Incrimination of Malaria vectors in Aligarh district of Uttar Pradesh, India

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Abstract: Anopheline vectors play a role in the transmission of this disease. In the Present study vectors responsible for malaria transmission in Aligarh were incriminated. *Anopheles culicifacies* and *Anopheles stephensi* were incriminated as malaria vectors in Aligarh by finding sporozoites in salivary glands. Sporozoite positivity rate and human blood index recorded for *An. culicifacies* and *An. stephensi* during peak transmission season (i.e. August to October, 2012) were 0.54%, 0.26% and 37.80% and 39.92% respectively.
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1.Introduction

Malaria is caused by infection with a single-cell parasite, *Plasmodium*. Four *Plasmodium* spp. cause malaria in human beings: *Plasmodium falciparum*, *P. vivax, P. ovale,* and *P. malariae. P. falciparum* is the most important because it accounts for the majority of infections and causes the most severe symptoms. Malaria remains one of the leading causes of morbidity and mortality in the tropics. According to the World Malaria Report (2011), there were 106 malaria endemic countries in 2010. There were 216 million cases of malaria in 2010; 81% of these were in the World Health Organization (WHO) African region. An estimated 3.3 billion people are at risk of malaria. An estimated 655, 000 persons died of malaria in 2010. 86% of the victims were children under 5 years of age, and 91% of malaria deaths occurred in the African region. Historically, malaria has been a problem in India for centuries. Malaria is endemic in India with varying levels of endemicity. Most regions in the country have an unstable malaria situation except in the North-Eastern region where stable malaria situation prevails. There are many endemic pockets of malaria in India particularly in North Eastern States, Orissa, West Bengal and Madhya Pradesh. In 1990s malaria re-emerged and took the lives of several thousand people (Sharma, 1996). Factors responsible for the re-emergence of malaria were vector resistance to insecticide and parasite's resistance to drug.

Anopheles mosquitoes are most frequent in tropical and sub tropical regions. In India 58 species of *Anopheles* are recorded, out of which six are considered as primary vectors and four as secondary vectors. The primary vectors include *An. culicifacies*, *An. stephensi, An. fluviatilis, An. dirus, An. minimus* and *An. sundaicus* whereas *An. annularis, An. philippiensis (nivipes), An. varuna* and *An. jeyporiensis* are considered as secondary vectors (Rao,1984). Among the primary vectors *An. culicifacies* has been established as a major vector of malaria in rural and periurban areas of India (Subbarao *et al*. 1988). *An. culicifacies* is responsible for 60-70% of total malaria cases reported annually in India (Sharma, 1984).

In Aligarh, where the proposed work is carried out is situated in the upper Ganga-Yamuna Doab and occupies the northern most portion of Agra division. It extends from 27^0 29' N to 28^0 11' N latitudes and 77^0 29' to 78^0 38' longitudes. It has tropical monsoon type of climate with its highly attributed seasonal variations including the North-East and North-West monsoons. The North-East monsoon occurs from December to mid June and is distinguished by high temperature and dry winds of continental region. Clear skies, dust and low humidity are observed from time to time. While rest of the period, that is from mid June to October is marked by humid winds of oceanic origin, including cloudy weather, rainfall and high relative humidity. The onset and retreat time of the monsoon differs considerably every year. Usually the rain starts by the mid of June and continues till the end of September or early October. Excess rain in this part of the year may cause the low-lying areas or depressions and ditches to be water-logged. Relative humidity varies considerably throughout the year. In the experimental area a variety of mosquito breeding grounds are present which facilitates the emergence of different anopheline species. The present study was, therefore, undertaken to screen and incriminate the malaria vector in Aligarh. Sporozoite positivity rate and human blood index were also recorded for the vector species as they have direct bearing in malaria transmission.

