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Survey of Mosquito Population in and Around Lucknow (U.P.) Region

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ABSTRACT

Background: The survey of breeding habitats of mosquito vector is helpful while plan for vector borne diseases management programme. Our study would be useful for strategizing local mosquito management programme and learning about the insect mosquito ecology and tropical areas of South East Asian countries.

Method: Diversity of mosquito fauna were studied in five various areas in and around of Lucknow District, Uttar Pradesh, in India. This study was done for twelve months (April 2018-March 2019). Three species namely *Anopheles stephensi, Aedes aegypti* and *Culex quinquefaciatus* belonging to three genera (*Anopheles, Aedes and Culex*) were observed during study period.

Result: Total 4691 no. of larvae were assembled from collection sites, maximum no larvae in Khushal Ganj (960), minimum no larvae Alam Nagar (926), Fazullaganj (945), Matiyari (930) and Rakab Ganj (930) showed moderate abundance. Monthly deviation in diversity of mosquito fauna observed *Anopheles stephensi*, maximum (15.2 %) in August month and minimum (0.0%) in January month, *Aedes aegypti* maximum (25.2 %) presence in August and minimum (2.7%) in March month and *Culex quinquefasciatus* were noted higher (17.5 %) in September month. Maximum Biodiversity index was calculated (0.68) during month of February and lower (0.49) during month of January 2019.

Key words: *Mosquitoes, diversity, abundance, breeding habitat, Lucknow*

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Introduction

Mosquitoes are the most important single group of arthropods of medical importance and cause not only nuisance but also transmit various diseases like dengue, filaria, malaria, chikungunya and Japanese encephalitis, west nile virus and rift valley fever etc. Approximately 4000 known mosquito species are found all over world but only less than 10% mosquito species are regarded as effective vectors of infections of high level impact diseases. Usually mosquito causes irritation, discomfort and harm to host, but vector act also as main vector for malaria protozoan and other diseases causing microorganism of about. 42 genera of mosquito vectors approximately 3500 species under 140 subgenera are found all over the world which belonging to order Diptera family Culicidae (Walter Reed Bio-systematic Unit, 2001). All over the world approximately 700 million population endure from various mosquito vector-borne diseases and about 2 million people die per year. Amid all mosquito-borne illnesses, dengue is a severe disease found in India and about 2.5 million people are at huge risk. WHO recently evaluated that approximately 50-100 million infections are found every year due of dengue (Monath, 2013). Approximately 90 percent of malaria death cases are found in the world. Malaria is also huge public health problem in our country. India report around 1 million people infected due to malaria case annually. People suffered are generally poor groups, their income are lesser than 6000 each month. Approximately 50% malaria cases recorded by reason of *Plasmodium falciparum* parasite (NVBDCP, 2013**).** Malaria is endemic, affects the lives of all public. Malaria contamination and infectivity was increased due to some important entomological and ecological factors, that affect directly and indirectly eruptions of diseases (Sharma, 1994). Some records were estimated of malaria outbreaks among various occupation groups like stone quarry, construction and agriculture. Estimation of malaria problems for duration of 5 year epidemiological study in stone mine location of Faridabad and occurrence of malaria diseases confirmed in Haryana because of migration of labors with 38.7% high infection ratio (Yadav *et al*., 1991). Urban area development in country India was started previously and continued very speedly throughout the post-independence period leading to scarcity in

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basic facilities (Alirol *et al*., 2011). Development in population was perceived in 19- 20th era because of huge scale growth in industries and trade (Bhagat, 2011). Development of urban areas in cities of India is unintentional with slower method of growth than rate of population growth, which is going towards shortage of basic facilities like sanitation, water supply, sewage problem and housing etc. Poor drainage and open sewage systems are a major problem for human society. Uneven water resources and storing water in large quantities generate breeding habitats for growth of mosquitoes of various species (Molyneux, 1997).

