Factors Affecting the Seasonal Prevalence of Mosquito Population

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ABSTRACT

Mosquitoes are the most prominent blood sucking arthropods that cause the greatest sufferings to human and their possessions. Besides sucking blood, they inflict painful and irritating bites; and act as vector transmitting some of the deadliest diseases like malaria, filariasis, dengue fever, yellow fever, encephalitis, etc. In Assam, mosquito fauna is rich and breeding sites are innumerable owing to heavy rainfall and high humidity, rendering the environment conducive for mosquito survival and proliferation. Certain physico-chemical parameters of various mosquito breeding grounds and the identification of the key factors that provide optimum condition for population density of mosquitoes in the urban areas like Guwahati, encourage the mosquito population. It has been observed that in Guwahati city mosquito population shows an abrupt rise during the period from February-April in contrast to the other non urban places of Assam. The population density of 3 important genera, *Anopheles*, *Culex* and *Aedes* of mosquitoes has been studied during Feb-Apr, 2009 by collecting larvae from different breeding grounds of Chandmari, Ambari and Uzanbazar of Guwahati. The total population of the mosquito is attaining its highest in the month of March. The genus *Culex* contributed the highest percentage of total population ranged from 96.80 to 99.09% and appeared as only dominative group followed by *Anopheles* (1.41 - 3.20%) at every place of collection while the population density of *Aedes* is nil. The population density of *Culex* indicates that all the 3 breeding places were found to be self sufficient nutritionally for the rich population of mosquito. It is due to the algal population which is good for mosquito larvae encouraged by the presence of high concentration of phosphate originated from the detergents of the domestic sewage.

Keywords: Arthropods, Vectors, Breeding ground, *Anopheles*, *Culex*, *Aedes*

INTRODUCTION

Mosquitoes are the most prominent blood sucking arthropods that undoubtedly cause the greatest sufferings to human and their possessions. Besides sucking blood,

they inflict painful and irritating bites; and transmit some of the deadliest diseases like malaria, filariasis, dengue fever, yellow fever, encephalitis, etc. The important genera of mosquitoes are *Anopheles*, *Culex* and *Aedes*. More than 20 *Anopheles* species have been recorded, comprising a few malaria vector species, namely *A. minimum, A. feuriatilis* and A. culicifacis (Dutta and Bhattacharya, 1993). Species of genus Culex are natural vectors of Japanese encephalitis (JE) in different countries of East and South-East Asia (Reuben, 1968). Three species namely Culex tritaeniohynelms, *C. vishnui and C. pseudovishnui,* has been studied as important vectors of JE in India also, and 16, 11 and 6 isolations of JE virus have been made from them respectively (Pant *et al.*, 1994 and Rodtrigues, 1988).

It has been recognized that the feeding behavior of mosquitoes is of paramount importance in the epidemiology of mosquitoes borne pathogens (Romoser *et al.*, 1989). Host feeding pattern of vector mosquitoes is crucial for the maintenance of the complex natural cycle of JE virus, which includes pigs and birds. The virus is transmitted from pig to pig and bird to pig by Culex vector and human is only incidental hosts (WHO, 1982).

As mosquitoes are known to breed in a wide variety of habitats, it is essential to determine species specific breeding habitats for species sanitation.

In Assam, mosquito fauna is rich and breeding sites are innumerable owing to heavy rainfall and high humidity, rendering the environment conducive for mosquito survival and proliferation.

The present investigation deals with certain physico-chemical parameters of various mosquito breeding grounds of Chandmari, Ambari and Uzanbazar; and the identification of the key factors that provide optimum condition for population density of mosquitoes in the urban areas of Greater Guwahati that encourage the mosquito population.

ORIGIN OF PROBLEMS

It is usually observed that in Guwahati mosquito menace becomes a great social problem during the period from February to April. The menace is experienced by members of all ages of the society. Students can't concentrate their minds in studies; man can't sit comfortably in libraries, in public places and in the academic centres having evening classes, etc. due to mosquito bites. This problem is greatly involved in the economy of the society because to escape from the mosquito repellants in the form of tablets, coils, aerosols, etc. which ultimately cause great harm to human health including baby. Moreover, it transmits germs of several diseases such as malaria, encephalitis, dengue fever, filariasis, etc. Moreover, each and every member of the family in Guwahati is bound to use mosquito net to remain away from the mosquito menace while sleeping.

It has been observed that in Guwahati city mosquito population shows an abrupt rise during the period from February-April in contrast to the other non urban places of Assam. Its main reason is the presence of numerous nutrients rich breeding grounds located in different places within the Guwahati city. The non urban places adjacent to Guwahati city are not experienced with such an erratic rise in mosquito population instead of having stagnant breeding grounds with similar climatic condition. In the present investigation a critical study has been carried to bring into focus the encouraging factors in the breeding grounds to support mosquito population.

