ROLE OF ANOPHELES CULICIFACIES S.L. AND AN. PULCHERRIMUS IN MALARIA TRANSMISSION IN GHASSREGHAND (BALUCHISTAN), IRAN

M. ZAIM, S. K. SUBBARAO, A. V. MANOUCHEHRI AND A. H. COCHRANE

ABSTRACT. A 2-site immunoradiometric assay (IRMA) was performed on the head and thorax of Anopheles culicifacies s.l. and An. pulcherrimus females, the 2 most common anopheline species in the District of Ghassreghand (Baluchistan, Iran), collected during the 2 peak malaria transmission seasons (May and September–October 1991). Positive IRMA results revealed the 2 species as potential vectors of malaria in this highly endemic district. This finding serves as the first report on natural infection of An. pulcherrimus in Iran and is the second on natural infection of An. culicifacies since the previous report of 1959.

INTRODUCTION

Malaria is one of the major health problems in Baluchistan, southeastern Iran from which, in recent years more than 50% of the country’s total cases have been reported. In 1991 with about 41,000 reported cases of malaria (annual parasite incidence of 28 in 1,000 population), this area has been confronted with the highest number of malaria cases in the past 16 years (Centre for Disease Control 1991).

In recent years, more than 80% of the cases of malaria in Baluchistan has been reported from the “Shahrestans” of Iranshahr and Chabahar where Anopheles culicifacies sensu lato is the most common anopheline species. This species has been incriminated as a vector of malaria in Iran during an epidemic outbreak in Zabol (Sistan and Baluchistan Province) in 1959 (Manouchehri and GhiasseMin 1959). Also in these 2 named shahrestans, four other known malaria vectors of Iran exist; however, their role in transmission in this part of the country has not been studied. These latter species are An. dthali Patton, An. fluviatilis James, An. stephensi Liston and An. superpicttss Grassi (Zaim 1987). Anopheles pulcherrimus Theobald, which has been incriminated as a vector of malaria in Iraq on epidemiological grounds (Rishikesh 1972) and in central Asia (Christophers 1933) and Kunduz area, northeast Afghanistan through natural infection (M. S. Badaway, in Zahar 1974), is also present in relatively high numbers in the rice growing regions of Chabahar (districts of Ghassreghand and Nikshahr, 300–900 m above sea level) (Zaim et al. 1992).

A highly sensitive immunodiagnostic technique, a 2-site immunoradiometric assay (IRMA) based on species-specific monoclonal antibodies (mAbs) has been developed by Zavala et al. (1982) that can detect, identify and quantify sporozoites in individual or pools of mosquitoes. The assay has been successfully used for the determination of the Plasmodium vivax and P. falciparum sporozoite rate and load in fresh and dried field collected mosquitoes (Collins et al. 1984, Subbarao et al. 1988). This study uses the IRMA to examine the potential role of An. culicifacies s.l. and An. pulcherrimus, the 2 most common anophelines in the Ghassreghand (Baluchistan) where the annual parasite incidence of malaria averages about 60/1,000 population.

MATERIALS AND METHODS

Study area: The investigation was carried out over a period of 11 months (February–December 1991) in the District of Ghassreghand, Shahrestan of Chabahar. Streams and stream fed pools, rice fields and palm irrigation plots are the main sources of mosquito breeding in the area. The average maximum and minimum temperatures in summer are 39.7°C and 26.2°C and in winter 24.1°C and 11.8°C, respectively. The average annual rainfall is about 100 mm. The district has been under an indoor residual spraying program for malaria control using malathion (50% wp, 2 g/m²) in February and primiphos-methyl (Acetelic) (40% wp, 2 g/m²) in September 1991.

Mosquito collections: Pyrethrum space spray catches were performed, once a month in 4 villages (Bocan, Hit, Homeiry and Zeineddini). In each village 8 fixed shelters (4 human and 4 animal shelters) were sampled. Mosquitoes were identified to species and the collections during the 2 main peaks of malaria transmission, i.e.,
RESULTS AND DISCUSSION

The mean indoor resting densities of An. culicifacies s.l. and An. pulcherrimus and the number of reported malaria cases in the district of Ghassreghand are presented in Fig. 1. Both species were active throughout most of the year and the peak indoor resting density, under the ongoing malaria control measures, was found to be in April and August. A total of 1,214 malaria cases were reported in this area during the study period, with the highest numbers reported in May and September (Fig. 1).

Table 1 summarizes the results of the IRMA performed on An. culicifacies s.l., An. pulcherrimus and the 3 other anophelines (An. dthali, An. fluviatilis and An. stephensi) collected in indoor resting sites during the peak malaria transmission seasons in Ghassreghand. Out of the 2,305 mosquitoes collected during May 1991 and tested for Plasmodium infection, 85.0% and 10.7% belonged to An. culicifacies s.l. and An. pulcherrimus, respectively, of which 2 pools of An. culicifacies s.l. were found positive for P. vivax. Also out of the 1,245 females collected...
Table 1. Results of the immunoradiometric assay performed on pools of 10 mosquitoes collected during peak malaria transmission seasons in Ghassreghand, Baluchistan, Iran (1991).

<table>
<thead>
<tr>
<th>Species</th>
<th>No. tested</th>
<th>No. of positive pools*</th>
<th>Sept.-Oct. 1991</th>
</tr>
</thead>
<tbody>
<tr>
<td>An. culicifacies</td>
<td>1,960</td>
<td>2</td>
<td>276</td>
</tr>
<tr>
<td>An. dthali</td>
<td>26</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>An. fluviatilis</td>
<td>56</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>An. pulcherrimus</td>
<td>246</td>
<td>686</td>
<td>2</td>
</tr>
<tr>
<td>An. stephensi</td>
<td>17</td>
<td>265</td>
<td></td>
</tr>
</tbody>
</table>

* Only positive for P. vivax.

during September–October 1991, An. culicifacies s.l. and An. pulcherrimus constituted 22.2% and 55.1% of the collected material, respectively, of which 2 pools of An. pulcherrimus were positive for P. vivax. Surprisingly no positives were found for P. falciparum. Surprisingly no positives were found for P. falciparum. Surprisingly no positives were found for P. falciparum. Surprisingly no positives were found for P. falciparum.

Our recent study on the seasonal activity of An. culicifacies s.l. and An. pulcherrimus in a village where no anti-mosquito control measures have been in practice, has revealed that An. culicifacies s.l. has 2 peaks of activity in the district of Ghassreghand, one in April–May (main peak) and the other in October–November (Zaim et al., unpublished data). Anopheles pulcherrimus has also 2 peaks of activity, one in April–May and the other in August–September (Zaim et al. 1992). Because the second peak for malaria cases in the district of Ghassreghand is in September, An. pulcherrimus has been suspected as a vector in this area. The present IRMA results correspond well with the observed infection of An. pulcherrimus in Iran and is the second report on natural infection of An. culicifacies and An. pulcherrimus based on salivary gland dissections and comparative vector potential studies that are currently underway should bring more light to the relative importance of these 2 species in Baluchistan, Iran.

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