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Species diversity, relative abundance, prevalence and breeding of mosquitoes in temporary and semi-permanent site at University of Peshawar and Islamia College University Khyber Pakhtunkhwa

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Abstract

Species diversity, relative abundance, prevalence and breeding of mosquitoes were surveyed in different department of Islamia College University and University of Peshawar, Pakistan and was carried out from mid of january to june 2019. Four (4) bamboo traps were taken from Zoology department of islamia college university, Peshawar (ICUP). The dry bamboo sticks were cut in pieces and were filled water and dry small leaves for the sake of nourishment of the young mosquitoes. After a week, bamboos were brought to lab and emptied in plastic cans. Raw water was also collected in plastic cans containing larvae and pupal stages of mosquitoes. All cans were covered with net cloth. A hole was made in the net cloth and was closed with cotton swab. Adult mosquitoes were then collected from these cans with the help of manual aspirator. By immersing the aspirator in the cans through hole where cotton swab was placed. Collected adults were then transferred to a flask. Mosquitoes were killed using chloroform. Cotton swab was immersed in the flask and then all adults were preserved in air tight glass tubes. Silica gel was added to all glass tubes which act as a preservative by absorbing the moisture. Specimens were segregated sex wise then females were studied primarily and then males. Out of 194 adults mosquitoes (110 male and 83 female) were identified, in which 5 species were of following four genera; Culex, Aedes, Anopheles and Culiseta. We concluded that species belonging to genera Culex are abundant compared to Anopheles and Culiseta.

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Introduction

Mosquito is an insect of Culicidea and Diptera order. They have two of wings but have scales, bulging proboscis, small body and long legs. Mosquito bite is the main cause of skin irritation but some serious diseases such as malaria, dengue they may have long time affect (Borrer and Delong, 1954). Different mosquito species have been reported from different regions of the world like 113 species from Bangladesh (Rueda, 2007); and 25 species of Anopheles from southern Israel (Lequime *et al.*, 2016); 39 from Egypt (NgTerry Fei Fan *et al.*, 2011); 41 species of mosquitoes from Lombok Island (Kittayapong *et al.*, 2000); 21 species from Turkey (Coffey *et al.*, 2011).

All mosquitos' body consists of head, thorax and abdomen. The basic difference is in the wings, female and male genitalia, legs, mouth parts, scales and setae. In female there is long piercing called proboscis in the same way male have feathery antennae and their mouth is not modified for piercing skin (Ali Khan *et al.*, 2013). Mosquitoes are small insects having normal length of 3–6 mm. (Ashfaq Blagoev *et al.*, 2019). Mosquitoes have one pair of functional wings, the fore-wings. The hind-wings has a pair of small, knob-like halteres (Borkent, 2012). The head has pair of kidney-shaped compound eyes. Between the eyes there are pair of filamentous and segmented antennae. Below the antennae is a pair of palps there may be long or short and dilated or pointed at their tips. Arising between the palps is the single elongated proboscis, which contains the piercing mouth parts of the mosquito (Medeiros Ceretti *et al.*, 2013). The wings are long and thin. The legs of mosquitoes are long and are covered with scales. The abdomen is composed of 10 segments but only the first seven or eight are visible (Qasim Naeem *et al.*, 2014).

Mosquitoes mostly live in stagnant water and lay their eggs there. but they can also live anywhere even the habitat is not natural for them (Sathe, 2011). They can live and reproduce inside and outside home. Their life cycle takes 8 to 10 days. Their life cycle has 4 stages such as egg, larva, pupa, and adult. Eggs are laid on the water surface, they hatch into motile larvae which

feed on aquatic algae and organic material; pupae are breathing non-flying primitive adults (Ali Khan *et al.*, 2013). Most mosquitoes mate shortly after development from the pupa. Female mosquito lay eggs on walls, or wet areas. They lay 100 eggs at a time. They can survive till 8 months (Tsukamoto Miyagi *et al.*, 1985). Larva comes out of those eggs but larva comes only when water level rises upto level so that egg is covered completely. This larva now feed on microorganisms in water. Molting take place and pupa will develop which develops into flying mosquito. Male mosquito feed on nectar of flowers while female feed on animals and humans to suck blood and lay eggs. Most mosquitoes mate directly after developing from pupa. After mating, sperm is passed in to female. This sperm fertilize all eggs laid during her lifetime; thus only one mating for one female is required. (Kavitha and Rao, 2008). This process is repeated several times throughout the female's life (Gunathilaka, 2017). This work was done to find number and percentage of specimens, number of mosquitoes larvae collected in different months, number of specimens from different habitat, Relative abundance and distribution of four selected mosquito genera.

