INTRODUCTION

It is estimated that 350 million people, in 88 countries, are at risk of leishmaniasis (visceral leishmaniasis (VL) and cutaneous leishmaniasis (CL)). These diseases have an estimated annual incidence of between 0.9 and 1.6 million new cases; 0.2 to 0.4 of VL; and 0.7 to 1.2 million cases of CL. About 90% of the CL cases occur in Afghanistan, Brazil, Iran, Peru, Saudi Arabia and Syria. These are recognized as Neglected Tropical Diseases (NTD).

It is widespread in Latin America, where it is described, and cases are recorded from the extreme south of the United States to northern Argentina, with the exception of Chile and Uruguay. The disease is spread throughout the municipalities of São Paulo state, mainly due to pressure on landuse promoting the entrance and maintenance of the transmission cycle and a change in the transmission pattern. Today, there are three epidemiological patterns of disease transmission: (a) wild; (b) occupational or leisure; and (c) rural or peri-urban.

In the last decade, 5898 cases of CL were reported in the state of São Paulo. This study was undertaken to analyze the epidemiology of CL in the municipality of Teodoro Sampaio, in São Paulo State, Brazil, based on a geographic approach, as very little is known of the relationship between CL and the spatial transformation process.

MATERIAL & METHODS

The city of Teodoro Sampaio is located in the western region of São Paulo state and, according to the 2010 Census; the municipality has about 22,386 inhabitants. Located in the Pontal do Paranapanema region (the extreme edge of Paranapanema River), it is the last non-coastal Atlantic Forest reserve, the Morro do Diabo State Park (MDSP). It is part of the epidemiological surveillance service (ESS) XXII-Presidente Venceslau, with 21
municipalities. The study was a population-based quantitative, descriptive and cross-sectional case study.

Data were obtained from the human CL records in the health department of municipality, when use of the information system on disease notification (ISDN) became compulsory. The ISDN’s role is to provide data of compulsory notification throughout the country9.

The website for the Zoonosis Division of the Epidemiological Surveillance Center of the Disease Control Office, São Paulo State Secretary of Health (ZD/ESC/DCO/SPSSH) was accessed for the same period10. Descriptive statistical techniques were used to interpret the distribution of the disease in the period and the spatial and temporal distribution of cases was aggregated in three-year periods. The Kernel method was used to observe spatial patterns, based on Global Positioning System points11. The structure and inter-relationship of spatial databases establish a model for aggregating the data12, and an area was defined covering parameters of 4 km by 3 km rectangle, with a radius of 200 m and a resolution of 15 m.

