



Article/Artigo

Phlebotomine sandflies (Diptera: Psychodidae) in Governador Valadares, a transmission area for American tegumentary leishmaniasis in State of Minas Gerais, Brazil

Flebotomíneos (Diptera: Psychodidae) em Governador Valadares, área de transmissão de leishmaniose tegumentar americana, no Estado de Minas Gerais, Brasil

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ABSTRACT

Introduction: A study on the phlebotomine sandfly fauna was carried out in an endemic area for American tegumentary leishmaniasis in the municipality of Governador Valadares, in the State of Minas Gerais, Brazil. **Methods:** Captures were undertaken using HP light traps in four districts, on three nights per month, for one year (from January to December 2008). Correlations between climatic factors (temperature, relative air humidity and rainfall) and the numbers of sandflies collected was observed. **Results:** 5,413 phlebotomine specimens were caught and were identified as belonging to 12 species. Of these specimens, 2,851 (52%) were females and 2,562 (48%) were males. **Conclusions:** *Lutzomyia intermedia* predominated (29.9% of the species caught), thus suggesting that they were responsible for transmission of American tegumentary leishmaniasis, together with *L. whitmani*, which was also found in the area (4.3%). The presence of *L. longipalpis* (11.9%), the main vector for visceral leishmaniasis in Brazil, is an important finding, which makes rigorous entomological surveillance of the area necessary.

Keywords: American tegumentary leishmaniasis. Phlebotominae. *Lutzomyia*. Sandflies. Governador Valadares.

RESUMO

Introdução: Um estudo da fauna de flebotomíneos foi realizado em uma área endêmica para leishmaniose tegumentar americana no município de Governador Valadares, no Estado de Minas Gerais, Brasil. **Métodos:** Capturas foram feitas com armadilhas luminosas HP em quatro bairros, três noites por mês, durante o período de janeiro a dezembro de 2008. A correlação entre fatores climáticos (temperatura, umidade relativa do ar e pluviosidade) e o número de flebotomíneos coletados foi avaliada. **Resultados:** Foram capturados 5.413 espécimes de flebotomíneos, distribuídos em 12 espécies, sendo 2.851 (52%) fêmeas e 2.562 (48%) machos. **Conclusões:** *Lutzomyia intermedia* foi predominante com 29,9% das espécies capturadas, sugerindo ser a responsável pela transmissão de LTA, juntamente com *L. whitmani*, que também foi encontrada na região (4,3%). A presença de *L. longipalpis* (11,9%), principal vetor de LV no Brasil, é um dado relevante tornando-se necessário uma rigorosa vigilância entomológica na região.

Palavras-chaves: Leishmaniose tegumentar americana. Phlebotominae. *Lutzomyia*. Flebotomíneos. Governador Valadares.

INTRODUCTION

In Brazil, American tegumentary leishmaniasis (ATL) is an important public health problem because of increasing numbers of human cases. The infection can cause mutilating lesions and lead to loss of the capacity to work and even death¹. Over recent years, the significant increase in deforestation has favored adaptation of vectors to anthropic environments and consequently increased human exposure to the parasite². The circulation of *Leishmania* in domestic environments has favored the emergence of a distinct profile for transmission of the disease that differs from the classical pattern³ and is associated with a wider range of activities.

Nowadays, in the State of Minas Gerais (MG), ATL is present in practically all municipalities, in areas where highways and hydroelectric power stations have been built and where clusters of people have settled⁴. In addition to its continuing presence in old endemic foci in the Atlantic forest and in the Rio Doce and Mucuri valleys⁵, numerous cases have also been reported in urban areas of large and medium-sized cities, such as Belo Horizonte, Montes Claros and Governador Valadares.

Governador Valadares, in MG, is considered to be an endemic area. It had 221 new cases of ATL between 2004 and 2007, and approximately 75% of the cases were in the urban area. In an epidemiological study in the 1970s, in the municipality of Caratinga, near to Governador Valadares, Mayrink et al⁵ recorded the presence of *Lutzomyia whitmani* and *L. intermedia*, which are known to transmit *Leishmania braziliensis* in southeastern Brazil⁶.

The aim of the present study was to identify the phlebotomine fauna and some aspects of the population's behavior, such as the frequency of presence in peridomestic and domestic environments, seasonal variation of the species implicated as vectors

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for leishmaniasis and the influence of climatic factors on the species density. Through this, better understanding of the transmission cycle of ATL in the municipality was sought, along with correlations between the data obtained and the risk of *Leishmania* transmission, as support for applying control actions in the area.