Material and methods

Study Area

Lucknow (26°51'0.0000" N and 80º56'59.9892" E) is located at northwestern shore of the Gomati River of Uttar Pradesh, a state in India. It is the capital of U. P. which covers area of 2528 km with 3,677,000 population and elevation about 123 m above the sea level. Lucknow is bounded in the east by Barabanki, in the west by Raebareli and Unnao in the South and in the north by Sitapur and Hardoi. Lucknow includes 5.66% forest cover area and main crops are wheat, sugarcane and vegetables potatoes, mustard and cabbage. Lucknow climate is mild usually with average annual temperature 25.7º C (78.3º F), average annual humidity of 74% and precipitation is about 1001mm (39.4) inch annually. Present study was conducted in five different areas (Matiyari, Fazullaganj, Alam Nagar, Rakab Ganj and Khushal Ganj) of Lucknow city.

Larval collection

Larvae were collected during April 2018 to March 2019 (twelve months) including all seasons from different mosquito breeding habitats of selected five localities (Matiyari, Fazullaganj, Alam Nagar, Rakab Ganj and Khushal Ganj) in Lucknow, U. P. in India. Breeding habitats are chosen on the basis of unplanned drainage system, population density, stagnation of water and poor management of waste. Breeding habitats were including many sewage canals, plastic garbage, shores of Gomti River, fishery market and cow farms. Sampling was done once in a month of each and every selected breeding localities in Lucknow city. Collection of larvae was conducted outdoors by using dipping technique, with the help of dipper of 500 ml capacity depending upon the collection container size and sources of mosquito breeding habitats. During this survey,

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various stages of larvae were amassed in containers and transferred in separate glass beaker then each beaker marked and transported in the research laboratory. Total no. of Larvae were counted of each and every inspection sites, larvae were kept in 70% alcohol for killing and preserved for identification purpose. During the sample collection temperature and humidity were noted on particular site by thermo-hygrometer (Sonalex).

Larval identification

50% of total amassed larvae were killed with 70% alcohol, and preserved in glass bottles for identification. 50% larvae were kept live in clean beakers containing sample water for emergence in adults and complete development. After emergence identification was done by using standard pectoral keys (Nagpal and Sharma, 1995) (Tyagi *et al*., 2012) (Barraud, 1934) (Leopoldo, 2004) with the help of entomologist of CDRI Lucknow.

Data Analysis

The data were used to evaluate diversity of mosquito species by using species richness index (alpha diversity) to calculate biodiversity index by using the following formula (Southwood, 1978).

$\alpha = 1\text{-}£(x1/t)^2\ (x2/t)^2\ (x3/t)^2 \ldots + \ldots\ldots (Xn/t)2$

Where,

α= Species richness index

t= Total number of mosquitoes of all species

x= Number of each species

Results

It is baseline survey to investigate mosquito abundance, variety of species and various habitats to reveal availability of water storage system including drainage system, manholes, canals, water lock areas, garbage collection, fishery market, cattle farms, unused wells which supports to increase favourable conditions to breeds mosquito species on the selected areas as mentioned before. The samples were collected from different breeding sources and areas such as plastic containers, natural ponds, side banks of river, cement tanks, and various stagnant lock polluted areas. They were varied in temperature, rainfall, humidity and other environmental condition.

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Mainly three species of mosquito were collected viz. *Anopheles stephensi*, *Aedes Aegypti* and *Culex quinquefasciatus* (Table-1) and Species composition of different mosquito larvae at selected sampling sites are shown. In this study a total of 4691 no. of larvae were collected. Abundance of mosquito larvae observed Matiyari (930), Fazullaganj (945), Alam Nagar (926) in minimum number, Rakab Ganj (930) and Khushal Ganj (960) in maximum number of selected areas indicated. Percentage of relative abundance of *Anopheles stephensi* were recorded maximum (23 %) in Khushal Ganj and minimum (17.9 %) in Rakab Ganj, abundance of *Aedes aegypti* noted maximum in (21.1 %) in Rakab Ganj and minimum (18.8 %) in Khushal Ganj such as *Culex quinquefasciatus* were recorded minmum (19.8 %) in Fazullaganj and equally (20.2 %) in two sites Matiyari and Khushal Ganj in (Graph-1). Total number of individuals, species richness and biodiversity index of each month, were calculated maximum (0.68) in February and minimum (0.49) in January in (Table-2). During present investigation monthly percentage variation in diversity of mosquito species *Anopheles stephensi* calculated maximum (15.2 %) in August month and minimum (0.0%) in January month, *Aedes aegypti* maximum (25.2 %) presence in August and minimum (2.7%) in March month and *Culex quinquefasciatus* were noted higher(17.5 %)in September month in (Graph-2).