RESULTS

During the period, 41 cases were notified to the ISDN, most of them (31/41) were males between 21 and 40 yr of age. Table 1. Teodoro Sampaio-SP: Distribution of the population notified by CL between 1998 and 2011, according to case confirmation criteria, according to ISDN data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Laboratory</th>
<th>Epidemiological</th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>28 (68.2)</td>
<td>3 (7.3)</td>
<td>31 (75.6)</td>
</tr>
<tr>
<td>Female</td>
<td>9 (21.9)</td>
<td>1 (2.4)</td>
<td>10 (24.4)</td>
</tr>
<tr>
<td>Zone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>19 (46.3)</td>
<td>3 (7.3)</td>
<td>22 (53.6)</td>
</tr>
<tr>
<td>Rural</td>
<td>18 (43.9)</td>
<td>1 (2.4)</td>
<td>19 (46.3)</td>
</tr>
<tr>
<td>Age(yr)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11–20</td>
<td>3 (7.3)</td>
<td>1 (2.4)</td>
<td>4 (9.7)</td>
</tr>
<tr>
<td>21–30</td>
<td>12 (29.3)</td>
<td>–</td>
<td>12 (29.3)</td>
</tr>
<tr>
<td>31–40</td>
<td>9 (21.9)</td>
<td>3 (7.3)</td>
<td>12 (29.2)</td>
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<tr>
<td>41–50</td>
<td>7 (17)</td>
<td>–</td>
<td>7 (17)</td>
</tr>
<tr>
<td>51–60</td>
<td>2 (4.9)</td>
<td>–</td>
<td>2 (4.9)</td>
</tr>
<tr>
<td>≥ 60</td>
<td>4 (9.7)</td>
<td>–</td>
<td>4 (9.7)</td>
</tr>
<tr>
<td>Educational attainment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I–IV grade incomplete in ES</td>
<td>2 (4.9)</td>
<td>–</td>
<td>2 (4.9)</td>
</tr>
<tr>
<td>IV grade complete in ES</td>
<td>4 (9.7)</td>
<td>–</td>
<td>4 (9.7)</td>
</tr>
<tr>
<td>V–VIII grade incomplete in ES</td>
<td>13 (31.7)</td>
<td>3 (7.3)</td>
<td>16 (39)</td>
</tr>
<tr>
<td>ES complete</td>
<td>10 (24.4)</td>
<td>1 (2.44)</td>
<td>11 (26.8)</td>
</tr>
<tr>
<td>HS incomplete</td>
<td>3 (7.3)</td>
<td>–</td>
<td>3 (7.3)</td>
</tr>
<tr>
<td>HS complete</td>
<td>2 (4.9)</td>
<td>–</td>
<td>2 (4.9)</td>
</tr>
<tr>
<td>HE complete</td>
<td>1 (2.4)</td>
<td>–</td>
<td>1 (2.4)</td>
</tr>
<tr>
<td>Ignored</td>
<td>–</td>
<td>–</td>
<td>2 (4.9)</td>
</tr>
<tr>
<td>Three-year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I(1998–2000)</td>
<td>10 (24.4)</td>
<td>2 (4.9)</td>
<td>12 (29.3)</td>
</tr>
<tr>
<td>II(2001–2004)</td>
<td>6 (14.6)</td>
<td>–</td>
<td>6 (14.6)</td>
</tr>
<tr>
<td>III(2005–2007)</td>
<td>17 (41.4)</td>
<td>2 (4.9)</td>
<td>19 (46.3)</td>
</tr>
<tr>
<td>IV(2009–2011)</td>
<td>4 (9.7)</td>
<td>–</td>
<td>4 (9.7)</td>
</tr>
<tr>
<td>Total</td>
<td>37 (90.2)</td>
<td>4 (9.8)</td>
<td>41 (100)</td>
</tr>
</tbody>
</table>

Source: ISDN, Epidemiological Surveillance Service of the Municipality of Teodoro Sampaio-SP, 2011; Figures in parentheses indicate percentages; *Values are non-cumulative, since the overall total is the sub-total for each class (41) and the percentage in relation to this value; ES–Elementary School; HS–High School; †2002 and 2008 were removed from the series because those had no notifications of CL.

Table 2. Teodoro Sampaio-SP: Distribution of the population notified by CL between 1998 and 2011, according to investigation form data, according to case confirmation criteria

