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ORIGINAL ARTICLE

Anopheline species and their *Plasmodium* infection (status in Aligarh, India



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Abstract Malaria is a global issue and India contributes substantially to global malaria incidence. Information related to malaria vectors is very limited in Aligarh. The environmental and climatological situations permit the continual breeding of vectors in permanent breeding sites. This study was designed with the aim to screen all the anophelines species and possible malaria vectors in three different localities of Aligarh. Anopheles mosquitoes were collected from three different localities (Fort, Jalali and Tappal) during peak malaria transmission season (July to November) by using mouth aspirator and CDC light traps. Enzyme-linked immunosorbent assay (ELISA) was done to detect Plasmodium falciparum, Plasmodium vivax-210 and P. vivax-247 circumsporozoite proteins (CSP) from the collected female species. A total of 794 female anopheline mosquitoes belonging to 7 species were collected by different methods. Circumsporozoite protein-enzyme-linked immunosorbent assay was performed with 780 anopheline mosquitoes out of which 13 mosquitoes were positive in CSP-ELISA. Thus, the overall infection rate was 1.66% (13/780). Four (0.51%) mosquitoes belonging to three species were positive for P. falciparum, 7 (0.89%) mosquitoes belonging to three species were positive for VK 210 and 2 (0.25%) mosquitoes belonging to Anopheles culicifacies and Anopheles stephensi species were positive for VK 247. No mixed infection was found in this study. According to species, the highest infection rate was observed in An. culicifacies (7/288, 2.43%) followed by An. stephensi (2.40%) and Anopheles annularis (1.98%). An. culicifacies and An. stephensi were previously incriminated as malaria vectors in Aligarh. There was, however, no previous report in favor of infections in An. annularis in Aligarh. The on-going Malaria Control Program in India needs up to date information on malaria vectors. A major challenge is the lack of knowledge about vectors and their role in malaria transmission. Findings of this study suggested that in the absence of major malaria vectors there is a possibility that other Anopheles species may have been playing a role in malaria transmission in Aligarh.

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1. Introduction

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Malaria remains one of the leading causes of morbidity and mortality in the tropics. Malaria is an entirely preventable and treatable mosquito-borne illness. In 2014, 97 countries and territories had ongoing malaria transmission. An

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estimated 3.2 billion people are at risk of malaria, of whom 1.2 billion are at high risk. There were an estimated 198 million cases of malaria worldwide ranging between 124 and 283 million (World Malaria Report, 2014). Even though Africa accounts for 90% of the mortality burden for malaria, South-East Asia region such as Thailand, Nepal, Bhutan, Bangladesh, Myanmar, Indonesia, Sri Lanka and India still suffers considerable mortality and morbidity. According to the first report of Roll Back Malaria (RBM) South-East Asia has the highest rate of drug resistance in the world, and multi-drug resistance has contributed to the re-emergence of malaria in many areas, especially along international borders (WHO, 2013). Among member countries of South East Asian Region Office (SEARO) of WHO, India contributes >85% cases annually. These malaria cases were highly under-reported. The estimates of WHO indicate about 81 million cases (Korenromp, 2004). 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. 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 Anopheles culicifacies, Anopheles stephensi, Anopheles fluviatilis, Anopheles dirus, Anopheles minimus and Anopheles sundaicus whereas Anopheles annularis, Anopheles philippiensis (nivipes), Anopheles varuna and Anopheles 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). In India Plasmodium vivax and Plasmodium falciparum cause benign and malignant tertian malaria and 60-65% of the malaria infections are reported to be due to P. vivax and 30-35% due to P. falciparum (Adak et al., 1998). A three years survey conducted by Saifi et al. (2010) showed that in Aligarh district the slide positivity rates for Plasmodium were 26.82%. The prevalence of P. vivax was 17.18% and for P. falciparum it was 9.6%.

Aligarh has a 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 temperatures and dry winds of continental region. In the Aligarh district a variety of mosquito breeding grounds are present which facilitates the emergence of different anopheline species. Although enough literature is available on mosquito fauna and vectors from many parts of India very little published information on screening and vector incrimination of malaria in Aligarh is available. Wajihullah and Saifi (2001) incriminate *An. culicifacies* as a predominant vector of malaria. The present study was, therefore, undertaken to obtain some information regarding prevalent anopheline species and their possible malaria vectors in Aligarh district.

2. Materials and methods

2.1. Study areas

Aligarh, where the proposed work was carried out is situated in the upper Ganga–Yamuna Doab and it extends from 27°29' N to 28°11' N latitudes and 77°29' to 78°38' longitudes.

It has a tropical monsoon type of climate typified by 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 temperatures and dry winds of continental origin. Clear skies, dust and low humidity are observed from time to time. Mid June to October is marked by humid winds of oceanic origin, including cloudy weather, rainfall and high relative humidity. Aligarh experiences extreme cold during winter as there is a subsequent fall in temperature. The average maximum temperature in November is 29.5 °C while in January which is the coldest month of the year, the mean maximum and minimum temperatures are 20 and 4 °C, respectively. The onset and retreat time of the monsoon differ considerably every year. Usually the rain starts by the mid of June and continues till the end of September or early October. During this period of the year 90% of the total annual precipitation occurs. 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. With the onset of monsoon, the relative humidity increases ranging from 65% to 77%. January records the highest percentage of relative humidity of about 82%.

2.2. Collection of Anopheles mosquitoes

For vector, screening mosquitoes were collected from Aligarh from July to November 2012. Mosquito collection was made from three different localities of Aligarh. These localities were Fort, Dhorra and Sasni Gate. Anopheles mosquitoes were collected from (18.00-24.00 h) both indoors and outdoors by human landing catches (HLC) methods by using mouth aspirators (WHO, 1975) and the resting collection was conducted in 20 households. After completion of HLC and resting collection, CDC miniature light trap model 512 (origin: John W. Hock Inc, USA) was also used for entomological investigation. Mosquitoes were collected from four houses per night on each of five successive nights once within the peak malaria transmission season (July to November). Four volunteers collected mosquitoes at each house two indoors and two outdoors. Every night the house was shifted randomly. Thus, in each study area for entomological surveillance, human landing catches (HLC), resting collection and CDC miniature light trap were conducted in 20 households. Each CDC trap was installed for at least 12 h (6 pm to 6 am). Each night four trappings were conducted for five days of a week for each of the areas alternatively once in the peak season.

2.3. Ethical consideration

A written consent was obtained from the houses where entomological collections were made. The mosquito collectors were monitored up to three months with a provision for treatment in case they got malaria, but such a case did not occur during the reported period.

2.4. Mosquito sample preparation

Next morning, mosquitoes were sorted and identified. Identifications were made on the basis of their morphological features with the help of standard regional pictorial keys (Wattal and Download English Version:

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