

Seasonal variation of *Lutzomyia longipalpis* in Belo Horizonte, State of Minas Gerais

Variação sazonal de *Lutzomyia longipalpis* em Belo Horizonte,
Estado de Minas Gerais

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ABSTRACT

Between October, 1997 and September, 1999 in Belo Horizonte, Minas Gerais a study of seasonal variation of *Lutzomyia longipalpis* was carried out in three distinct areas of the municipality. Sand flies were sampled at 15-day intervals in three residences, in each of which two CDC light traps were installed, one indoors and the other in the peridomicile. A total of 397 sand flies were captured in the three areas, with 65%, 30% and 1% of specimens collected in the eastern, northeast and Barreiro districts, respectively. The overall proportions of sand flies collected inside and around the houses were similar (57% vs 43%) and this pattern was seen for both *Lutzomyia longipalpis* and *Lutzomyia whitmani*. The highest population levels during the two years of the study were from October to March. From October onwards, numbers increased constantly until February. A gradual fall was seen from April onwards until the lowest levels were reached in the months of June, July and August.

Key-words: Sand fly. Seasonal variation. Control. Leishmaniasis.

RESUMO

Entre outubro de 1997 e setembro de 1999, em Belo Horizonte, Minas Gerais foi conduzido um estudo de variação sazonal de *Lutzomyia longipalpis* em três áreas distintas do município. Os flebotomíneos foram coletados quinzenalmente em três residências, em cada área, nas quais foram instaladas duas armadilhas luminosas CDC, sendo uma no intradomicílio e a outra no peridomicílio. Um total de 397 flebotomíneos foi capturado nas três áreas, com 65%, 30% e 1% exemplares coletados nos distritos Leste, Nordeste e Barreiro, respectivamente. A proporção total de flebotomíneos coletados no intradomicílio e peridomicílio foi semelhante (57% vs 43%) e este padrão foi visto para *Lutzomyia longipalpis* e *Lutzomyia whitmani*. Durante os dois anos de estudo, o nível da população foi maior no período de outubro a março. A partir de outubro o número de flebotomíneos aumenta constantemente até fevereiro. Uma gradual redução foi observada a partir de abril até alcançar o nível mais baixo nos meses de junho, julho e agosto.

Palavras-chaves: Flebotomíneos. Variação sazonal. Controle. Leishmanioses.

The incidence of American visceral leishmaniasis (AVL) has increased significantly in some Brazilian cities. In Belo Horizonte, State of Minas Gerais, the process of AVL urbanization began in 1990, and the city still confronts an epidemic state, which demonstrates a worrying geographical advance, with 221 human cases and 23 deaths reported up to 1999.

In Minas Gerais, the main vector of *Leishmania chagasi*, the etiological agent of AVL, is the phlebotomine sand fly *Lutzomyia longipalpis*. This species has a wide geographical

distribution, from Mexico to Argentina⁴ and has been collected in all Brazilian states, except those of the southern region, *i.e.*, Paraná, Santa Catarina and Rio Grande do Sul⁹.

Despite the medical importance of phlebotomines, information on breeding sites, blood feeding activity, population fluctuations and seasonal variation of these insects is highly variable. This can be attributed to factors inherent to the region, the locality and the observation period.

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Studies on the duration of phlebotomine generation of under natural conditions revealed that in southern Canada and northern US, the various species of sand flies produce a single annual generation and can remain in diapause during the winter months⁶. In Minas Gerais, *L. longipalpis* appears to produce about four generations per year, with a three-month interval between generations, this interval corresponds to the incubation period of *L. chagasi* in the dogs, the main domestic reservoir of the protozoan⁹.

Considering AVL's morbidity and mortality, disease control should be prioritized in actions of epidemiological surveillance.

Thus, studies of the seasonal variation of *L. longipalpis* become necessary, since the data obtained can support a program of integrated control; to determine the most favorable times of the year to apply insecticides, with a view to the rational utilization of resources and a reduction in environmental damage as a result of this zoonosis control. In this study, the seasonal variation of *L. longipalpis* in three areas of the municipality of Belo Horizonte was investigated.

MATERIAL AND METHODS

The City of Belo Horizonte, in the State of Minas Gerais, Brazil, has a population of 3,420,000 inhabitants and the greater part of the population live in substandard accommodations, without basic sanitation and hygiene conditions. Belo Horizonte is formed by nine regional areas: Barreiro, Centro Sul (Center-South), Leste (East), Nordeste (Northeast), Noroeste (Northwest), Norte (North), Oeste (West), Pampulha and Venda Nova. We selected the regions Barreiro, Leste (East) and Noroeste (Northeast) due to orientation by the Municipal Health Secretary of Belo Horizonte, through which data on AVL prevalence in dogs and humans was assessed.

The study was carried out for over 24 months, between October, 1997 and September, 1999, in three distinct areas belonging to the municipality of Belo Horizonte: *i.e.*, the East (E) and Northeast (NE) districts (areas with a high prevalence of canine AVL and the occurrence of human cases) and the Barreiro district, where the canine AVL prevalence is low and human cases have not been reported.

Three residences were chosen from each region totaling 9 houses for insect collection and the selected residences signed a consent term in order to assure their participation and collaboration during the period of the study. The houses under study presented a favorable environment for the reproduction and development of sand flies. In general, the houses had the following features: large back yards, plants and domestic animals (dogs, birds, chickens, and others). Phlebotomines were sampled at 15-day intervals in three residences, in each of them two CDC light traps were installed, one indoors and the other one in the peridomicile.