2.Material and Methods

For vector incrimination three suspected anthropophilic species viz. *An. culicifacies, An. stephensi* and *An. annularis* were collected from human dwellings of different localities during high transmission season (i.e. August to October, 2012). *Anopheles* mosquitoes were collected from (18.00-24.00 hours) both indoors and outdoors by human landing catches methods with the help of mouth aspirators (Maheswary et al, 1994). Mosquitoes were collected from four houses per night on each of five successive nights once within the peak malaria transmission season (August to October). Four volunteers collected mosquitoes at each house two indoors and two outdoors. After completion of HLC (human Landing cateching) and resting collection, CDC miniature light trap model 512 (origin: Jhon W. Hock Inc, USA) was also used for entomological investigation. Each trap was installed for at least 12 hours (6 pm to 6 am). Each night four trapping was conducted for five days of a week for each of the areas alternatively once in the peak season (August to October).

The mosquitoes were anaesthetized with ether and identified with the help of standard regional pictorial keys of Wattal and Kalra (1961). Identified mosquitoes were dissected to look for salivary gland infection. Sporozoite positive slides were stained with Leishmann's stain as described by Choudhrey and Ghosh (1982) and sporozoite positivity rate was worked out. For human blood index, blood smears were prepared from the gut of fully fed female *Anopheles* on Whatman filter paper No. 1 and analyzed by counter current electrophoresis.

3.Results

Table- I shows the blood meal analysis of *An. culicifacies* and *An. stephensi*. Out of 1259 blood smear analyzed for *An. culicifacies*, 476 (37.80%) were found positive for human blood, 396 (31.45%) for bovine blood and 387(30.7%) for mixed. Out of 799 blood smears analyzed for *An. stephensi*, 319 (39.92%) were found positive for human blood, 270 (33.79%) for bovine blood and 210 (26.28%) for mixed. Human blood index for *An. culicifacies* and *An. stephensi* were 37.80% and 39.92%, respectively.

Table-II shows the result of dissection of glands of three suspected anopheline species i.e. *An. culicifacies, An. stephensi* and *An. annularis*. From 2190 *An. culicifacies,* 742 *An. stephensi* and 502 *An. annularis* salivary glands were successfully dissected out and examined for the sporozoite positivity. Salivary glands of 12 specimens of *An. culicifacies* and 2 specimens of *An. stephensi* were found to contain sporozoites showing positivity rates of 0.54% and 0.26%, respectively. While none of the glands of *An. annularis* showed presence of sporozoite.

Table I- Blood meal analysis results of *An. culicifacies* and *An. stephensi*

Species	No. of Blood Smears analyzed	Numbers positive for human blood	Numbers positive for bovine blood	Mixed	HBI
An. culicifacies	1259	476 (37.80%)	396 (31.45%)	387 (30.7%)	37.80
An. stephensi	799	319 (39.92%)	270 (33.79%)	210 (26.28%)	39.9

Table II- Results of dissection of anophelines collected from the human dwellings

Species	Numbers Collected	Dissected Glands	Positive Glands	Sporozoite Positivity rate
An. Culicifacies	2899	2190	12	0.54%
An. Stephensi	787	742	2	0.26%
An. Annularis	800	502	0	0%

4. Discussion

Malaria still continues to be one of the most important vector borne diseases of the world causing extensive morbidity and mortality in tropics and subtropics. Anopheline vectors play a role in the transmission of this disease. In the Present study vectors responsible for malaria transmission in Aligarh were incriminated. Sporozoite positivity rate and human blood index of vector species were also determined.