METHODS

Study area

The municipality of Governador Valadares (18° 51' 12" S and 41° 56' 42" W) is part of the administrative area of Rio Doce valley. The total area of the municipality is 2,349 km², and it is physically characterized by predominance of hills, with altitude levels ranging from 191 to 1,008 m above sea level. The climate is classified, according to Koppen, as the AW type (tropical sub-warm and sub-dry), with a mean annual temperature of 25.6 °C and mean annual rainfall of around 1,350 mm.

Capture sites

Systematic captures were carried out using HP light traps⁷ between January and December 2008. Sixteen traps were distributed in four districts of the municipality (Elvamar, Vila Isa, Vila Parque Ibituruna and Village da Serra): two inside homes (domestic areas) and two in areas surrounding homes (peridomestic areas). These districts are characterized as transitional environments between the urban area and an area of environmental preservation. These traps were exposed from 4:00 pm to 8:00 am, for three consecutive nights every month, always in the last week of each month.

Phlebotomine identification

The taxonomic keys of Young and Duncan⁸ and Forattini⁹ were used for identification of the sandfly species. Specimens with missing or damaged characteristics that impaired identification at the species level were considered to be *Lutzomyia* spp. Females belonging to the genus *Brumptomyia* were not identified to the species level.

Climatic data

Climatic data for the study period were obtained through the website <http://www.inmet.gov.br/sim/sonabra/convencionais.php>. Average monthly values were used in our study.

Statistical analysis

The correlations between climatic variables (temperature, air humidity and rainfall) and population density of phlebotomines were evaluated by means of Spearman's coefficient (p -value ≤ 0.05).

RESULTS

The phlebotomine fauna of Governador Valadares was composed of 12 species: *Brumptomyia avellari* (Costa Lima, 1932), *B. nitzulescui* (Costa Lima, 1932), *Lutzomyia cortellezzii* (Brèthes, 1923), *L. intermedia* (Lutz & Neiva, 1912), *L. ischyraantha* (Martins, Falcão & Silva, 1962), *L. lenti* (Mangabeira, 1938), *L. longipalpis* (Lutz & Neiva, 1912), *L. minasensis* (Mangabeira, 1942), *L. quinquefer* (Dyar, 1929), *L. sordellii* (Shannon & Del Ponte, 1927), *L. termitophila* (Martins, Falcão & Silva, 1964) and *L. whitmani* (Antunes & Coutinho, 1939). A total of 5,413 specimens was caught, of which 2,851 were females (52%) and 2,562 were males (48%). The peridomestic and domestic areas accounted for 64% and 36% of the specimens caught, respectively. *Lutzomyia intermedia* was the predominant species, comprising 29.9% of the total number of phlebotomines collected (Table 1).

TABLE 1 - Phlebotomines captured in HP light traps according to the species, environment and gender, in Governador Valadares county, State of Minas Gerais, from January to December, 2008.

Species	Intradomicile		Peridomicile		Total		%
	♀	♂	♀	♂	♀	♂	
<i>Brumptomyia avellari</i>	0	4	0	13	0	17	0.3
<i>B. nitzulescui</i>	0	1	0	0	0	1	0.1
<i>Lutzomyia cortellezzii</i>	288	91	532	145	820	236	19.5
<i>L. intermedia s.l.</i>	241	248	412	719	653	967	29.9
<i>L. ischyraantha</i>	141	62	292	125	433	187	11.4
<i>L. lenti</i>	17	23	197	217	214	240	8.3
<i>L. longipalpis</i>	43	190	61	355	104	545	11.9
<i>L. minasensis</i>	0	1	0	0	0	1	0.1
<i>L. quinquefer</i>	327	123	117	62	444	185	11.7
<i>L. sordellii</i>	0	0	2	1	2	1	0.1
<i>L. termitophila</i>	16	1	48	3	64	4	1.2
<i>L. whitmani</i>	17	42	44	131	61	173	4.3
<i>Brumptomyia</i> spp.	7	0	9	0	16	0	0.3
<i>Lutzomyia</i> spp.	16	2	24	3	40	5	0.9
sub-total	1,113	788	1,738	1,774	2,851	2,562	
total	1,901		3,512		5,413		100.0

The monthly averages for climatic variables, considering rainfall, temperature and relative air humidity, can be seen in Table 2. The correlation between the number of phlebotomines captured and the climatic conditions is represented in Figure 1. All the variables evaluated showed a positive Spearman correlation coefficient in relation to phlebotomine density, but only the rainfall and humidity showed significant values ($p = 0.008$ and $p = 0.007$, respectively), while the temperature variable showed a p -value = 0.064.

