value observed for R.H was 39% and for temperature it was 14^{o}C, and the highest values were recorded to be 67% and 35^{o}Crespectively. It was observed that *Ae. albopictus* and *Cx. quinquefasciatus* were most abundant at R.H. of 55-65 % whereas *Cx. vagans* was found to be abundant at R.H of 50-65%. In terms of temperature most suitable temperature range for *Ae. albopictus Cx. quinquefasciatus* and *Cx. vagans*was 18-28^{o}C.

In this way types of holes were also observed in our study and mosquito population relation with the type of holes is indicated. Two types of holes are categorized such as pan holes and rot holes. All species of mosquitoes abundantly found in pan holes as compare to the rot holes. Larval population in pan holes is 53% while 47% larval population is found in rot holes.

Table.2. Association of hole type with population of mosquitoes species

	Ae. albopictus	*Cx.quinquefasciatus*	*Cx. vagans*
TDS (ppm)	3122 – 3678	3122 – 3678	3122 – 3678
pH	6.7 - 7.6	6.7 – 7.6	6.7–7.6

Population of larvae with respect to the height of hole was also observed in this study which shows that the relation between height of hole and larval population. Holes which are at 4 feet above the ground level are most favorable habitat for mosquito population.

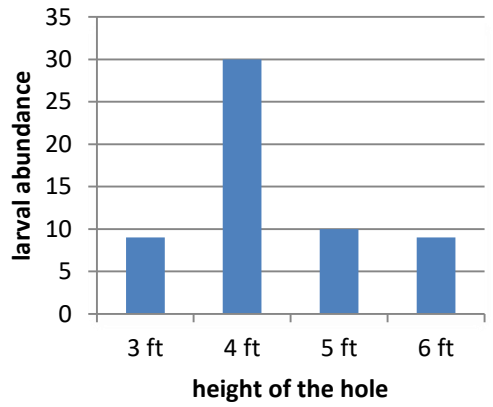

Fig.2. Association of Larval population with respect to the height of hole

4. DISCUSSION

A study was conducted in area of Nagasaki Japan. During the research two types of holes were identified, open type and drought resisting tree holes were most preferable for *Ae. albopictus*. These holes were top opening, large in volume and on surface of tree holes standing water was easily checked. This study also shows that larvae of *Ae. albopictus* were abundantly found in pan holes which are shown in (Table 2).

A study was conducted by Mangudo *et al*., 2018, to check the mosquito population in tree holes of urban and adjacent forest area a study was conducted in 2017 at different locations of Argentina. Normally trees which have holes above 2 m height and can hold water were selected for sample collection. In this study holes are selected for sample collection were also above than two feet and larval population found abundantly in holes which are above than height of four feet results are shown in (Fig 2).

Another study by Seid, *et al.*, 2013, showed that temporary water habitats such as ditches, ponds, rain pools, irrigation channels and open pits were recorded as preferred habitats for *Cx. quiquefaciatus* immature. These are the either natural habitats or manmade. According to another study of Yadav, *et al.*, 1989 also discussed that temporary, river pools, permanent (pond, wells and river) semi-permanent (small channels, sewage pools, paddy fields and irrigation canals), were observed the major breeding habitats of different mosquito species. Present study also depicts that *Culex quiquefaciatus* and *Aedes albopictus* larvae were found in tree holes which are also favorable habitat for mosquito population is shown in (Table 1).

An effective research conducted by Anderson *et al*., 1980, shows that rice fields, swamps and irrigated pastures are places which are favorable for mosquitoes breeding. But western tree holes mosquito *Aedes sierrensis* breeds naturally in water holding places. These natural places may be 10-20 feet above the ground level. Results of this study depict that tree holes which are at the height of 4 feet above the ground level also provide a favorable habitat for the population of mosquitoes which is indicated with the help of (Fig. 2)

A study on mosquito habitat preference conducted by Gautam in 2006, his findings revealed that *Aedes* species mostly found from tires, traps, water container, tree holes as their most preferred habitats. Another research of the Kristan *et al.*, 2012 represent some other habitats for *Aedes viz.*, cemented water tank, water channels and air coolers are most preferred habitat for the both species *Aedes aegypti* and *Aedes albopictus.* Current study represents that tree holes are also favorable for *Aedes albopictus* and two species of genus *Culex*. In the current study population of *Aedes* species was recorded highly abundant shows in (Fig. 1)

5. Conclusions

Mosquitoes are growing day by day all over the world and spreading many diseases. Health departments or other surveillance agencies which are responsible to minimize the mosquitoes population they work on the destruction of habitats of mosquitoes, So Tree holes are the mostly ignored places in the surveillance of mosquitoes, while this study show that tree holes are the most favorable habitats for mosquitoes. Current study will help to minimize the population of mosquitoes by adopting necessary measures by the surveillance agencies.

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7. Conflict of Interest

There was no conflict of interest among authors.

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