<table>
<thead>
<tr>
<th>Variable</th>
<th>Laboratory</th>
<th>Epidemiological</th>
<th>Total*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form of disease</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutaneous</td>
<td>35 (85.4)</td>
<td>4 (9.7)</td>
<td>39 (95.1)</td>
</tr>
<tr>
<td>Mucosal</td>
<td>2 (4.9)</td>
<td>–</td>
<td>2 (4.9)</td>
</tr>
<tr>
<td>Presented lesion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>24 (58.5)</td>
<td>2 (4.9)</td>
<td>26 (63.4)</td>
</tr>
<tr>
<td>Ignored</td>
<td>13 (31.7)</td>
<td>2 (4.9)</td>
<td>15 (36.6)</td>
</tr>
<tr>
<td>Probable source of infection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Municipality of residence</td>
<td>32 (78)</td>
<td>3 (7.3)</td>
<td>35 (85.3)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (4.9)</td>
<td>–</td>
<td>2 (4.9)</td>
</tr>
<tr>
<td>Undetermined</td>
<td>3 (7.3)</td>
<td>1 (2.4)</td>
<td>4 (9.7)</td>
</tr>
<tr>
<td>Classification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autochthonal</td>
<td>34 (82.9)</td>
<td>3 (7.3)</td>
<td>37 (90.2)</td>
</tr>
<tr>
<td>Imported</td>
<td>2 (4.9)</td>
<td>1 (2.4)</td>
<td>3 (7.3)</td>
</tr>
<tr>
<td>Undetermined</td>
<td>1 (2.4)</td>
<td>–</td>
<td>1 (2.4)</td>
</tr>
<tr>
<td>Type of entry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New case</td>
<td>35 (85.4)</td>
<td>2 (4.9)</td>
<td>37 (90.2)</td>
</tr>
<tr>
<td>Relapse</td>
<td>1 (2.4)</td>
<td>2 (4.9)</td>
<td>3 (7.3)</td>
</tr>
<tr>
<td>Undetermined</td>
<td>1 (2.4)</td>
<td>–</td>
<td>1 (2.4)</td>
</tr>
<tr>
<td>DP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>3 (7.3)</td>
<td>–</td>
<td>3 (7.3)</td>
</tr>
<tr>
<td>Negative</td>
<td>4 (9.7)</td>
<td>–</td>
<td>4 (9.7)</td>
</tr>
<tr>
<td>Not done</td>
<td>30 (73.2)</td>
<td>4 (9.7)</td>
<td>34 (82.9)</td>
</tr>
<tr>
<td>MIDR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>23 (56.1)</td>
<td>1 (2.4)</td>
<td>24 (58.5)</td>
</tr>
<tr>
<td>Negative</td>
<td>4 (9.7)</td>
<td>2 (4.9)</td>
<td>6 (14.6)</td>
</tr>
<tr>
<td>Not done</td>
<td>10 (24.4)</td>
<td>1 (2.4)</td>
<td>11 (26.8)</td>
</tr>
<tr>
<td>Histopathology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compatible</td>
<td>24 (58.5)</td>
<td>–</td>
<td>24 (58.5)</td>
</tr>
<tr>
<td>Incompatible</td>
<td>2 (4.9)</td>
<td>–</td>
<td>2 (4.9)</td>
</tr>
<tr>
<td>Not done</td>
<td>11 (26.8)</td>
<td>4 (9.7)</td>
<td>15 (36.6)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>41</td>
</tr>
</tbody>
</table>

Source: ISDN, Epidemiological Surveillance Service of the Municipality of Teodoro Sampaio-SP, 2011; Figures in parentheses indicate percentages; *Values are non-cumulative, since the overall total is the sub-total for each class (41) and the percentage in relation to this value; DP – Direct parasitological; MIDR–Montenegro’s intradermal reaction.
that 35/41 (85.37%) were of the cutaneous type. Nearly, 60% of cases showed a lesion and in nearly 80% the source of infection was the municipality of residence (Table 2).

The official source of ZD/ESC in the state of São Paulo shows data that considers Teodoro Sampaio-SP as a probable infection site where there were 35 cases between 1998 and 2011. The years when most cases were recorded according to this source were 2004, with nine cases, 2003 and 2005, with five cases each (Fig. 1). With regard to case confirmation criteria, 90.2% was laboratory based, with a greater proportion in men (68.29%) than women (21.95%) (Table 1). Lesions in CL are classified into three types: cutaneous lesion, diffuse cutaneous or mucosal. The type of lesion presented by the patient is entered on the investigation form. Among the notifications studied, 26 (63.41%) of the individuals presented a confirmed lesion, without specifying the kind of lesion. Histopathology was compatible in 24 cases. Most CL cases in the study period were new cases, 37 (90.24%). Three cases were imported and one was undetermined (Table 2). The data on the investigation form was cross- checked with the confirmation criteria and it was observed that 35/41 (85.37%) were of the cutaneous type. Nearly, 60% of cases showed a lesion and in nearly 80% the source of infection was the municipality of residence (Table 2).

Kernel shows that CL presented two micro outbreaks: three-year period I (from 1998 to 2000) and three-year period III (from 2005 to 2007) (Fig. 2).