Table no-1: Diversity and Relative abundance of mosquito species found in study area (Matiyari, Fazullaganj, Alam Nagar, Rakab Ganj and Khushal Ganj) during the survey period (April 2018-March 2019).

S. No	Species name	Matiyari	Fazullaganj	Alam Nagar	Rakab Ganj	Khushal Ganj	Total
1	*Anopheles stephensi*	271	289	301	260	335	1456
2	*Aedes aegypti*	423	425	393	437	389	2067
3	*Culex quinquefasciatus*	236	231	232	233	236	1168
	No of species	3	3	3	3	3	
	Total	930	945	926	930	960	4691

Table no-2: Monthly variation in biodiversity index of diversity in mosquito species recorded in selected study areas (Matiyari, Fazullaganj, Alam Nagar, Rakab Ganj and Khushal Ganj) during the study period April 2018- March 2019.

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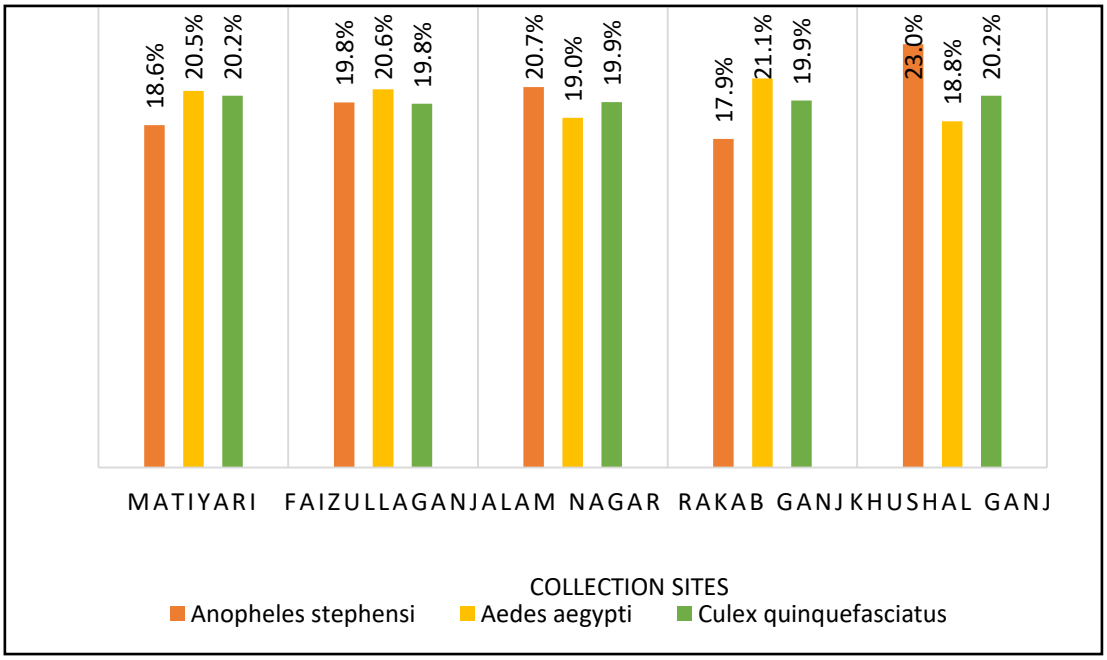
S. no.	Species name	Mosquito species diversity												Total
		Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	
1	*Anopheles stephensi*	147	161	157	153	222	128	159	162	39	0	43	85	1456
2	*Aedes aegypti*	71	93	92	87	520	347	275	197	135	108	87	55	2067
3	*Culex quinquefasciatus*	77	81	70	53	130	204	157	122	79	78	64	53	1168
	Total	295	335	319	293	872	679	591	481	253	186	194	193	4691
	Species Richness	3	3	3	3	3	3	3	3	3	2	3	3	
	Biodiversity index	0.63	0.63	0.62	0.61	0.56	0.61	0.64	0.65	0.59	0.49	0.68	0.65	



Graph-1: Distribution of Mosquito species percentage (%) according to the collection sites

