Mosquito population dynamics of Ballari city

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Abstract

The mosquito diversity survey was conducted in Ballari city, VSK university surrounded, Goutham Nagar, municipal area, city and slum area, canal water surrounding area for four months 2019 – 2020. The adult mosquito were collected by trapping instruments such as aspirator tube, spray sheet method, and electric grid method. The results revealed that all together 12 mosquitoes of 4 genera identified and recorded. Anopheles, is predominant genus with 5 species, followed by Culex Aedes, Armigeres and Mosonia respectively. An early peak was observed in February when *Anopheles* contributed maximum in the entire population. Later tall peak was observed in March. The other three *Culex* and *Aedes* predominant species.

Biodiversity encompasses the variety of all living organisms on earth. India has rich biological diversity and one of the 12 mega countries of the world Biodiversity is a general term encompassing the variety of organism[6] several studies on mosquito were carried out in different regions of the world in order to study, species composition, density.

Mosquitoes being the commonest insects of the earth, are known to transmit dangerous pathogens to man. Heamatophagic behaviour of the mosquito is the main reason for the transmission of the pathogens. Human behaviour is also reported to be playing an important role in the emergence of pathogens through the mosquitoes. Global increases in temperatures and urbanization are impacting the epidemiology of mosquito-borne diseases[9] resulting in severe outbreaks, even in formerly non-endemic areas[7], Gould *et al.*[3,4], Gjenero-Margan[2]. Urbanization consists of altering the natural environment to make it more suitable for human populations and to accommodate both the growth of the local population and people moving from rural areas to cities Johnson,[5] and Reba *et al.*,[8].

Understanding the mosquito diversity in an area would help the public health personnel to keep a watch on the intrusion of new vector species of public health importance in the area. In India, a few studies have been undertaken to document the diversity of mosquito species and reported the frequent changes in the mosquito species composition in different areas. Periodic surveys must be done to update the diversity of mosquitoes and

in this context.

The present attempt has been made to record the diversity of mosquito species composition of Ballari city.

To study the diversity of mosquitoes with respect to different areas in Ballari city to know their species richness and their distribution. The present work is undertaken to study the diversity of mosquitoes in Ballari city in Karnataka.

There is no research work carried out in Ballari district after 2003. The mosquito fauna of Ballari city not much diverse, possibly because of hot and dry climate conditions of area. Hence, the present study attempted to study the diversity of mosquito in Ballari city.

Study Area :

Ballari district is situated between 14°30' and 15° 50' north latitude and 75° 40' and 77° 11' east longitude in Karnataka state. In Ballari district paddy is the major agricultural product, with two crops grown from January to April and from July to December. The climate condition of Ballari district is characterized by dryness in the major part of the year and hot summer. Both indoor and outdoor collection were made present study, Adult mosquito were collected randomly in different selected area in Ballari city.

Study Time :

Resting and biting adult mosquito were collected in the evening dusk collection 6:30 pm to 9:30 pm hours from human dwelling, cattle shed, classroom and paddy field. The collection of the mosquito aid with help of electronic mosquito trap, aspirator tube and spray sheet collection. All the sampling sites were visited weekly to record the diversity of mosquito. The collected mosquito were preserved in a plastic vials for later identification and they are preserved aid with the chemical Chloroform. The adult mosquito collected and stored were identified in the department laboratory with aid electronic microscopic.

Collection methods of mosquito as followed:

The Ballari city were selected for regular mosquito collection from indoor and outdoor. Phylum Arthropod (class Insecta) which includes insects, mites, spider, and mosquito *etc*. The insects alone account for nearly 55% of all species known to science. The behaviour of the insects and species can be observed most easily that environment. Especially smaller one must be collected and properly preserved before they can be identified.

Instrument and collecting method :

Electric grid method: In recent year electronic pest device has been used to control the insects . The mosquito are attracted towards device by the phenomenon of UV light rays trap. The device is placed in dark nature, which catch attention towards UV light. It is placed by strongly charged electric grid. Device collect mosquito by centrifugal force and store in chamber.

