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Climatic Variability and Its Impact on Mosquito Fauna in Bareilly Terai Region Uttar Pradesh, India

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Abstract- The distribution, abundance, growth and reproduction of organisms comprising different species populations are influenced by various environmental factors. A survey was conducted during the period 2014–2015 and 2015–2016 to study mosquito fauna in the Bareilly Terai region. Three major genera, Anopheles, Culex, and Aedes were predominantly recorded. A total of 28 species were identified, showing seasonal variations in their population percentage. Climatic factors such as temperature, humidity, rainfall, and moisture significantly influenced mosquito diversity and abundance. The annual average percentage ratio of these genera has been analyzed and reported in this study.

Keywords: Mosquito fauna, Climate variability, Bareilly Terai, Anopheles, Culex, Aedes, Seasonal variation.

I. INTRODUCTION

Mosquitoes are one of the most significant insect groups, acting as vectors of several diseases such as malaria, dengue, chikungunya, and yellow fever. These mosquito-borne diseases have become a serious public health concern, especially in tropical and subtropical regions like the Terai belt of Bareilly ,these diseases are endemic in all the states and union territories of India including Uttar Pradesh and Uttarakhand. A series of reports published by WHO show incidence of different fever in various region of North India, Bareilly, Nainital and surrounding Areas the important tourist place of U.P. and Uttarakhand attract thousand of tourists annually resulting the enhancement of these endemic fevers every year and create a havoc on socio-cultural and economic activities.

.The Bareilly Terai region, along with surrounding areas such as Aonla, Faridpur, Nawabganj, and Baheri, provides favorable environmental conditions for mosquito breeding due to high humidity, rainfall, and temperature variations. These climatic conditions play a crucial role in determining the distribution and population dynamics of mosquito fauna.

Very recently our Indian government is very much concerned regarding the spread of Dengue fever due to the organization of Common Wealth Games. So many NGO's are making their efforts for the prevention and cure of Dengue fever. Mosquitoes, family culicidae (Nematocera: Diptera) belongs to subfamily culicinae.

Climate change and variability have further intensified the spread and seasonal occurrence of mosquito-borne diseases. Increased temperature and irregular rainfall patterns enhance mosquito breeding habitats, thereby increasing their population density. The survey of mosquito fauna reported on the bases of the distribution; abundance, growth and reproduction of the organism comparing the individual members of some mosquito specimen which are controlled by certain environmental factors such as temperature, humidity, rains and moisture although these factors show interactions, between different population of mosquitoes (Diptera- insecta) to instinctive control mechanism. It varies continualys through out months and years and exerts an effluence on mosquito spp. abundance distribution, longevity, development rate etc. Mosquitoes reported in this paper are of there types Anophelini. Aedes and culicinae.

Since no detailed reports are available on specieus composition of mosquito fauna of Bareilly District, the present study deals with the distribution pattern and species composition of mosquitoes in Bareilly district based on the change in climatic condition during 2014–2016.

Bareilly distirct is located in North West Uttar Pradesh. It is situated between lattitudes 25'50' N and 28' 55' N and longitudes 79' 40° E and 79' 46' E. The district covers 3.9475sq meter area.

Climatically district lies in Northern temperate Zone and being nearer to the tropics it has a subtropical climate. The summer season with a mild spring state in early March and temperature continues to rise gradually till the June when it is hot and dry. After that monsoon reason starts from late June or early July and extends upto the third week of september. Post monsoon season extends from Oct-Nov. The winter season extends from December to February.

II. MATERIALS AND METHODS

For the purpose of survey five tahsils surrounding the Bareilly district in all direction were selected. These were Aonla, Baheri, Nawabganj, Faridpur and Bareilly Terai region over a period of two years (2014–2016). Mosquito samples were collected from different habitats such as stagnant water bodies, drains, ponds, and residential areas.

The collected specimens were preserved and identified using standard taxonomic keys. Environmental parameters such as temperature, humidity, and rainfall data were recorded during the study period. The district has a net work of rivers. Ram Ganga is the main river which originates from Garhwal Himalayas and flows through study area. Indoor and out door collections were made from human and mixed dwellings spending 20-30 man hours in each place daily using an aspiration tube and Dipteral Sweeping Net. These Collections were made continuously in every season at different intervals from the year 2014 to June 2016. In order night collections were done by using uv. light trap method. Collection methods included:Light traps ,Hand collection ,Larval sampling from water sources

Adult spp were preserved in 70% Ethanol in collection tube. Some specimen were preserved by dry preservation method and stored in thermocol boxes for the study of chetotaxy.

Identification was done by using standard pectoral keys - Rao & Das Meteorological data (Temperature Max and minimum temperature' relative humidity and rainfall was recorded regularly in every season and month. from the region.

III. RESULTS & DISCUSSION

The study revealed the presence of three dominant mosquito genera:Anopheles Cule xAedes

Bareilly has a semi-arid climate with high variation between summer and winter temperature. Summers are long from early April to October, with the monsoon season. Then winter starts and extends till Feb but in the high peaks in January and is notorious from its heavy Fog. Extreme temperature ranges from 4°C to 47°C. the annual mean temperature is 25°C (77°F) monthly mean temperature range from 14°C to 33°C (58°F to 90°F) the average annual rainfall is approximately 714 mm (28.1 includes) most of which is during the monsoon in July and August. Average date of the advert of monsoon winds in Bareilly is 25th June.