During vector incrimination in the present study 12 *An. culicifacies* and 2 *An. stephensi* were found positive for sporozoites. Sporozoite positivity rate for *An. culicifacies* and *An. stephensi* were 0.54% ad 0.26%, respectively. Human blood index for *An. culicifacies* and *An. stephensi* was recorded 37.80% and 39.5%, respectively. Sporozoite positivity rate was low because mosquito were collected randomly from different localities of Aligarh and only a fraction of captured *An. culicifacies* and *An. stephensi* were

infected. Out of infected mosquito only a few of them might have completed sporogony at the time of dissection. Since sporozoites reach salivary glands only after 10-12 days, probability of finding sporozoites at the time of dissection becomes very low. Low HBI further minimized the chance of infectivity. Low HBI also indicates their moderate endophilic nature. Both the species have slightly higher preference for human blood as compared to bovine. Though *An. culicifacies* found in good numbers, only 37.80% of them show positivity for human blood. A fair population of *An. culicifacies* was found to be exophagic and exophilic in nature and feeding on cattle as earlier reported by Kalra (1978) and Nagpal and Sharma (1985) who also observed exophilic and exophagic population of *An. culicifacies* from Tamil Nadu and Orissa.

Sporozoite positivity rate of 0.54% and 0.26% are low count for malaria transmission but it is not very low for a place like Aligarh, which is not a high transmission region. 0.26% sporozoite positivity rate for *An. stephensi* which was recorded during present study is in agreement with Siddons (1946), Negoy and Sen (1962) and Choudhury and Sen (1987) who recorded 0.57%, 0.52% and 0.10% sporozoite positivity rate from Kolkata. Our findings of incriminating *An. culicifacies* as malaria vector in campus of Aligarh showing transmission rate of 0.54% is in agreement with Nagpal and Sharma (1986) who had reported slightly high positivity of 1.33% for *An. culicifacies* in comparatively higher transmission region of Orissa. Bhatnagar *et al*. (1982), Das and Baruah (1985), Dutta and Baruah (1987) and Wajihullah *et al*. (1992) incriminated *An. minimus* in Nagaland, Mizoram, Arunachal Pradesh and Assam, respectively. The sporozoite positivity rate observed by these workers ranged from 1.4 to 8.3%, which are comparatively much higher than reported in the present study. It is probably because of the reason that vector involved in these studies was *An. minimus* which is highly anthropholic species showing human blood index of 90% and is operating in high transmission region (Wajihullah *et al*. 1992).

Our finding of sporozoite positivity rate (0.54%) for *An. culicifacies* in of Aligarh is in corroboration with the findings of Mayne (1928), Covell and Jaswant (1943), Bhatia *et al*.(1958); Chaudhury *et al*. (1983), Annual report MRC (1983-84), Ansari *et al*.(1986) and Prasad and Sharma (1990) who had reported sporozoite positivity rates of 0.148%, 0.196%, 0.157%, 0.189%, 0.489%, 0.832%, 0.490%, and 2.89% from Saharanpur, Delhi, Khurja, Gadarpur, Ghaziabad, villages of Bareilly and Meerut

The present study which was conducted in low transmission region of Aligarh, by enlarge have rural or suburban types of localities where *An. culicifacies* is acting as a principal vector is in conformity with the findings of Nagpal and Sharma (1986) who reported *An. culicifacies* as principal vector in Orissa. Incrimination of *An. culicifacies* by above workers in the villages of plains of U.P and plains, coastal and even urban areas of Orissa established its role in malaria transmission. While *An. stephensi*, which is an established vector for urban areas, was also incriminated in the present study from thickly populated area of Aligarh probably supports transmission of malaria in Aligarh particularly in the hot summer in urban type of locality as earlier observed by Negoy and Sen (1962) and Choudhury and Sen (1987) in Calcutta.

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References:

1. World Malaria Report. WHO Press, World Health Organization, 20 avenue Appia, 1211 Geneva 27, Switzerland 2011; pp. 1-137.
2. Sharma VP. Re-emergence of malaria in India. . Indian Journal of Medical Research 1996; 103: 26 – 45.
3. Rao TR, The anophelines of India. Malaria Research Centre (ICMR), New Delhi.1984
4. Subbarao SK, Vasantha K, Raghuvendra K, Sharma VP Sharma GK. *An. culicifacies*: sibling species composition and its relationship with incidence. Journal of American Mosquitoes Control Association 1988; 4:29 – 33.
5. Sharma GK. Review of malaria and its control in India in proceedings of the Indo-U.K. Workshop on malaria Nov 14 – 19, 1983 edited by V.P. Sharma, Malaria Research Center (ICMR) Delhi 1984:13 – 40pp.
6. Maheswary NP, Majumdar S, Chowdhury AR, Faruque MS, Montanari RM. Incrimination of *Anopheles vagus* Donitz, 1902 as an epidemic malaria vector in Bangladesh. Indian Journal of Malariology1994; 31**:**35-38.
7. Wattal BL, Kalra NL (1961). Regionwise pictorial keys to female Indian *Anopheles*. Bulletin Nat. Social Indian Malaria Mosquitoes Disease 1961; 9: 85 – 130.

8. Choudhury, DS, Ghosh SK. Staining of sporozoites from human infected mosquitoes. Indian Journal of Malariology 1982 19:143-144.
9. Kalra NL. Assignment report on the investigations carried out in persistent transmission areas of malaria and kala-azar in Tamil Nadu. Unpublished report submitted to National Institute of Communicable Diseases, Delhi, India 1978.
10. Nagpal BN, Sharma VP.Tree hole breeding and resting of mosquitoes in Orissa. Indian Journal of Malariology 1985; 22:115 – 117.
11. Siddons LB. *An. stephensi* as a vector of malaria in Calcutta. Journal of Malaria Institute of India 1946; 6: 367 – 376.
12. Negoy BP, Sen AK. *An. stephensi* as a carrier in rural Bengal. Indian Journal of Malariology 1962; 16:81 – 85.
13. Choudhury, DS, Sen AK. Incrimination of *An. stephensi* Liston as malaria
14. vector in Calcutta. Indian Journal of Malariology 1987; 24:183 –185.
15. Nagpal BN, Sharma VP. Incrimination of *An. culicifacies* as vector of malaria in Orissa. Indian Journal of Malariology 1986;23: 57 – 59.
16. Bhatnagar VN, Dwivedi SR, Mishra BG, Das M. Detection and incrimination of *An. minimus* Theobald, 1901 as malaria vector in the foot hill area of Nagaland. Indian Journal of Malariology 1982; 19:129.
17. Das SC, Baruah I . Incrimination of *An. minimus* Baisus (*An. dirus*) as malaria vector in Mizoram. Indian Journal of Malariology 1982; 22: 53-55.
18. Dutta P, Baruah BD. Incrimination of *An.minimus* Theobald as vector of malaria in Arunachal Pradesh. Indian Journal of Malariology 1987; 24:159- 162.
19. Wajihullah, Jana B, Sharma VP. *Anopheles minimus* in Assam. Current Science 1992; 63: 7 – 9.
20. Mayne B. *Anopheles* mosquitoes as host for the parasites of bird malaria. Indian Journal of Medical Research 1928; 16: 557 – 578.
21. Covell G, Singh J. Anti malaria Operations in Delhi, part IV. J. Mal. Inst. Ind. 1942; 5: 87 – 106.
22. Bhatia ML, Mannen ML, Ray AP. Malaria transmission during spring in the plains of U.P. Bulletin Nat Social Indian Medical Mosquito Disease 1958; 5 :82-5.
23. Choudhury DS, Malhotra MS, Shukla RP, Ghosh SK, Sharma VP. Resurgence of malaria in Gadarpur PHC, District Nainital, Uttar Pradesh, Indian Journal of Malariology 1983; 20:49-58.
24. Annual Report. (1983). Malaria Research Centre, Delhi.
25. Ansari MA, Sharma VP, Razdan RK, Batra CP. Malaria situation in Meerut district villages, U.P. Indian Journal of Malariology 1986; 23:147-150.
26. Prasad RN, Sharma SN. Outbreak of malaria in Banda PHC of district Shahjahanpur. Indian Journal of Malariology 1990; 27: 45 – 50.

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