Short Notes

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Studies on anopheline fauna and malaria incidence in Dhansiripar PHC of Dimapur, Nagaland

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Northeastern region of India is in the Indo-Chinese hill zone of Macdonald's classification of stable malaria. Despite numerous control measures, malaria continues to be major health problem with high morbidity and mortality in the areas of its occurrence even today. Perennial and persistent transmission of malaria is common in this region due to the predominance of *Plasmodium falciparum*[1-3], development of resistance to chloroquine[4,5], efficient anthropophagic vectors and congenial climate conditions. The role of *Anopheles minimus* (Diptera : Culicidae) as a principal vector in the transmission of malaria was established during early forties[6]. However, studies carried out in the fifties to seventies revealed near elimination of this species from northeastern region of India[7,8], due to extensive use of insecticides under the National Malaria Eradication Programme (NMEP) presently National Vector Borne Disease Control Programme (NVBDCP) since 1953 and re-appeared in early eighties and its role in malaria transmission is well recognised[1,2,9,10]. Deforestation, urbanisation and development projects brought out changes in the eco-environment, which influenced the transmission of disease resulting in some changes in behavioural aspects of the vectors. Thus, it is essential to review the distribution and species composition of vector mosquitoes in a given area for adopting appropriate antimalaria control measures.

Here we present the results of a study carried out on anopheline fauna and prevalence of malaria incidence in three forest-fringed villages during July and August 2003.

Three riverine villages—Khekiho, Denial and Dhansiri under Dhansiripar PHC of Dimapur, Nagaland were selected for these studies. These villages, located in foothill areas on the bank of the river Dhansiri bordering Karbi-Anglong district of Assam are traversed by perennial and seasonal streams. Houses are made of bamboos with thatched roofs and are often adjacent to cattlesheds. The population of these villages is comprised of Naga tribes, migratory population of Nepalese and Muslim community. Agriculture is the main occupation and the principal crops are rice and maize. The main breeding habitats of mosquitoes were paddy fields and slow moving streams and kutcha nallah. Chloroquine was the drug of choice, commonly used in this area. No report on the intervention measures on mosquitoes/malaria was available in the study area.

Adult mosquitoes were collected with the help of 6-volt battery operated CDC (Communicable Disease Centre, USA) miniature light traps from human dwellings and cattlesheds from dusk-to-dawn (1800–0500 hrs), with the consent of the head of the family. The inhabitants were briefed about the precautions as not to smoke, cook food, etc. during the operation of the traps. Traps were hung in the middle of hut at 2 m (approximately) above the ground level. Hand collection of mosquitoes was also done in human dwellings and cattlesheds next day in early hours (0500–0600 hrs) with aspirator tubes and torch-light. Collected mosquitoes were identified to species based on species-specific morphological characters following standard keys[11,12]. Vector mosquitoes were dissected for their physiological age determination and sporozoite infection[13].

Blood smears, both thick and thin were collected from the fever cases. Blood smears were stained with 1:10 Giemsa diluted in buffer (pH 7.2) and examined under microscope. Presumptive treatment was given to all fever cases during collection of blood smears and radical treatment to all malaria positive cases as per NVBDCP policy to check further transmission of the disease. Epidemiological indices such as slide positivity rate (SPR), slide falciparmn rate (SFR), *Pf* %, age and sex-wise distribution of malaria cases were determined.

A total of 3074 mosquitoes were collected during the study period in 20 trap nights from human dwellings and cattlesheds. They comprised of 19 species belonging to four genera—*Anopheles* (11), *Culex* (5), *Mansonia* (2) and *Armigeres* (1). Per trap night density of mosquitoes in human dwellings and cattlesheds were respectively 95 and 192.8 (Table 1). Anopheline mosquitoes comprised 40.5 percent of the total collection. Malaria vectors recorded were *An. philippinensis/An. nivipes, An. minimus, An. culicifacies* and *An. varuna* (50.1 percent of the total anophelines). Among the anophelines, *An. philippinensis/An. nivipes* was the predominant species (12 %) followed by *An. barbirostris* (8.7), *An. vagus* (5.9), *An. minimus* (4.1), *An. kochi* (2.9) and *An. culicifacies* (2.5) and rest three species together formed 4.4 percent of

Table 1. Collection of mosquitoes by CDC light trap in villages under Dhansiripar PHC of Dimapur, Nagaland