Materials and method

Area of study

This study was done in University of Peshawar and Islamia College University Peshawar.

Methodology

Four (4) bamboo traps of Zoology department of Islamia College University Peshawar (ICUP) were used. Thickness of bamboo was 3 inches and its length was 12 inches. The dry bamboo sticks were cut in many pieces and were filled water and dry small leaves for the sake of nourishment of the young mosquitoes. These bamboo traps were hung in different tree trunks. After a week, bamboos were brought to lab and emptied in plastic cans. Some of the larvae were appeared which means that bamboo traps provided breeding habitat for mosquitoes. Raw water was also collected in plastic cans from different sites containing larvae and pupal stages of

mosquitoes. All cans were covered with net cloth to prevent escape of mosquitoes. A hole was made in the net cloth and was closed with cotton swab. Adult mosquitoes were then collected from these cans with the help of manual aspirator. By immersing the aspirator in the cans through hole where cotton swab was placed, adults were collected by sucking through the aspirator. Collected adults were then transferred to a flask. Mosquitoes were killed using Chloroform. Cotton swab soaked with chloroform was immersed in the flask for 1 to 2 minutes and the all adults were preserved in air tight glass tubes and were studied later on. Silica gel was added to all glass tubes which act as a preservative by absorbing the moisture. Specimens were segregated sex wise then females were studied primarily and then males. The specimens were studied under binocular microscope and identified upto specie level with the help of taxonomic key.

Sites for collection of species	
Site.1	Department of Zoology, Islamia College University Peshawar (ICUP)
Site.2	Department of Physics, Islamia College University Peshawar (ICUP)
Site.3	Department of English, University of Peshawar (UOP)
Site.4	Department of Microbiology, University of Peshawar (UOP)
Site.5	Pashto Academy, University of Peshawar (UOP)
Site.6	Coffee Shop, Islamia College University Peshawar (ICUP)
Site.7	Near gate 2 of Islamia College University Peshawar (ICUP)

Results

Mosquito's larva were collected from January to June and maximum were found in May and June. Percentage of their species were recorded. Maximum percentage was of *Cx. quinquefasciatus* specie which is 92%. Minimum percentage was of *An. Stephensi* and *Ae. Albopictus* which is 1.5%. Furthermore, *Ae. albopictus*,

An. stephensi, *Cx. bitaneorhynchus*, *Cx. quinquefasciatus*, *Cs. longiareolata* were found in Coffee shop ICUP, Raw water ICUP, Raw water UOP. 22-38 species were found near Coffee shop ICUP. It means maximum species were near Coffee shop ICUP.

Relative abundance of *Ae. albopictus*, *An. stephensi*, *Cx. bitaneorhynchus*, *Cx. quinquefasciatus*, *Cs. longiareolata* was recorded. *Cx. quinquefasciatus* has distribution of about 80, *Cx. bitaneorhynchus* 83.3, *An. stephensi* 75.3, *Ae. albopictus* 50.0, and *Cs. longiareolata* 79 while Relative abundance status of all was dominant. Total 193 mosquitoes were collected belonging to 4 genera, *Culex*, *Anopheles*, *Aedes* and *Culiseta*. Among these 2 species of genus *Culex*; *Culex quinquefasciatus* and *Culex bitaneorhynchus*, 1 species of each *Aedes albopictus*, *Culiseta longiareolata*, and *Anopheles stephensi* were reported.

Table 1. No of mosquitoes larvae collected months during survey period Jan-June 2019.