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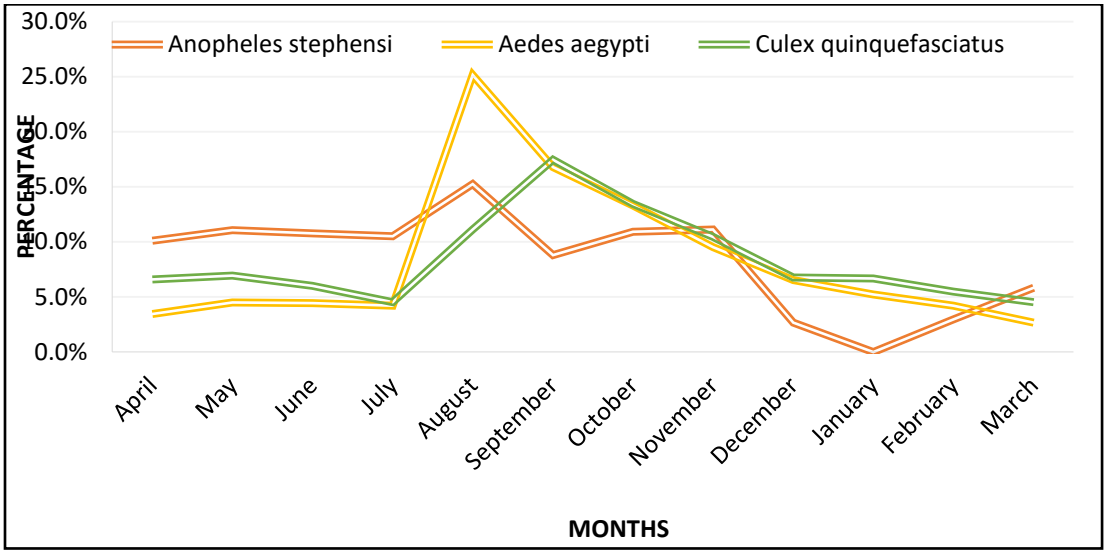

Graph-2: Monthly distribution of Mosquito species percentage in during study period

Discussion:

Mosquito-borne infections are major menace among all public health problems found. Present study was conducted first time in and around Lucknow (U.P.) to inspect the abundance and diversity of mosquito species including natural and artificial habitats and observed three mosquito species *Anopheles stephensi, Aedes aegypti* and *Culex quinquefaciatus*. In our study many water bodies (ponds, containers, old tyres, cement tanks, canals and pots etc.) has been inspected as like given some previous studies and this method is used most widely in investigation of mosquitoes for entomological surveillance so that larval survey can be done (Rajesh *et al*., 2013). There were some areas where people are facing water scarcity problem due to low rainfall so that they collect water in various containers and these container are main sources of mosquito breeding habitat (Kisan *et al*., 2013). In present study larvae of *Aedes* mosquito were mainly found in water holding containers as well as in given prevoius study also. Water quality and condition of water holding containers play important role for breeding and plenty of *Aedes* species in study areas. Larvae of *Culex quinquefasciatus* were found mainly in stagnant organic polluted water. In our study *Culex quinquefasciatus* were most abundance in August September October and November months due to high temperature and humidity and

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mostly found in organic polluted water bodies as mentioned in previous research study ((Hidayati *et al*., 2005), but some in other natural and artificial breeding habitat also. Larvae of *Anopheles stephensi* mosquito were collected mainly in fresh water breeding habitats in our study period. Fresh water artificial ponds and rainfall surface pools are favored mainly to breed mosquito of *Anopheles* vector species as observed previous study (Ramasamy *et al*., 1992). Agricultural expansion are enhanced favourable conditions for *Anopheles* mosquito breeding problems mostly so that transmission of malarial diseases are mainly found in tribal areas (Mereta *et al*., 2013) but in our study has not been conducted in farm or nearby areas and collected maximum number (222) mosquito in August and minimum (00) in January months of larvae of *Anopheles stephensi*. Abundance of different mosquito species in Ernakulam district of Kerala state was found higher with biodiversity index (0.86) in the January and August 2018 (Radhakrishnan, 2019). Present study recorded mosquito faunal richness maximum (2) in January and similar (3) in all other months and biodiversity index were lower (0.49) in January and (0.68) higher in February months.