Species	Human dwelling	Cattleshed	Total	% collected	Parity rate	PMHD
Anopheles aconitus	10 (1.3)	24 (2)	34 (1.7)	1.1	–	–
An. barbirostris	84 (10.5)	182 (15.2)	266 (13.3)	8.7	–	7.2
An. crawfordi	12 (1.5)	38 (3.2)	46 (2.3)	1.6	–	2
An. culicifacies	20 (2.5)	56 (4.7)	76 (3.8)	2.5	64	3
An. kochi	26 (3.3)	64 (5.3)	90 (4.5)	2.9	–	2.8
An. minimus	46 (5.8)	80 (6.7)	126 (6.3)	4.1	71.1	3.7
An. philippinensis/ An. nivipes	110 (13.8)	260 (21.7)	370 (18.5)	12	61.8	9.5
An. vagus	52 (6.5)	130 (10.8)	182 (9.1)	5.9	–	6.3
An. varuna	16 (2)	36 (3)	52 (2.6)	1.7	65	–
Culicines	384 (48)	1444 (120.3)	1828 (91.4)	59.5	–	–
Total	760 (95)	2314 (192.8)	3074 (153.7)			

Figures in parentheses indicate per trap night collection of mosquitoes; PMHD—Per man hour density of mosquitoes.

Table 2. Results of active surveillance of malaria in villages under Dhansiripar PHC of Dimapur, Nagaland

Village	Pop.	BSC	+ve	*Pf*	SPR	SFR	*Pf* %
Khekiho	365	370	111	87	30	23.5	78.4
Denial	285	76	23	17	30.3	22.4	73.9
Dhansiri	575	47	15	10	31.9	21.3	66.7
Total		493	149	114	30.2	23.1	76.5

the total collection. Culicine mosquitoes formed 59.5 percent of the collection. The established vectors—*An. dirus*[14–17]. *An. fluviatilis*[15] and *An. maculatus*[6,18] of northeastern region could not be recorded in the present study.

Dissection of malaria vectors revealed high parity rate (65.6 %) ranging between 61.8 and 71.1, which gives a strong indication of their longevity and vectorial status. However, no vector mosquito could be found positive with sporozoite infection.

In epidemiological studies, examination of 493 blood smears revealed 30.2 per cent SPR ranging between 30 and 31.9 percent in different villages. *P. falciparum* was the predominant parasite species (76.5 %) and ranged between 66.7 and 78.4 percent in the study villages (Table 2). There was no significant difference in malaria infection between male (31.3 SPR) and female (29.6 SPR) populace. Populations below 14 years of age were affected more, while children of age group between 5 and 9 years were the most sufferers (Table 3), which indicates indigenous transmission of malaria in these areas. A similar observation has also been reported from forest-fringed villages of North Lakhimpur district of Assam[19].

The present study though very limited in its scope, revealed that variety of anophelines maintain a high density in this area. In the recent past, survey carried out in Nagaland recorded 8 to 10 anopheline species[20,21], but *An. minimus* and *An. varuna* were altogether absent in their survey. The present study recorded 9 of the 20 anopheline species observed by Misra *et al*[22] in Dimapur PHC. However, *An. dirus*, *An. fluviatilis* and *An. maculatus* could not be recorded in the present study. In similar studies carried out in Tirap and Subansiri disctricts of Arunachal Pradesh, Malhotra *et al*[23] had observed 18 anopheline species but could not record *An. minimus.*

An. minimus, one of the major vectors of malaria in northeastern region may be playing the important role in the transmission of the disease[22]. However, the pre-

Table 3. Prevalence of malaria among different age groups

Age group	BSC	+ve	*Pf*	SPR	SFR	*Pf* %
0–11 months	2	–	–	–	–	–
12–23 months	17	4	3	23.5	17.6	75
2–4 yrs	56	16	14	28.6	25	87.5
5–9 yrs	110	39	34	35.5	30.9	87.2
10–14 yrs	61	21	17	34.4	27.9	80.9
>15 yrs	247	69	46	27.9	18.6	66.7
Total	493	149	114	30.2	23.1	76.5

ponderance of *An. philippinensis/An. nivipes* (40.9% of malaria vectors collected), the earlier established vector of this region[7,8] and its role in the transmission of malaria cannot be overlooked. It appears that *An. philippinensis/An. nivipes* is establishing as a major species owing to increased paddy cultivation by deforestation, there by disrupting the ecological niche of *An. dirus*[24]. *An. culicifacies*, which has recently been incriminated as a malaria vector[25] in this region has the possibility of playing a supporting role in the transmission of the disease.

The study area has high incidence of malaria with no history of DDT spray. High vector density, the poor socio-economic condition and presence of parasitic load in the community make the population more vulnerable for contacting malaria, as locals are not in habit of using mosquito nets or any other personal protection measures. Repeated infections and non-clearance of parasites from the blood because of under-dosage of antimalarial drugs may lead to asymptomatic carriers in the population. Unlike other parts of the country, the major malaria vectors are still susceptible to 4% DDT in Assam[5,26]. So, use of impregnated bednets as a personal protection measure, reasonable coverage and methodical indoor residual spray coupled with reduction of parasitic load in the community through surveillance and malaria awareness camps can certainly improve the situation.

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