METHODOLOGY

Three areas viz. Chandmari, Ambari and Uzanbazar of Guwahati metro has been selected for the study. While selecting the area, primary importance has given in the location of breeding ground where large amount of organic nutrients are deposited by the sewage carrying drains from the thickly populated areas containing adequate amount of water, providing best ecological parameters for mosquito breeding.

Collection of water sample containing mosquito larvae: The comparative population density of 3 families of mosquitoes has been studied by collecting larvae from breeding grounds. Water samples containing the larvae were collected in the plastic bowls of 300 ml without agitating the area. Utmost care was taken not to disturb the mosquito larvae. Ten samples were drawn from each breeding site per month. After collection, the larvae were killed by mild formaldehyde solution and they were identified using microscope up to family level with the help of standard literature. Simultaneously the number of larvae of different families was taken into account for the study of their population. To obtain an errorless data all the larval stages are counted and the data so obtained is considered to be a total number of larvae present.

Various physico-chemical parameters were studied by using standard methods in the laboratory of Assam Pollution Control Board, Bamunimaidan, Guwahati.

Morphological differences of 3 families of mosquitoes Culicine, Anopheline and Aedes:

	Character	Culicine	Anopheline	Aedes
1	Position of siphon	Penultimate segment of the abdomen	Does not possess respiratory siphon	Penultimate segment of the abdomen
2	No. of spiracles	2 pairs	1 pair	2 pairs
3	Body orientation	Larva hangs down at an angle with only the tip of the siphon in the surface film	Larva held up	Lara hangs

Larval population is expressed in terms of density, frequency and abundance.
Density = Total no. of individual encountered/Total no. of observation
Frequency = No. of species occurrence/Total no. of observation
Abundance (%) = No. of individual sp. in a sample/Total no. of all spp. in that sample x 100

Analysis of physico-chemical parameters of water:

(i) Rainfall: Stagnant water reservoir is the primary requirement for mosquito breeding. The population density of mosquitoes is very high during the period from February to April. It infers that high rainfall is not conducive for mosquito breeding in the drains of Greater Guwahati because during summer months the drains are flooded with running water that provides unfavourable condition for mosquito breeding.

(ii) Temperature: It is most important factor influencing the population density of any insect in an area. The temperature of Guwahati ranges from 280C to 320C ± 20C from February to April. During winter season population density seems to be low due to lower temperature; however, population of culicine species doesn't reduce as because of their non-hibernating nature. The study reveals that the atmospheric temperature between 280C to 320C ± 20C is the optimum temperature for culinine mosquito.

(iii) pH: pH level of all breeding grounds found to be slightly alkaline ranging from 7.5 - 7.6. It suggests that the urban drains during pre-monsoon period are not affected by inorganic pollutions. However, higher range of pH is the optimum for breeding of culicine species.

(iv) Chemical parameters: The water quality reveals that certain important parameters like biological oxygen demand (BOD), chemical oxygen demand (COD), chloride, phosphate etc. have exceeded the permissible limits in the breeding grounds of mosquitoes in stagnant aquatic body in polluted drain water. Ammonia, nitrogen, nitrogen, nitrites, nitrates and phosphates are the best requirements of algal growth but level of BOD and COD clearly indicate that the water of selected breeding ground is highly polluted to provide condition for aerobic macro and micro flora and fauna except the algal population.

The study has been carried out during February to April, 2009. This period seems to be the best period for mosquito population in Guwahati.

In the present studies, the population distribution of the 3 mosquito families in their natural breeding grounds within the boundary of Greater Guwahati has been studied in relation to the encouraging factors in the breeding habitats.

RESULT AND DISCUSSION

In the present investigation, the seasonal abundance of mosquito population of 3 breeding places in Guwahati area has been critically studied in relation to the sewage borne organic component in the breeding grounds during pre-monsoon period from February to April. There was a little variation in population in 3 breeding sites. The result shows that the total population of the mosquito is attaining its highest in the month of March. The genus *Culex* contributed the highest percentage of total population and appeared as only dominative group followed by *Anopheles* at every place of collection while the population density of Aedes is nil.

In Chandmari (Spot-I) the population percentage of *Culex* is highest in all the months of the study. On the other hand, Anopheles shows its highest (3.2%) abundance in April and lowest in March (1.41%). During the study period it was found that when population abundance of *Culex* is highest then the *Anopheles* shows lowest. In Ambari (Spot-II) also population abundance of *Culex* is highest (98.29%) in the month of March. The *Anopheles* population contributed an insignificant percentage and reached its peak in the month of March. In Uzanbazar (Spot-III) the Culex group contributed 99.09% of total population in the month of February followed by 98.56% and 97.61% in March and April. The *Anopheles* population contributed an insignificant percentage in Spot-III too (Table 1).