The Spray Sheet Collection: A two-man spray team was employed in order to get a complete catch as possible; one man stood in the room and sprayed the inside, while the

other sprayed outside the house, around the eaves and the inner walls that divide the room from the rest of the house, putting up a barrier of spray round all possible exits, the spraying was synchronised so that the eaves of air space above each wall were sprayed simultaneously from inside and outside. In each location five rooms were randomly chosen and the collection was performed between the hours of 7.00AM. The floor surfaces of the room, as well as beds, furniture were completely covered with white sheets. The windows and doors were closed and the eaves (openings) were blocked to prevent mosquitoes from escaping. Then the aerosol (New Mortein power Gard containing-Imiprothrin, d-Phenothrin, and D-trans allethrin) was used to fit the room and around the eaves outside the room, then the room was closed for 10 minutes. After 10 minutes, the sheets were carefully retrieved from the floor, starting from the door by lifting them at the four corners and moving them gently so that the mosquitoes were gathered at the middle of the sheet. The mosquitoes were collected in plastic vials with forceps and then taken to the laboratory for identification.

Aspirator Tube Or Sucking Tube: This is the most widely used and convinent method for mosquito collection. The aspirator tube generally having a length 32-5cm (internal diameter is 8-12mm it is made of glass or plastic tubing). A pieces of mosquito netting fixed over, short pieces smaller diameter rubber tubing, which is inserted into the end of large tubing. A 50cm long rubber tubing is slipped over the end of glass tubing provided with mosquito netting. The feeding on being detector with torch light is sucked in gently and the end of the tube is closed with a finger or cotton plug or, so that the captured mosquito are unable to fly out. The mosquito collected by the sucking tube are transferred into test tube and plugged with cotton. Later mosquito are anesthetized using chloroform with little amount and identified using hand lens or microscope.

Identification : The collected adults were stored in vials and all the collected mosquito photographed in a magnified from and then identified using standard keys and nomenclature[1].   .

The diversity survey was conducted in Ballari city, VSK university surrounded, Goutham Nagar, municipal area, city and slum area, canal water surrounding area for four months 2019 – 2020. The adult mosquito were collected by trapping instruments such as aspirator tube, spray sheet method, and electric grid method.

We selected 9 hotspots in Ballari city. All together 12 mosquitoes of 4 genera identified and recorded. Anopheles, is predominant genus with 5 species, followed by Culex Aedes, Armigeres and Mosonia respectively.

The study area was rich of mosquitoes, the breeding of mosquito was observed virtually in all habitats sampled. Every mosquito had its own preference on oviposition sites

The seasonal mosquito population fluctuation, in general mosquito population showed bimodal pattern of peak occurrence. An early peak was observed in February when *Anopheles* contributed maximum in the entire population. Later tall peak was observed in March. The other three *Culex* and *Aedes* predominant species.

Table-1. Species richness of Mosquito fauna recorded during study period in the Study area

Number of the species	March	April	May
Aedes aegypati	12	4	1
Aedes albopictus	6	10	
Anopheles annularis			8
Anopheles subpictus	3	2	
Anopheles culicifacies	3	3	
Anopheles vegus	1	4	5
Anopheles stephensi	3		1
Culex triarniorhyncus		5	6
Culex vishnui			1
Culex quinquefascitus	12	7	5
Armigers subalbatus		4	6
Mansonia annulifera			4
Total	40	39	38

Table-2. Distribution of Mosquitoes species in Ballari city with respect to selected areas

	VSKU Campus	Belagallu	Bapuji nagara	Kuvempu nagara	Municipal colony	Vidya nagara	KHP colony Gandhi nagara	Ibrahimpura APMC	Allipura
Aedes ageypti		1	3		2	1	4	2	4
Aedes albopictus	2	4		2		4	2		2
Anopheles annularis		1		2	3		2		
Anopheles culicifacies			1		2	1		2	
Anopheles subpictus						2	2		1
Anopheles stephensi						1		2	1
Anopheles vegus		2	3		2		1	2	
Culex vishnui									1
Culex quinquefasciatus	2	2	3	5	2	1	3	3	3
Culex tritarniorhyncus		1	3		2		2		3
Armigers subalbatus			2		3	3		2	
Mansonia annulifera					2			2	