There were 19 cases in rural areas occurring mainly on the date of the notification. Most had completed elementary school (33/41) (Table 1). The year with most recorded cases was 1998 (8 cases), followed by 2004 (7 cases). The average age for all notified cases is 37 yr; median age is 32 yr, with a standard deviation of 14.86.

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There were 19 cases in rural areas occurring mainly...
in settlements: Ribeirao Bonito (6 cases), Corrego Seco (3 cases), Sitio Capim Santo (2 cases). It is suggested that the municipal authorities could raise awareness of any possible foci of CL in these rural locations, because 20% of the inhabitants live in rural areas.

**DISCUSSION**

The municipality has differing numbers when compared as a municipality of notification (ISDN) and as a probable source of infection (ZD/ESC) (Fig. 1). This may indicated that some transmission reports in Teodoro Sampaio-SP were not recorded in both data sources in the municipality. In 2005, the municipality presented parity between the notified data as a source of infection and the municipality of notification, with five cases. In 2011, it contributed one of the two cases among all ESS municipalities.

Analyzing this in percentages, the municipality’s participation in notifications from the state of São Paulo, according to ZD/ESC, ranged between 0.21% in 1998 and 1.20% in 1999 of all notified cases, and the participation in relation to Presidente Venceslau’s ESS varied between 14.3%, with one case out of a total of seven, and seven of the eight cases presented in 2004. The municipality contributed in every year, except for 2002 and 2008, when the ESS recorded 15 and 4 cases, respectively (Fig. 1).

The epidemiological profile of CL identified in other studies is similar to this study, suggesting patterns as described in Isfahan, Iran, studying 1213 patients13, in the rural areas of Mirjaveh, southeast Iran, studying 122 patients14, on the northern coast of São Paulo State where 689 cases occurred: in Caraguatatuba (81), in Ilhabela (229), in Sao Sebastiao (164) and in Ubatuba (215)15. In the Parana municipalities of Cianorte, Jussara, Japura and Sao Tome16, 68.8%, in Acre State17, 83% in Parana State18, and 60% in Minas Gerais State19 all showed a higher proportion in men. Other research also detected more cases among individuals with low educational attainment17. An association exists in the literature of transmission with the age groups13–14, 17, 20.

Most (85.37%) confirmations using laboratory criteria were new cases and, in 56.1%, MIDR was conducted. There was a predominance (95%) of the cutaneous clinical form, which was also found in 84.6% cases in Caratinga, Minas Gerais21.

Municipalities along the north coast of São Paulo underscored a heterogeneous spatial distribution of the disease, occurring in urban and rural areas, although predominant in urban areas16. In the case of this study in Teodoro Sampaio, possible foci of infection occurred in rural as well as urban environments.

There was a much higher proportion of cases in rural environments (78%) compared to urban in the micro region of Caratinga/MG, and a significant number of cases in rural workers, among the 2782 notified cases between 1966 and 200321.

The pattern for the disease in Teodoro Sampaio has been considered wild or peri-urban, because of the MDSP, just 5 km away from the main district, in which the following vector species were found: *Brumptomyia brumpti*, *Nyssomyia neivai*, *Nyssomyia whitmani*, *Pintomyia fischeri* and *Pintomyia pessoai*8.

The male population was most affected. However, the affirmatives regarding the disease’s occupational pattern were not detected by the ISDN notifications, and relapses and new cases were not well explained. It is very difficult to work with secondary data due to the large number of sub-notifications and notification and investigation forms poorly completed by the service22. This occurs because the investigation is often not concluded and address information may not be correct.

In conclusion, the municipality should maintain a constantly active surveillance service because environmental and socioeconomic factors in the area lend themselves to the dissemination of the disease. These include the presence of the vector, favorable peri-urban conditions, underscoring the presence of MDSP, reduction in impacts on the municipality’s forest coverage, etc. As in the past, the enzootic cycles of *Leishmania*, probably *L. (Viannaia) braziliensis* continue among wild animals, thus, guaranteeing the perpetuation of the pathogen in nature and the risk of further outbreaks of cases of CL in reservoirs and humans. *Lutzomyia longipalpis* has been encountered in urban areas. In the future, it may contribute to an overlapping of the two forms of disease, VL and CL.

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