The *Anopheles* species is the most dominant one in Assam, tend to breed in stagnant fresh water bodies and larvae are sensitive to polluted water (Bhattacharya, 1992). The larvae feed upon organic particles present in the water viz. protozoa, bacteria, algae, fungal spores, pollen, etc. In this study, their population density was found to be almost nil in all 3 breeding places. Moreover, *Anophiles* species grow well in sunlight ponds or aquatic body, especially with aquatic vegetation.

Culex species can be categorized into i) domestic and peri-domestic, ii) semi domestic members of blood sucking dipterans (Carpenter and Lacasec, 1995). Large number of *Culex* species form culicine complex and the members are prone to breed in small collection of water around human dwelling furthermore the adult commonly enters houses and feed on man. Culicine species are prone to breed in polluted water and hence, in drains, swamps containing organic sewage (Harstall, 1995).

The present study reveals that culicine population density encouraged by eutrophic conditions of the breeding grounds caused by abnormally high amount of nutrient from sewage, fertilizer, animal waste and detergents. From the pH record it is interpreted that the drains of the Guwahati city contain mainly organic pollutants. The results of BOD, COD and DO don't encourage micro/macro flora or fauna to func-

tion as trophic level to supply nutrients to the mosquito larvae. On the other hand, the population density of culicine indicates that all the 3 breeding places were found to be self sufficient nutritionally for the rich population of mosquito. It is due to the algal population which is good for mosquito larvae encouraged by the presence of high concentration of phosphate originated from the detergents of the domestic sewage.

CONCLUSION

The seasonal abundance of mosquito population in Guwahati shows little variation in population in 3 breeding sites. The total population of the mosquito is attaining its peak in the month of March. The genus *Culex* contributed the highest percentage of total population and appeared as only dominative group followed by *Anopheles* at every place of collection while the population density of *Aedes* is nil. The population density of *Culex* indicates that all the 3 breeding places were found to be self sufficient nutritionally for the rich population of mosquito. It is due to the algal population which is good for mosquito larvae encouraged by the presence of high concentration of phosphate originated from the detergents of the domestic sewage.

Table 1. Species wise Density, Frequency & Abundance (%) of Mosquito in Guwahati

Month	Study area	Mosquito species	Density	Frequency	Abundance (%)
February	Spot-I	Culicine	12.7	1.0	98.44
		Anopheline	0.5	0.1	1.55
	Spot-II	Culicine	9.6	1.0	98.96
		Anopheline	0.1	0.1	1.03
	Spot-III	Culicine	11.0	1.0	99.09
		Anopheline	0.1	0.1	0.90
March	Spot-I	Culicine	13.8	1.0	98.57
		Anopheline	0.5	0.5	1.42
	Spot-II	Culicine	11.5	1.0	98.29
		Anopheline	0.5	0.5	1.70
	Spot-III	Culicine	13.7	1.0	98.56
		Anopheline	0.5	0.5	1.43

April	Spot-I	Culicine	12.1	1.0	96.80
		Anopheline	0.4	0.4	3.20
	Spot-II	Culicine	10.5	1.0	97.22
		Anopheline	0.3	0.3	2.77
	Spot-III	Culicine	12.3	1.0	97.61
		Anopheline	0.3	0.3	2.38

Spot-I=Chandmari; Spot-II=Ambari; Spot-III=Uzanbazar

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REFERENCE:

Bhattacharya DR, 1992. Anopheline fauna of parts of Tirap District, Arunachal Pradesh reference to malaria trasmission.

Carpenter SJ and Lacasec WJ. 1995. North American Masquito University of California Press.

Dutta PVD and Bhattacharya DR. 1993. Anopheline fauna and malaria incidence in Changlang District, Arunachal Pradesh, India. J. Malaria. 30: 135-143.

Horstall WR. 1955. Mosquitoes, bionomics and relation to disease. RONALD, New York. 723 p.

Pant UI, Seman MA and Shetty RS. 1994. First isolation of Japanese encephalitis virus from mosquito in UP. UP. J. Res. 99: 149-151.

Rodtrigues FM. 1988. Epidemiology of arboviral diseases of man in India. Known facts and unsolved questions. NIV Bull. 6: 3

Reuben R. 1968. A redeseription of culex vishnui Theo, with notes on C. pseudovishnui Colless from Southern India. Bull. Entomol. Res.

Romoser WSE and Scoff TW. 1989. Histological parameter useful in the identification of multiple blood meals in mosquitoes. Med. Hyg. 41: 737-742.

WHO, 1982. Manual of Environmental Management for mosquito control. WHO Publication, 1982. WHO, Geneva.