Relative abundance of *Phlebotominae* sandflies with emphasis on vectors of kala-azar

Naveen Samuel Singh, Doris Phillips-Singh

Department of Zoology, Lucknow Christian College, Golaganj, Lucknow-226018 (U.P.) India

### Article info

<table>
<thead>
<tr>
<th>Article history:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received 1 March 2010</td>
</tr>
<tr>
<td>Received in revised form 20 March 2010</td>
</tr>
<tr>
<td>Accepted 22 March 2010</td>
</tr>
<tr>
<td>Available online 20 April 2010</td>
</tr>
</tbody>
</table>

### Keywords:

*Phlebotominae* sandflies
Kala-azar
Vector

### ABSTRACT

**Objective:** To identify potential vectors of kala-azar from northern plains of Uttar Pradesh, India. **Methods:** The collections were made using sticky paper traps, CDC light-traps, and aspirators from outdoors as well as indoors. All female sandflies were dissected and identified. **Results:** During January 2009 to July 2009, 528 phlebotomine specimens were collected including 329 males (62.3%) and 199 females (37.7%), approximately 238 (45%) of them were captured from indoor and 290 (55%) from outdoor resting places. Five species belonging to the genera *Phlebotomus* (8%) and *Sergentomyia* (92%) were recorded. **Conclusions:** Public health measures such as case detection and treatment, the control of sandflies, the conjunction elimination of infected stray dogs and health education can be effective in controlling the disease.

1. Introduction

The subfamily *Phlebotominae* has a wide distribution throughout the world, mainly in the tropics and subtropics[1]. It contains about 600 species and subspecies, and about 70 among them are proven or suspected vectors of a definite type of leishmaniasis[2].

*Phlebotomine sandflies* are small, blood–sucking dipteran insects, usually crepuscular–nocturnal in their activity[3], and are widely known as vectors of several human leishmaniasis. They have a very limited flight range (estimated to be 250 m), and are active during warm months. Female sandflies of the vector are small (2-5 mm), and feed on blood of various vertebrate animals such as reptiles and mammals including man, and use the nutrients to develop eggs[4], males of the species are not hematophagous and can be differentiated from females by their smaller size.

The distribution of *phlebotomine sandflies* varies highly within its range, depending on local environmental factors, such as precipitation and temperature, physical factors, such as geographical barriers and habitat availability and biotic factors, such as the distribution and abundance of vertebrate hosts[5]. This study was aimed to identify the potential vector of kala-azar in northern plains of Uttar Pradesh, India.

2. Materials and methods

This investigation was carried out in northern plains of Uttar Pradesh, India during January, 2009 and July, 2009. Sticky traps and an aspirator were used to collect sandflies at selected indoor and outdoor sites including cracks in walls, caves, on riverbanks, and in private homes, which were selected on the basis of previous investigations of the biology of sandflies. For identification of species and sex, specimens were slide mounted in Faure’s medium after a clearing process in lactophenol for three days[6]. Female identification was based on the shape of spermathecae and the disposition of the teeth in the pharyngeal armature, whereas males were identified based on their genitalia (hypopygium), in particular the parameres and aedeagus, the shape, insertion, disposition, and length of the hairs in the coxite, and spines[7-12].

3. Results

During January 2009 and July 2009, 528 phlebotomine specimens were collected including 329 males (62.3%) and 199 females (37.7%), approximately 238 (45%) of them were captured from indoor and 290 (55%) from outdoor resting places. Five species belonged to the genera *Phlebotomus* (42/528, 8%) and *Sergentomyia* (486/528, 92%) were recorded (Table 1). Common sandflies collected indoors and outdoor resting places were *Sergentomyia punjabaensis* (S. punjabaensis) and *Sergentomyia babu* (S. babu). The changes in seasonal temperature prevalence of these species are shown in Figure 1 and 2. The population build-up of *Phlebotomus papatasi* (P. papatasi), S. punjabaensis and S. babu were started in the end of February and reached to low levels in June, with a peak in July for the S. babu and two peaks in March and April for the other species (Figure 1).
The dissection results showed that female sandflies had no flagellates. The sex distribution (Table 1) showed the total number of males was higher than that of females. The sex ratios (male/female) for different species were different. There was also a seasonal change in male/female ratio. Because the density of the other species was very low, it was impossible to determine the monthly density.

### Table 1

Sandfly species collected in Northern plain of Uttar Pradesh and their relative abundance.

<table>
<thead>
<tr>
<th>Species</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Total relative proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. (Phlebotomus) papatasi</td>
<td>29</td>
<td>13</td>
<td>42</td>
<td>42/528, 8</td>
</tr>
<tr>
<td>S. (Sergentomyia) sintoni</td>
<td>69</td>
<td>32</td>
<td>101</td>
<td>101/528, 19</td>
</tr>
<tr>
<td>S. (Sergentomyia) dentate</td>
<td>73</td>
<td>38</td>
<td>111</td>
<td>111/528, 21</td>
</tr>
<tr>
<td>S. (Sergentomyia) punjabaeensis</td>
<td>76</td>
<td>47</td>
<td>123</td>
<td>123/528, 23</td>
</tr>
<tr>
<td>S. (Sergentomyia) baba</td>
<td>82</td>
<td>69</td>
<td>151</td>
<td>151/528, 29</td>
</tr>
</tbody>
</table>

Figure 1. Variation of the monthly temperature (maximum and minimum in °C).

Figure 2. Seasonal prevalence of P. papatasi, S. sintoni, S. dentate, S. punjabaeensis and S. baba in Northern plains of Uttar Pradesh.

### 4. Discussion

In this study, 5 species (one Phlebotomus and four Sergentomyia) were collected and identified in Northern plains of Uttar Pradesh. All four species of genus Sergentomyia were the most abundant species in both indoors and outdoors, but P. papatasi was very few in number. Moreover, the walls and the floors of most houses are made of mud, leading to an ideal resting and breeding ground for sandflies. Prevalence of S. baba was observed for five months with one peak in July. P. argentipes is the main vector of VL in India.

The epidemiological data on kala–azár in India indicate that the disease is of the Mediterranean type. Dogs are the principle reservoir of these parasites and play a central role in the transmission cycle to man by *Phlebotomine sandflies*.[13] Since sandfly vectors are present in the area, an active transmission cycle of the leishmania parasite could have established, resulting in an increase in the occurrence of leishmaniasis in humans.

The existence of resistant population of *P. papatasi* to DDT, in kala–azár epidemic areas of Bihar, India, was reported by Kaul SM *et al* for the first time[14]. The outdoor insecticide spraying is an important strategic entomological activity for leishmaniasis control programmes in field conditions. Thus before planning any control measure against leishmania vectors, a study should be done in order to establish the baseline susceptibility to representative insecticides.

In conclusion, no leishmania parasites were found in this study. Proportions of gravid flies may be a valid indicator of the physiological age and epidemiologic importance of the vector sandfly population. At this point, public health measures such as case detection and treatment, the control of sandflies, the conjunction elimination of infected stray dogs and health education can be effective in controlling the disease.

**Conflict of interest statement**

We declare that we have no conflict of interest.

**Acknowledgements**

Financial assistance from the University Grants Commission (U.G.C.) New Delhi, India, through project No. F.6–2(46)/2008(MRP/NRCB) is gratefully acknowledged. Authors are also thankful to the Principal and Manager, Lucknow Christian College, Lucknow for providing necessary facilities.

**References**