Conclusion

This study would be helpful to formulate awareness programs for sustainable management of mosquito vectors and to take precautions against various mosquito borne epidemics. The result evaluated maximum biodiversity index (0.68) in February month and minimum (0.49) in January month. Maximum abundance in Khusal Ganj site and minimum abundance in Alam Nagar site whereas Matiyari and Rakab Ganj shown moderate presence of all observed species. Our study will help to identify to spots of mosquito borne diseases outbreak in most vulnerable areas where huge impact of mosquito borne incidences are originated due to various breeding habitat.

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References

Amruthraj Radhakrishnan (2019). Study on mosquito (Diptera: Culicidae) diversity in Ernakulam district of The Kerala state, South India. *International Journal of Mosquito Research*, 6(1): 01-05.

ISSN PRINT 2319 1775 Online 2320 7876

 UGC CARE Listed (Group -I) Journal Volume 11, S Iss 3, Dec 2022

Bhupinde N Nagpal, Sharma V. (1995). Indian Anopheline. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi. 416.

Brij Kishore Tyagi, Munirathinam A, Krishnamoorthy R, Venkatesh A (2012). A field based handbook on Identification keys to mosquitoes of public health importance in India. CRME Madurai.

David H Molyneux. 1997. Patterns of change in vector-borne diseases. *Annals of tropical medicine & parasitology,* 91(7): 827-839.

Emilie Alirol, Laurent Getaz, Beat Stoll, Francois Chappuis, Louis Loutan. (2011). Urbanisation and infectious diseases in a globalized world. *The Lancet infectious diseases*. 11(2): 131-141.

Hidayati H, Mohd Sofian-Azirun WA, Nazni Lee HL (2005). Insecticide Resistance Development in *Culex quinquefasciatus* (Say), *Aedes aegypti* (L.) and *Aedes albopictus* (Skuse) larvae against Malathion permethrin and temephos. *Tropical Biomedicine,* 22(1):45-52.

Kisan D, Laxmikant V (2013). Survey of Container Breeding Mosquito Larvae in Jalna City. Biological Forum – *An International Journal* 5(1):124–128.

Leopoldo M. Rueda. (2004). Pectoral keys for the identification of mosquitoes (Diptera: Culicidae) associated with Dengue Virus Transmission. Zootaxa, 589: 1-60.

Monath T. P. (1994). Dengue the risk to developed and developing countries. Proceedings of the National Academy of Sciences of the United States of America, 91(7) 2395–2400. https://doi.org/10.1073/pnas.91.7.2395

Phillip James Barraud. (1934). The Fauna of British India, including Ceylon and Burma, Diptera. Family- Culicidae. London: *Taylor and Francis*. V: 1-463.

Ram B Bhagat (2011). Emerging pattern of urbanisation in India. Economic and political week, 10-12.

Rajpal SinghYadav, Sumit K Ghosh, Chand SK, Ashwani Kumar (1991). Prevalence of malaria and economic loss in two major iron ore mines in Sundargarh district, Orissa. *Indian J Malaria*, 28: 105-13.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, S Iss 3, Dec 2022

Ramasamy R, De Alwis R, Wijesundera A, Ramasamy MS (1992a). Malaria transmission in a new irrigation scheme in Sri Lanka the emerhance of Anopheles annularis as a major vector. *American Journal of Tropical Medicine and Hygiene*. 47:547-553.

Seid Tiku Mereta, Delenasaw Yewhalow, Pieter Boets, Abdulhakim Ahmed, Luc Duchateau, Niko Speybroeck, Sophie O Vawambeke, Worku Legesse, Luc De Meester and PeterLM Goethals. (2013). Physico chemical and biological characterization of *Anopheline* mosquito larval habitats (Diptera: Culicidae): implications for malaria control. *Parasites & Vectors*, 6(1).

Shailesh N Sharma (1994). Malaria and mining practices–a survey note with possible control methods. *Environ & Ecology*, 12: 973-5.

ssSouthwood TRF. (1978). Ecological method with particular reference to the study of insect population. The ELBS 2nd edn. University printing, Oxford, Chapter. 13:420- 421.

Walter Reed Bio-systematic Unit (2001). Systematic Catalog of Culicidae. Smithsonian Institution, Washington, DC, USA. http://wrbu.org.