Site	Jan	Feb	March	April	May	June
Bamboo traps ICUP	X	0-2	0-1	X	X	X
Raw water ICUP	X	1-1	3-3	2-4	6-11	6-11
Raw water Biotechnology Dpt, UOP	X	0-1	8-4	6-6	20-14	5-10
Raw water coffee shop	X	3-1	0-5	3-7	7-10	9-15
Tyres in zoology Dpt, ICUP	0	0	0	0	0	0
Total	0	4-5	11-13	11-17	33-35	24-40

Table 2. No and % age of specimens during survey.

Genra	Species	No. of species	%age
<i>Culex</i>	<i>Cx. quinquefasciatus</i>	179	92%
<i>Culex</i>	<i>Cx. bitaneorhynchus</i>	4	2%
<i>Anopheline</i>	<i>An. stephensi</i>	3	1.5%
<i>Aedes</i>	<i>Ae. albopictus</i>	3	1.5%
<i>Culiseta</i>	<i>Cs. longiareolata</i>	4	2%

Discussion

In present survey total of 5 mosquito species belonging to 4 genera (Aedes, Culiseta, Anopheles and Culex) were recorded. Maximum frequency was

observed for *Cx. quinquiefasciatus* followed by *Cx. Bitaneorhynchus*. Some records showed 15 species in department of zoology (ICUP) and 21 species in department of physics (ICUP).

Table 3. No of specimens from different habitats.

Site	<i>Ae. albopictus</i>	<i>An. stephensi</i>	<i>Cx. bitaneorhynchus</i>	<i>Cx. quinquiefasciatus</i>	<i>Cs. longiareolata</i>	Total
Bamo traps	0-3					0-3
Coffee shop ICUP			3-1	18-34	1-3	22-38
Raw water ICUP		1-3		21-32		22-34
Raw water UOP				39-35		39-35
Total	0-3	1-3	3-1	78-101	1-3	83-

Table 4. Relative abundance and distribution of four selected mosquito genera.

Species	Total	Relative abundance	Distribution	Relative abundance status	Distribution class
<i>Cx. quinquiefasciatus</i>	332	8.2	80	Dominant	Constant
<i>Cx. bitaneorhynchus</i>	365	8.93	83.3	Dominant	Constant
<i>An. stephensi</i>	122	6.0	75.2	Dominant	Frequent
<i>Ae. albopictus</i>	101	5.7	50.00	Dominant	Frequent
<i>Cs. longiareolata</i>	302	7.8	79	Dominant	Moderate

This difference was due to difference in environmental conditions in different study areas (Ashfaq Hebert *et al.*, 2014). We studied population dynamics of mosquitoes in various breeding habitats at University of Peshawar, KP

Pakistan and found 5 mosquito species of four genera Aedes, Culex, Armigeres and Anopheles with maximum frequency of occurrence for *Ae. albopictus* followed by *Cx. quinquiefasciatus*, *Ar. subalbatus*, *Ae. walbus*.

