THE SUSCEPTIBILITY TO 4% DDT AND HOST PREFERENCE OF THE PROBABLE VECTORS OF VISCERAL LEISHMANIASIS IN NORTH WEST OF IRAN

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Key words: Susceptibility, host preference, vector, visceral leishmaniasis, Iran

Abstract

This study was carried out on Phlebotomus kandelakii and P. periclitewi, the probable vectors of visceral leishmaniasis in the north west of Iran during the summer of 1994.

The results of the susceptibility test showed that the mortality rate with 60-minute exposure to 4% DDT was 100% for each species, while with 30-minute exposure the average mortality rates were 93.3% and 94.4% for P. kandelakii and P. periclitewi respectively, indicating the sensitivity of the two probable vectors to DDT in Ardabil Province.

The blood meals of 116 engorged sand-flies were collected from 3 villages of Meshkin-shahr county, including P. papatasi, P. caucasicus and P. kandelakii, and eighty one of them belonged to P. kandelakii. All of the blood meals were identified by Enzyme Linked Immunosorbent Assay (ELISA); 33.3% of them were positive with human and 11.1% with dog antisera, indicating a strong preference to man.

Introduction

The first report of the human cases of visceral leishmaniasis (VL) in Iran was from the Caspian area in 1949 (10).

Afterwards, up to the end of 1975 about 120 cases had been reported from different parts of Iran (7). In the last decade more than 1800 cases of the disease had been reported from Ardabil, northwest of Iran (1), and at the present time VL is known as an endemic disease in several foci of at least two Provinces.

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Fars and Ardabil, in the south and the northwest of Iran.

The high number of cases in Bushehr, Khuzistan (5), Khorasan (14), East Azerbaijan and Kerman (9) indicate that the disease may also be endemic in these parts or Iran.

The suggested criteria for incrimination of a vector are anthropophily and supporting observations are the demonstration that the sandfly commonly feeds on the reservoir host, which means that the host supports development of the parasite and the fly can transmit the parasite by bite.

On the basis of epidemiological evidence the most suspected vectors of VL in Iran was Phlebotomus major, while in recent years P. kandelakii and P. perfiliewi as well as P. major and P. kesheshianii were found with natural promastigote infection in Ardabil (11) and Fars provinces respectively (12,13).

The purpose of this study was to determine the host preference of the vectors of VL that have not been studied specifically in the foci of the disease in our country and this paper is the first report of anthropophily index of P. kandelakii in Iran. Meanwhile, the control of vectors (sand-flies) is the most important methods of the disease control. According to several reports on insect resistance to insecticides, there are no published report on the susceptibility situation of P. kandelakii and P. perfiliewi and so this study is also the first report from Iran in this regard.

Materials and methods

Sand-flies were collected by aspirators, oiled papers, and CDC light traps from human dwellings, stables and dog shelters, in the villages of Ahmad-Abad, Gouret-Tapeh, Gerdeh-Gol (Meshkinshahr district) and Tazeh-Kand, Seyed-Lar (Germi district), in Ardabil Province, north-west of Iran, during 1994.

The head and posterior parts of dissected sand-flies were mounted in a drop of Puri’s medium for identification by the method of Theodor and Mesghali (8,14).

The smear of blood meals of each engorged female was prepared on Whatman No.1 filter paper, which was then marked with the number of the sand-fly, place and date of collection. The papers were sent to the protozoology Unit, Department of Medical Parasitology and Mycology in Tehran University of Medical Sciences for ELISA testing (3).

The Susceptibility

In order to determine the susceptibility level of sand-flies, the tests were performed on a field population of adult females of P. kandelakii and P. perfiliewi collected from unexposed indoor resting places of human dwellings, stables and dog shelters. The blood-fed females were caught by active search using a mouth aspirator and torch light. The testing method used was that developed by the World Health Organization (WHO, 1970). DDT impregnated papers were used together with the corresponding control papers.

