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Original Article

Monitoring of malaria, Japanese encephalitis and filariasis vectors

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ABSTRACT

Background: Vector monitoring in military stations would help in protecting the armed forces from vector borne diseases such as malaria, Japanese encephalitis and filariasis.

Methods: Adult mosquitoes were collected from four villages around a military station in India using light traps and the species composition was estimated. Insecticide susceptibility of disease vectors against DDT, deltamethrin and permethrin was established using WHO kits.

Results: The known malaria vectors constituted 4.9% of the total mosquito collections and *Anopheles philippinensis/nivipes* (2.05%) was the most abundant. Japanese encephalitis and dengue vectors constituted 25.3 and 0.05% whereas the known vectors of both Japanese encephalitis and filariasis formed 50.9%. The mean ($\pm SE_{mean}$) of annual parasitic index, slide positivity and *Plasmodium falciparum* percentage among the civilian population during the study period were 1.46 ± 0.37, 1.65 ± 0.77 and 50.2 ± 10.7. The filariasis vector *Culex quinquefasciatus* was resistant to DDT with 65.4% mortality whereas the DDT resistance in the Japanese encephalitis vector *Culex vishnui gr.* with 91.9% mortality needs to be confirmed. All other species tested were susceptible to DDT, deltamethrin and permethrin.

Conclusion: Targeted interventions are needed to reduce the disease burden and vector activity in the villages adjoining the military station. The use of insect repellents, bed nets and repellent impregnated uniforms by the troops should be ensured for protection from vector borne diseases.

Introduction

Mosquitoes are insects of medical importance since they transmit many diseases such as malaria, Japanese encephalitis, filariasis and dengue. The reduction of mosquito populations is an integral part of our attempts to manage these vector borne diseases.[1,2] The knowledge about the species composition, seasonal prevalence and insecticide

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susceptibility of mosquitoes is vital for the planning and implementation of vector control activities in an area. The control of mosquito vectors assumes much significance in the areas where there is a high incidence and transmission of malaria and other mosquito borne diseases.[3,4]

The military and paramilitary personnel are highly vulnerable to the incidence of malaria. The loss of man-days resulting from morbidity and mortality may adversely affect the security operations. The armed forces personnel are more prone to disease incidence due to their patrolling activities and increased exposure to the environment.[5,6] The mapping of disease vectors in each geographical area is needed to protect the troops and their families from vector borne diseases.[7] The villages situated around the cantonment areas often serve as the reservoirs for malaria infections apart from offering sufficient breeding grounds for mosquito proliferation.[8] Chemical insecticides remain the most commonly used method of mosquito control in India. However, the development of insecticide resistance in mosquito vectors due to the indiscriminate use of insecticides is a matter of public health concern in the country.[9]

The present study was undertaken to monitor the activity of the vectors of malaria and other mosquito borne diseases in a military station in India so as to estimate the risk of disease transmission to the military personnel. The insecticide susceptibility of disease vectors against the commonly used insecticides was also established.

Material and methods

The studies were conducted during March 2009–February 2011 in four villages namely, Balitika, Paruwa, Rupkuria, and Udmari situated around a military station in India. The study period was categorised into two – March–August and September–February.

Adult mosquitoes were collected from human dwellings during 1800–0600 h using CDC light traps on monthly basis. Indoor resting collections were made using aspirators and flashlights during 0500–0700 h. The mosquitoes were brought to the laboratory and identified based on standard taxonomic keys.[10,11] The species composition was estimated as the percent contribution of each mosquito species to the total number of mosquitoes collected. WHO kits were used as per the guidelines[12] for establishing the insecticide susceptibility status. The percent mortality 24 h after exposure to DDT (4%), deltamethrin (0.05%) and permethrin (0.75%) impregnated papers was recorded. The data on annual parasitic index (API), slide positivity rate (SPR) and *Plasmodium falciparum* percentage (Pf%) from the public health centres (PHC) around the military station during 2009–2011 was collected from the office of the District Malaria Officer.

Results

Twenty five mosquito species were collected and identified from the study areas. This included 13 species of *Anopheles*, 5 species of *Culex*, 4 species of *Mansonia* and one species each of *Coquilletidia*, *Armigeres* and *Aedes*. *Culex quinquefasciatus* was the predominant species constituting 33.7% of the total collections. *Culex vishnui gr.* (14.7%) and *Mansonia uniformis* (12.2%) were also recorded in high numbers. The percent compositions of *Culex bitaeniorhynchus*, *Culex gelidus* and *Culex malayi* were 1.55, 3.3 and 3.9 respectively. *Mansonia annulifera*, *Mansonia indiana* and *Mansonia longipalpis* constituted 5.05, 3.45 and 3.2% of the collections. *Aedes albopictus*, was the only *Aedes* species recorded in the study although in very low numbers (0.05%). *Armigeres subalbatus* and *Coquilletidia crassipes* formed 7.1 and 0.35% of the adult collections (Table 1).

Culex mosquitoes were predominant in all the four villages surveyed. The percent composition of *Cx. quinquefasciatus* was the highest in Rupkuria (43.8) whereas the lowest in Udmari (24.4). *Cx. vishnui gr.* constituted 21.3% of the total collections from Rupkuria whereas only 10.2% of collections from Udmari. Udmari recorded the highest percent composition of *Ma. annulifera* (9.85), *Ma. indiana* (5.3) and *Ma. longipalpis* (5.1). The percentage of *Ma. uniformis* was the highest in Paruwa (21.7) while Balitika recorded the highest percent composition of *Armigeres* (11.7). *Cq. crassipes* was recorded from Balitika (0.5%) and Udmari (0.9%) whereas *Ae. albopictus* was recorded only from Balitika (0.2%). The percent composition of *Anopheles annularis* and *Anopheles philippinensis/nivipes* were the highest in Balitika (1.48 and 4.18) while the percent composition of *Anopheles culicifacies* was the highest in Udmari (4.45) (Table 2).

Among the anophelines, *Anopheles vagus* was the predominant species forming 22.3% of the anophelines collected. It was followed by *Anopheles barbirostris* (19.6%) and *An. philippinensis/nivipes* (17.9%) and while *An. culicifacies*, *Anopheles*

Table 1 – Seasonal prevalence of mosquito species around a military station in India during 2009–2011.

Mosquito species	Percent composition		
	March–August	September–February	Yearly mean
Anopheles annularis	0.40	1.3	0.85
An. barbirostris	1	3.3	2.25
An. crawfordi	0.8	2.4	1.6
An. culicifacies	0.60	3.4	2
An. philippinensis/ nivipes	0.20	4.1	2.05
An. vagus	3.2	1.9	2.55
Other anophelines[a]	0.2	0.1	0.15
Culex bitaeniorhynchus	2.7	0.4	1.55
Cx. gelidus	2.4	4.2	3.3
Cx. malayi	5.7	2.1	3.9
Cx. quinquefasciatus	40.3	27.1	33.7
Cx. vishnui gr.	17.2	12.3	14.7
Mansonia annulifera	4	6.1	5.05
Ma. indiana	2.7	4.2	3.45
Ma. longipalpis	2	4.4	3.2
Ma. uniformis	9.9	14.4	12.2
Armigeres subalbatus	6	8.2	7.1
Coquilletidia crassipes	0.6	0.1	0.35
Aedes albopictus	0.1	0	0.05

[a] *An. aconitus*, *An. jamesi*, *An. karwari*, *An. subpictus*, *An. minimus*, *An. fluviatilis* and *An. kochi*.