The adult density of the species was higher in the area, survey on the water bodies with water plants yield one species of Mansonia, *Aedes albopictus*, *Culex quinquefasciatus* and *Aedes aegypti* were the predominant vector species in the dawn collection. Blood fed females of these species were collected from human dwellings during the study periods. *Anopheles vegus* and *Anopheles subpictus* were present throughout slum areas. A viral vector *Aedes albopictus* was found throughout the study area in higher density than *Aedes aegypti*, breeding in almost all types of freshwater holding containers. Polythene sheets were a major source of *Aedes albopictus* breeding the rural areas of the study area. *Aedes albopictus* and was dominant than Aedes *aegypti* in rural areas of the study areas where as *Aedes aegypti* was present in considerable higher densities in urban areas. Plastic containers were the predominant breeding habitat found in the study. The species collected during the study are all of potential medical importance. The presence of urban vector *Anopheles stephensi* during the months of March, April, and May 2020 is a potential risk of diseases. The changes in the local ecosystems and microclimatic conditions results in the altered preference of mosquito species in their breeding and feeding behaviours *Anopheles stephensi* was found to be breeding. *Anopheles stephensi* represented 0.75% of the total anopheline female mosquitoes collected in the study whereas *Anopheles vegus* was the most represented species with (26%) of total anopheline females. *Culex vishnui* (21.5%) was predominant among all the species collected. The cohabitation of *Aedes albopictus, Aedes aegypti* and *Culex quinquefasciatus* were seen in the urban environments where a*s* the

rural breeding habitats favour the breeding of *Aedes albopictus* and resulted in theexclusion of *Aedes aegypti* as described in other previous studies. In the present study the species richness was found to be high during the month April.

The study revealed that discarded automobile tyres, open drainage, cattle shed, stagnant water served as very important breeding places of mosquito species in the study area. The ability of mosquito species to breeding the discarded tyres attributed to the collection of in the abandoned tyres when dumped in the open bushes or roadsides around residential areas. The availability of discarded tyres in the environment thus offers a suitable habitat for opportunistic mosquito to breed. In this study, six species from two mosquito genera were isolated. Our finding isolate fewer species compared with a recent study conducted in Ballari city this could be due to smaller scope of ecological difference. Mosquitoes were encountered from the localities visit during the conduct of this research. Probably this area is more of an urban slum settlement with lots of open refuse and other stagnant water locations. However, Railway quarters had the least of mosquitoes probably because the area consist of more spaced government quarters with adequate drainage system and less surface stagnant water for larger concentration mosquitoes. During the study, *Culex quinquefasciatus* was the most dominant species over there maining species encountered in the cattle shed, house, and college. Our findings agree with the report by Simard (2011). Who maintained that *Aedes aegypti* and *Aedes albopictus* breed frequently in used tyres and other artificial sites. It also concurs with the findings from a similar Nigerian study by

(Adebote). The dominance of *Culex quinque-fascistus* in the discarded tyres also probably indicate that the species could tolerate a wide range of physico-chemical and ecological conditions, compared to other mosquito species. In this research, not high species of Anopheles mosquito was encountered, this could be probably attributed to the fact that water amount in the discarded tyres is small in quantity and could contain high concentration of ions and less dissolved oxygen which do not favour for development.

Previous studies have shown that, the genus Anopheles favour larger volumes of water with less contraction of chemical ions and much of dissolved oxygen Kanoja, *et al.*, (2003). They surveyed the mosquito species in Ballari district. A total of 120113 mosquitoes collected at dusk collections belonging to 5 genera and 24 species. During their survey period the mosquitoes fauna richness and abundance was high, because the presence of eco-friendly habitat. But in the present study we surveyed in Ballari city of selected area, total 12 mosquito species were identified. In our study the species richness and abundance decreased.