Ten sand-flies were used for each replicate and for each of the two exposure times (30 and 60 minutes). Sand-flies were held for 24 hours after exposure, and mortalities recorded, and then all dead and living sand-flies were transferred into 70% alcohol for identification.

Results

From the 116 engorged females, eighty one belonged to P. kandelakii species. It is suggested that blood-fed females of Ph. kandelakii were scarce in this area.

The host preference of this species are presented in Table 1. It is seen that, according to the ELISA test, of the 81 blood meals of Ph. kandelakii, the proportion giving a positive reaction from (+) to (++++) with alkaline phosphatase antihuman conjugate, ranged between 15.28 - 100% , with an average of 33.33% , indicating a strong preference for man in this study. The proportions positive for dog, the main animal reservoir host of the disease, were between 0-22% with an average of 11.11%.

The results of the susceptibility of Ph. kandelakii and Ph. perfiliewi transcaucasicus to 4% DDT are shown in tables 2 and 3.

In the susceptibility tests of 95 females of Ph. kandelakii and 98 females of Ph. perfiliewi transcaucasicus, the proportions of mortality rates with 60 minute exposure were 100% for each species, while with 30 minute exposure the average mortality rates were 93.3% and 94.4% for those species, respectively (see Table 2 and 3), indicating sensitivity of two species to DDT-impregnated papers. Meanwhile, all of the sandflies in the control tubes were alive.

Discussion

As mentioned before, the most important criteria for incrimination of a vector are anthropophily and common infection with the same leishmania parasite.
as that found in the same place. In this survey we observed the females of *Ph. kandeiakii* feed on humans (33.33%) and domestic dogs (11.11%) and according to finding on natural leptomaniac infection in *Ph. kandeiakii* and *P. perflavescens transcaucasicus*, it is concluded that they are the probable vectors of VL in Ardabil Province, north-west of Iran.

Another finding of this study was the susceptibility level of the two above-mentioned species to 4% DDT solution. We found both, *Ph. kandeiakii* and *P. perflavescens transcaucasicus*, sensitive to 4% DDT, and the mortality rates with 60-minute exposure were 100%; the average mortality rates with 30-minute exposure were more than 93% for each species. According to these results, we can use DDT as a suitable insecticide for the control of sand-flies in the human dwellings or the animal shelters.

Table 1. Results of ELISA testing of blood meals of *Ph. kandeiakii* (Meshkinshahr-1994)

<table>
<thead>
<tr>
<th>Name of village</th>
<th>Date of sand-fly capture</th>
<th>Total no. of blood meals</th>
<th>Human</th>
<th>Dog</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gour-e-Siah</td>
<td>9 July 1994</td>
<td>14</td>
<td>5</td>
<td>35.7</td>
<td>4</td>
</tr>
<tr>
<td>Ahmad-Abad</td>
<td>31 July 1994</td>
<td>6</td>
<td>6</td>
<td>100</td>
<td>9</td>
</tr>
<tr>
<td>Ahmad-Abad</td>
<td>1 August 1994</td>
<td>13</td>
<td>2</td>
<td>15.4</td>
<td>2</td>
</tr>
<tr>
<td>Ahmad-Abad</td>
<td>12 August 1994</td>
<td>22</td>
<td>7</td>
<td>31.8</td>
<td>2</td>
</tr>
<tr>
<td>Ahmad-Abad</td>
<td>24 August 1994</td>
<td>13</td>
<td>5</td>
<td>38.5</td>
<td>0</td>
</tr>
<tr>
<td>Gerdel-Gol</td>
<td>27 August 1994</td>
<td>13</td>
<td>2</td>
<td>15.28</td>
<td>1</td>
</tr>
<tr>
<td>Total no. of blood meals</td>
<td></td>
<td>81</td>
<td>27</td>
<td>33.33</td>
<td>9</td>
</tr>
</tbody>
</table>

* Positive

Because of the small quantity of blood meals of sand-flies, each of them couldn't be tested against all antisera, so, was tested against human and dog antisera.
Fig. 1 - The map of Ardabil province

References


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