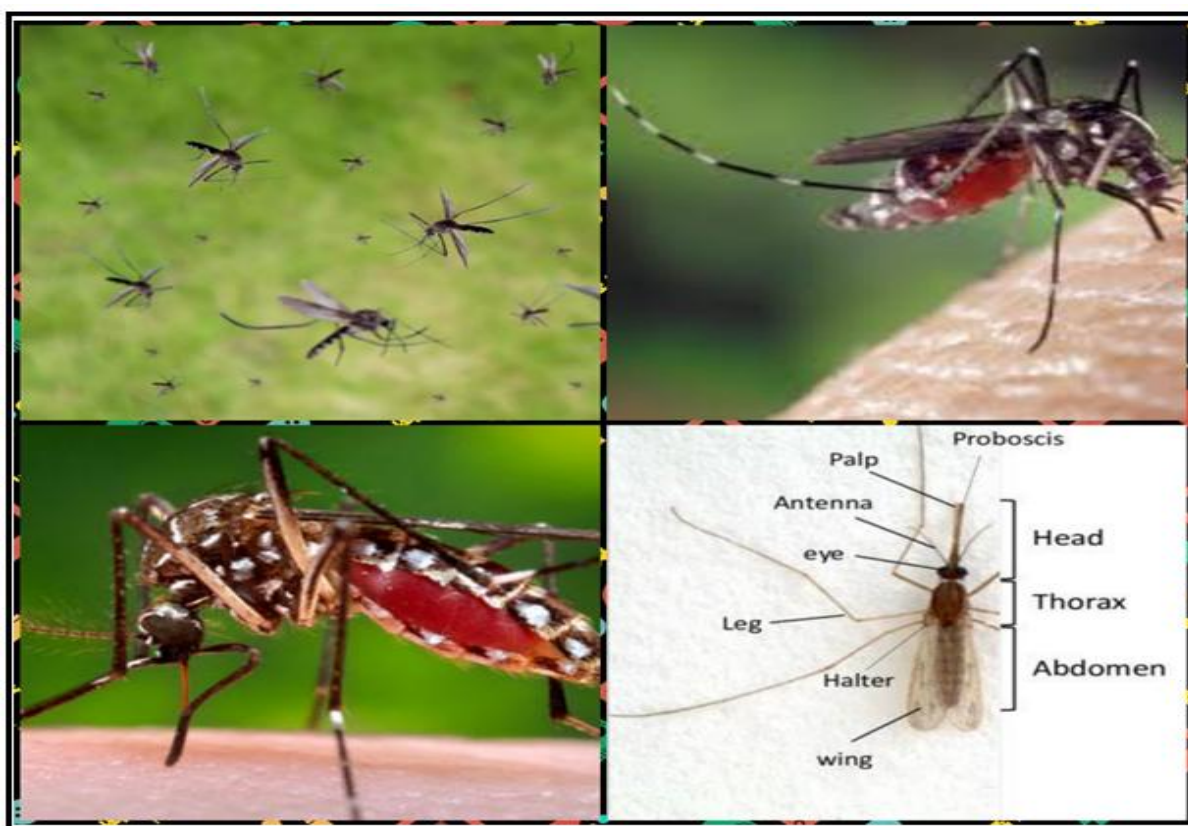


Fig. 1. Female anopheles mosquitoes (Qasim, 2014).

Some records showed 9 species of two genera *Culex* and *Anopheles* near university hostel stream. Out of 9 species; *Cx. quinquefasciatus*, *Cx. tritaeniorhynchus*, *Cx. vishnui*, *An. culicifacies*, *An. maculatus*, *An. subpictus*, and *An. stephensi* are similar with species

recorded in our study. The maximum similarity of species was because of similar environmental conditions i.e., temperature, humidity and habitats. While in literature human activities and climate changes strongly effect larval breeding.



Fig. 2. Trees near zoology department where mosquito's species were found.



Fig. 3. Stream which opens to hostel where mosquitoes species multiplied rapidly.

In present study there is some variation in mosquito population with seasonal difference which was observed in swat by (Khan and Zaman, 2015). An increase in mosquito population was noticed in the successive months from May and June. Mosquitoes activity during June and July was high because of

relative humidity (70%) while in August the mosquito population began to increase with rising temperature. mosquitoes are active throughout the year but they are most active during May, September and October and lowest in December (224/2419).



Fig. 4. Area where more *Culiseta* mosquitoes were logged.

In the present study different habitat specificity of mosquitoes was observed. The raw water appeared to be the most favourable breeding habitat as maximum mosquitoes were recovered. Tyres were preferred breeding site in the study conducted near coffee shop (Ishaq Khan *et al.*, 2014). Ecological as well as urban nature of Peshawar might be the reason of difference in breeding sites.

Conclusion

Mosquito fauna of study areas (University Campus Peshawar) at district Peshawar is represented by genera *Aedes*, *Culex*, *Anopheles* and *Culiseta* respectively. It is thus concluded that species belonging to genera *Culex* are abundant compared to *Anopheles* and *Culiseta* species. Human activities are contributing to availability of mosquitoes breeding sites and may lead to establishment of pathogens and increased risk of transmission of vector borne diseases. The finding of this study requires further

entomological investigations of mosquitoes using different sampling methods to describe their feeding, resting behaviors and role in disease transmissions.

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