Generally mosquito population showed bimodel pattern of peak occurred during march in the peaks *Culex quinqefasciatus*, because in this month atmospheric temperature is gradually increases and dissolved oxygen also increases and it is favorable condition for spawning of mosquito. The mosquito population low peak level occurred both during April and May because during this season the temperature is maximum so this condition is not favorable for mosquito larval development. However, $34^{\circ}C$ mosquitoes laid significantly fewer eggs then those at $27^{\circ}C$.

The current result showed that population of mosquitoes species increased with increase in humidity, decreased with increased temperature. *Culex* species showed a broad range of habitat performance then the other genera and on the other hand the genus *Aedes* was found from a few habitats and second least diverse. Mostly, the same kind of habitat was observed with most of collection sites. The only difference was the rice field which could be considered as the most preferred habitat. Therefore, suggested that irrigated field, rain catch basin and stagnant water in rice field could serve as a potential breeding site for mosquitoes in the rural area.

Summary :

The results of this study showed that deforestation is a major affects the overall mosquito species community. The mosquitoes species richness decline due to the high hygiene facilities and awareness of the diseases and improved control measures.

Mosquitoes are not just a menace, they can also cause health hazards to human beings. At the same time it is a carrier of many diseases. Therefore it must be got rid off. The increasing trend of rapid changes in environment leading to the changing vector distribution demands frequent surveys to monitor change in vector distribution. A proper study of mosquito fauna would help in finding the distribution pattern of vector and non-vector mosquitoes and hence able to fight against them by implementing proper control measures.

Through the diversity of mosquitoes survey conducted in the Ballari city it was found out that Ballari is a conglomeration of semi urban places and hence there is no clear cut distribution between rural and urban localities seasonal habitat based prevalence were noted among the mosquito population. Ecosystem plays a significant role in the determination of species composition and biodiversity. In the study area is also found out that the female mosquitoes have predomination over male mosquitoes and it indicates the capacity to maintain generation.

In the present study a total 12 mosquito species were identified. Survey revealed that the mosquito fauna of Ballari city which comprises 12 species. Out of 12 species mosquito species are established vector and non-vectors.

Total identified species are : *Aedes albopictus*, *Aedes ageypti*, *Anopheles annularis*, *Mansonia annulifera*, *Anopheles subpictus*, *Anopheles culicifacies*, *Anopheles vegus*, *Anopheles stephensi*, *Culex tritarnio-rhyncus*, *Culex vishnui*, *Culex quinquefasciatus* and *Armigers subabatus*.

Reference :

1. Barraud PJ. (1934). The fauna of British India, including Ceylon and Burma. Diptera: Family Culicidae; Tribes Megarhinini and Culicini. 1934; Vol. *5,* Taylor & Francis, London, 463.
2. Gjenero-Margan, I. *et al.* (2011). *Euro Surveill. 16:* 1–4.
3. Gould, E. A., P. Gallian, De Lamballerie, X. and R. N. Charrel, (2010). *Clin. Microbiol. Infect. 16:* 1702–1704.
4. Gould, E., J. Pettersson, S. Higgs, R. Charrel and de Lamballerie, X. (2017). Why today? *One Heal. 4:* 1–13.
5. Johnson, M. T. J. and J. Munshi-South, (2017). *Science 358:* 8327.
6. Mackenzie, S.M., M.R. Brooker, T.R. Gill, G.B. Cox, A.J. Howells, and G.D. Ewart, (1999). *Biochim. Biophys. Acta 1419*(2): 173—185.
7. Poletti, P. *et al.* (2011). Transmission potential of chikungunya virus and control measures: Te case of Italy. PLoS One 6, e18860.
8. Reba, M., F. Reitsma, and K. C. Seto, (2016). *Sci. Data 3:* 1–16.
9. Rosenberg, R. *et al.* Vital Signs (2018). *Morb. Mortal. Wkly. Rep. 67:* 496–501.