Figure 2 shows the monthly distribution of vector species in the municipality of Governador Valadares. Table 3 displays the monthly distribution of phlebotomines captured in each neighborhood, in Governador Valadares, from January to December, 2008. It was observed that in all neighborhoods located in the transitional area between the sylvatic and urban environments, the number of insects captured was considerable, with greatest success in Village da Serra and Vila Isa, probably due to the presence of domestic animals (dogs, chickens, cows, horses and pigs) next to the sampling sites.

TABLE 2 - Monthly averages for climate variables (temperature, relative humidity and rainfall) in Governador Valadares, State of Minas Gerais, from January to December, 2008.

Month	Temperature (°C)	Relative humidity (%)	Rainfall (mm)
January	25.3	72.0	190.4
February	25.3	76.0	169.6
March	25.2	77.0	74.4
April	24.9	79.0	57.6
May	21.6	76.0	0
June	21.3	70.0	0
July	19.9	65.0	0
August	23.1	59.0	0
September	23.5	60.0	0
October	26.2	58.0	0
November	24.6	75.0	0
December	24.4	79.0	221.4

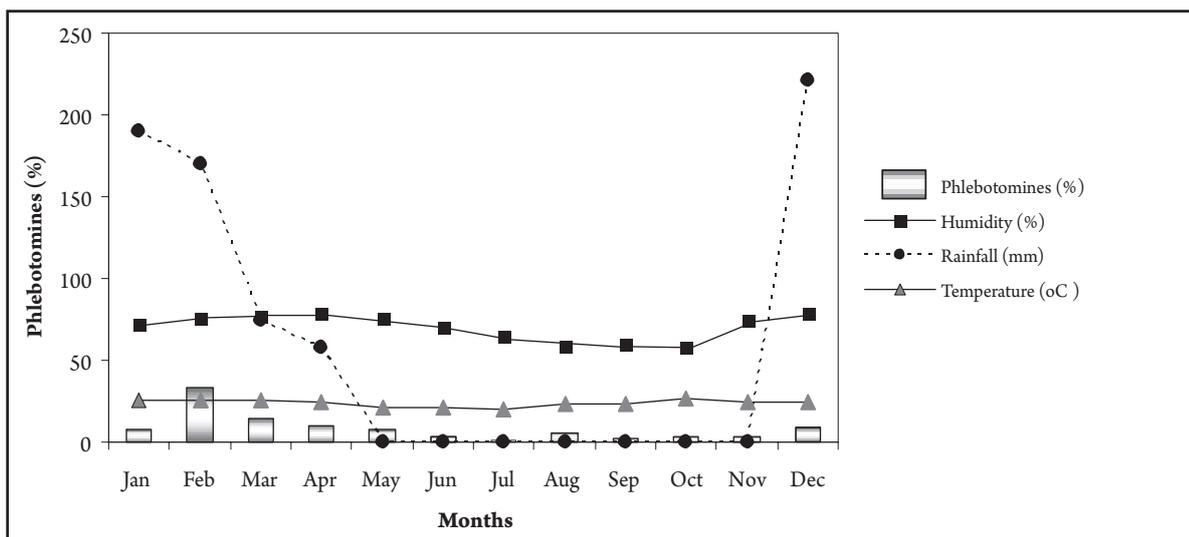


FIGURE 1 - Correlation between population density of phlebotomines and climatic variables (rainfall, temperature and relative humidity of the air) in Governador Valadares County, State of Minas Gerais, Brazil, from January to December, 2008.