In the survey years 2014-15 & 2015-16 the bulk of collection consisted of Culex followed by Anopoheles & Aedes.

Table No. 1-Annual composition of Different Species of Anopheles

S. No.	Different Spp.	Total % (2014–2015)	Total % (2015–2016)
1	A. aconitus	0.68	0.53
2	A. annularis	3.61	3.12
3	A. culicifacies	7.23	5.23
4	A. flaviatilis	1.02	1.02
5	A. hyrcanus	0.18	0.31
6	A. maculatus	0.24	0.84
7	A. pallidus	0.16	—
8	A. splendidus	0.70	—
9	A. stephensi	6.12	7.81
10	A. subpictus	11.23	10.13
11	A. vagus	1.13	1.43

In the year 2014-15 during the survey period a total of 15,978 mosquitoes belonging 11 spp of Anopheline (32.30%) 8 spp. of Aedes (26.92%) and 8 spp. of culex (40. 78%) were collected spending 360 man hours from study area spp wise composition of all the three genera in shown in given tables.

In year 2015-16 18,616 mosquitoes were collected during the survey. belonging 9 spp of Anophelne (30.42%) 8 spp of culex (42.45%) and 8 spp of Aedes were collected spending 412 man-hours for the study area spp. wise composition is given in the tables.

Table No. 2: Annual Composition of Different Species of Culex

S. No.	Different Spp.	Total % (2014–2015)	Total % (2015–2016)
1	C. brevipalpis	0.04	0.14
2	C. epidesmus	3.26	3.83
3	C. fatigans	5.18	6.12
4	C. geldius	0.73	0.62
5	C. mimeticus	2.14	2.62
6	C. quinquefasciatus	19.28	19.20
7	C. vishnui	9.13	8.78
8	C. vorax	1.02	1.14

No. 3: Annual Composition of Different Species of Aedes

S. No.	Different Spp.	Total % (2014–2015)	Total % (2015–2016)
1	Ae. aegypti	1.35	1.38
2	Ae. albopictus	2.06	2.04
3	Ae. albolateralis	10.01	9.89
4	Ae. assamensis	1.72	1.84
5	Ae. aureostriatus	3.42	3.55
6	Ae. pipersalatus	0.58	0.86
7	Ae. scatophagoides	6.06	6.01
8	Ae. walbus	1.72	1.56

IV. DISCUSSION

The observation show that vector spp of Malaria and Dengue Fever increases in the monsoon season in both the years 2014-15 & 2015-16, and declined in pre monsoon season. The variation in the diversity distribution of mosquito population of different Tahsils of Bareilly by was also studied. The average density was high in periods of August, September and February, March, several ecdogical & climates factors were found to be regulatory factors of indoor mosquito density in this study. Malaria & Dengue cases usually reported after the periods of heavy rainfall in the study region.

Among Anopheles species, A. subpictus showed the highest percentage composition in both 2014–2015 (11.23%) and 2015–2016 (10.13%), indicating its dominance in the region. This was followed by A. culicifacies and A. stephensi, which are well-known malaria vectors. The presence of these species in considerable proportions highlights the potential risk of malaria transmission. Minor fluctuations were observed in species such as A. aconitus, A. hyrcanus, and A. maculatus, suggesting environmental influence on their breeding patterns.

In the case of Culex species, C. quinquefasciatus was found to be the most dominant species, contributing approximately 19% in both years (2008–2009 and 2009–2010). This species is a known vector of filariasis, indicating a possible risk of vector-borne diseases in the region. Other species such as C. vishnui and C. fatigans also showed notable presence, while the rest of the species contributed in smaller proportions, reflecting a stable yet diverse Culex population.

Similarly, among Aedes species, Ae. albolateralis showed the highest composition (around 10%), followed by Ae. scatophagoides and Ae. aureostriatus. Importantly, Ae. aegypti and Ae. albopictus, which are primary vectors of dengue fever, were also present consistently across both years. Although their percentage composition was relatively lower, their epidemiological importance is high due to their efficiency in transmitting dengue virus.

The findings indicate that climatic variability plays a crucial role in shaping mosquito fauna distribution. Higher temperature and moisture levels provide suitable breeding conditions, leading to increased mosquito density.

The dominance of Culex species suggests their adaptability to diverse environmental conditions, while Aedes species show strong seasonal dependence. The increase in mosquito population during monsoon correlates with higher incidence of vector-borne diseases in the region.

V. CONCLUSION

Overall, the comparative analysis of all three genera indicates that while Culex species dominate in terms of abundance, Anopheles and Aedes species hold greater medical importance due to their role in transmitting malaria and dengue, respectively. The variation in species composition across different years may be attributed to environmental factors such as temperature, rainfall, humidity, and availability of breeding habitats.

The findings suggest that the study area provides favorable ecological conditions for the survival and proliferation of multiple mosquito vectors. Therefore, integrated vector management strategies, including environmental sanitation, control of stagnant water, and public awareness, are essential to reduce the burden of vector-borne diseases. Continuous monitoring of species composition is also necessary for effective disease surveillance and control planning.

The study concludes that climatic factors such as temperature, rainfall, and humidity significantly affect the diversity and abundance of mosquito fauna in the Bareilly Terai region. The period 2014–2016 showed notable seasonal variations in mosquito populations.

Effective mosquito control strategies and environmental management are essential to reduce the risk of mosquito-borne diseases in this region.

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