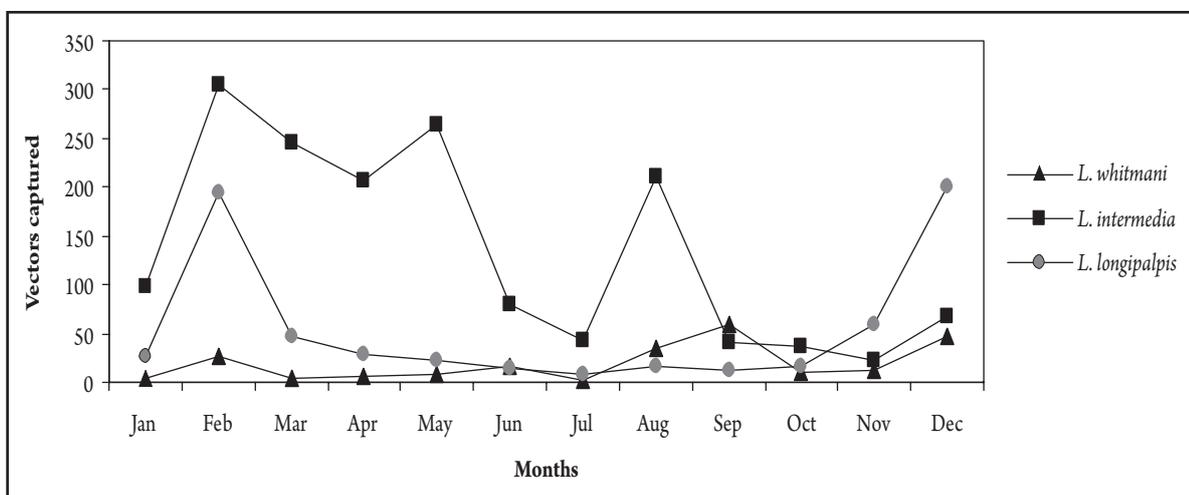


FIGURE 2 - Monthly distribution of vectorial species in Governador Valadares County, State of Minas Gerais, from January to December, 2008.

TABLE 3 - Monthly number of phlebotomines captured in HP light traps according to the neighborhood and gender, in the municipality of Governador Valadares, State of Minas Gerais, from January to December, 2008.

Month	Districts								Total	
	Elvamar		Vila Isa		Vila Parque Ibituruna		Village da Serra			
	♀	♂	♀	♂	♀	♂	♀	♂	n	%
January	47	29	125	58	29	8	59	72	427	7.9
February	245	166	402	193	164	53	267	303	1793	33.1
March	72	45	143	85	62	24	179	169	779	14.4
April	39	29	99	103	32	19	90	154	565	10.4
May	19	13	107	70	36	23	72	89	429	7.9
June	11	9	35	40	10	11	14	21	151	2.8
July	7	9	13	13	7	6	3	8	66	1.2
August	11	25	62	89	49	57	1	4	298	5.5
September	16	19	18	37	22	25	3	6	146	2.7
October	19	20	19	18	25	23	25	8	157	2.9
November	8	5	16	8	11	7	28	68	151	2.8
December	41	133	17	26	15	14	56	149	451	8.4
Total	535	502	1,056	740	462	270	797	1,051	5,413	100.0

DISCUSSION

The results showed that the phlebotomine fauna in the municipality of Governador Valadares is diversified, with some species of epidemiological interest. The presence of *L. intermedia* and *L. whitmani* suggests that these species participate as vectors for ATL in this area, as well as in other Brazilian endemic areas¹⁰⁻¹².

In Governador Valadares, the larger proportion of *L. intermedia* in relation to *L. whitmani* indicates that the first of these is a better adapted and more domesticated species, as shown by Souza et al¹¹. Females of *L. intermedia* were frequently found in and around homes, while *L. whitmani* was predominantly captured in peridomestic areas characterized by the presence of domestic animals and banana plantations. The presence of both species in these environments increases the risk of *Leishmania* transmission.

Forattini¹³ studied the seasonal variation of phlebotomines and found that in the hottest and most humid months (December to February), the number of species caught was greater, while in the coldest and driest months (June and August), the population density of these insects became considerably reduced. This was also observed by Dias et al¹⁴ and Barata et al¹⁵. Our results support this pattern of population distribution, with high densities during periods of high rainfall and high temperatures.

In the present study, the climatic variables of rainfall and relative humidity were statistically significant ($p \leq 0.05$). This observation agrees with several other studies that showed that temperature does not present a positive correlation with phlebotomine density¹⁴⁻¹⁶. In fact, this finding is not a rule, and therefore the climatic characteristics of each region, which are essential for the knowledge of the disease epidemiology, need to be taken into account.

If only the vector species are considered (**Figure 2**), it can be seen that after an intense period of rains (January), the populations of *L. intermedia*, *L. whitmani* and *L. longipalpis* increased during the subsequent month (February), with a tendency to decrease during the coldest and driest months. In an endemic area for tegumentary and visceral leishmaniasis, Souza et al¹⁷ observed that *L. longipalpis* and *L. whitmani* tended to undergo noticeable increases in populations after rainfall periods (March and April). This may be explained by the favorable environmental conditions of the microhabitats. Michalsky et al¹⁸ showed similar results reinforcing this hypothesis.

Another finding that deserves special attention is the high density of *L. longipalpis* in the districts studied. The presence of the vector for *Leishmania infantum* makes it necessary to undertake intensive entomological surveillance for visceral leishmaniasis prevention in this area. Moreover, the high phlebotomine percentage inside homes increases the synanthropy index and the possibility of *Leishmania* sp transmission.

In Brazil, the use of residual insecticides against phlebotomines is feasible in situations of peridomestic and domestic transmission. In the particular case of Governador Valadares, the use of insecticide in the districts studied is possible because they are a transitional area between sylvatic and urban environments. It is therefore recommended that insecticides should be used in the months of March, April and May, with the aim of reducing the numbers of phlebotomines.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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