The traps were hung 80cm above the ground, operated between 5:00 PM and 6:00 PM and collected between 07:30

AM and 08:30 AM the next morning. The samples were sent to laboratory of the Núcleo de Entomologia of Fundação Nacional de Saúde (FUNASA) of Minas Gerais, where the specimens were separated, prepared and identified according to Young & Duncan¹⁴.

RESULTS

Sampling of phlebotomines by district. The total number of phlebotomines and the number of *L. longipalpis* collected in the E, NE and Barreiro districts of Belo Horizonte between October, 1997 and September 1999 are shown in Table 1. In general terms, the number of collected sand flies and *L. longipalpis* was shown to be higher in the year I than year II. A total of 397 sand flies were captured in the three areas with 275 (69%), 118 (30%) and 4 (1%) specimens collected in the E, NE and Barreiro districts, respectively. *L. longipalpis* was not found in the Barreiro district and, although lower numbers of this species were collected in the NE than the E, the highest proportion (62.7%) of all sand flies were captured in the former rather than in the latter regions.

Table 1 - Total number of phlebotomines and of *Lutzomyia longipalpis* collected in three districts of Belo Horizonte, from October 1997 to September 1999.

Districts	Year I (Oct/97-Sep/98)		Year II (Oct/98-Sep/99)		Overall Total Years I & II		
	<i>L. longipalpis</i>		<i>L. longipalpis</i>		<i>L. longipalpis</i>		
	Total	n°	Total	n°	Total	n°	%
Barreiro	4	0	0	0	4	0	0.0
East	222	77	53	5	275	82	29.8
Northeast	29	20	89	54	118	74	62.7
Total	255	97	142	59	397	156	39.3

Distribution of phlebotomines by species and gender. The total numbers and relative proportions of each gender of the phlebotomine species collected in the three districts of Belo Horizonte are presented in Table 2. A similar proportion of male (55%) and female (45%) sand flies were collected during the 24-month study, all 10 (ten) species belonging to the genus *Lutzomyia* (França, 1924). The predominant species were:

Table 2 - Relative proportions of each gender of the phlebotomine species collected in Belo Horizonte from October 1997 to September 1999.

Species	Male (M)		Female (F)		Total n°
	n°	%	n°	%	
<i>L. longipalpis</i>	129	83.0	27	17.0	156
<i>L. whitmani</i>	78	52.0	72	48.0	150
<i>L. monticola</i>	1	2.0	54	98.0	55
<i>L. sallesi</i>	8	33.0	16	67.0	24
<i>L. lloydi</i>	1	50.0	1	50.0	2
<i>L. edwardsi</i>	0	0.0	2	100.0	2
<i>L. intermedia</i>	0	0.0	1	100.0	1
<i>L. lenti</i>	1	50.0	1	50.0	1
<i>L. evandroi</i>	0	0.0	1	100.0	1
<i>L. migonei</i>	1	100.0	0	0.0	1
<i>Lutzomyia sp</i>	0	0.0	3	100.0	3
Total	219	55.0	178	45.0	397

Lutzomyia longipalpis, 156 (39%) specimens, *L. whitmani*, 150 (38%), *L. monticola*, 55 (14%) and *L. sallesi*, 24(6%) specimens. The other species found in the municipality represented only 3% of the total collected and included *L. intermedia*, *L. lenti*, *L. lloydi*, *L. edwardsi*, *L. evandroi* and *L. migonei*. Three of these species i.e., *L. intermedia*, *L. whitmani* and *L. migonei* have been incriminated as vectors of *L. braziliensis*, the etiological agent of American cutaneous leishmaniasis (ACL).

Frequency of phlebotomines by habitat sampled. The relative distribution of the 10 phlebotomine species in two habitats (intradomiciliary and peridomiciliary) during the study period are shown in Table 3. The overall proportions of sand flies collected inside and around the houses were fairly similar (57% vs 43%) and this pattern was seen for both *L. longipalpis* and *L. whitmani*. Only one of the species collected in

significant numbers (*L. monticola*) was less numerous in intradomiciliary samples.

Monthly distribution of phlebotomines. The monthly distribution of sand flies captured in the three districts of Belo Horizonte, is presented in Figure 1, together with the mean monthly rainfall (mm) and minimum and maximum monthly temperatures (°C). The numbers of phlebotomines, in general and *L. longipalpis*, in particular, were greater when the combination of the highest mean temperatures and regular rainfall occurred. Sand fly populations reach their lowest levels in Belo Horizonte during the coldest and driest months.

The highest population levels during the two years of the study from October to March. From October onwards, the numbers increased constantly until February. A gradual fall was observed from April onwards until the lowest levels were reached in the months of June, July and August.

Table 3 - Relative distributions of 10 phlebotomine species collected in and around houses in Belo Horizonte from October 1997 to September 1999.

Species	Intradomicile (I)		Peridomicile (P)	
	nº	%	nº	%
<i>L. longipalpis</i>	85	55,0	71	45,0
<i>L. whitmani</i>	62	41,0	88	59,0
<i>L. intermedia</i>	0	0,0	1	100,0
<i>L. lenti</i>	1	50,0	1	50,0
<i>L. sallesi</i>	11	46,0	13	54,0
<i>L. lloydi</i>	1	50,0	1	50,0
<i>L. edwardsi</i>	0	0,0	2	100,0
<i>L. evandroi</i>	0	0,0	1	100,0
<i>L. monticola</i>	8	15,0	47	85,0
<i>L. migonei</i>	1	100,0	0	0,0
<i>Lutzomyia</i> sp	2	67,0	1	33,0
Total	171	43,0	226	57,0

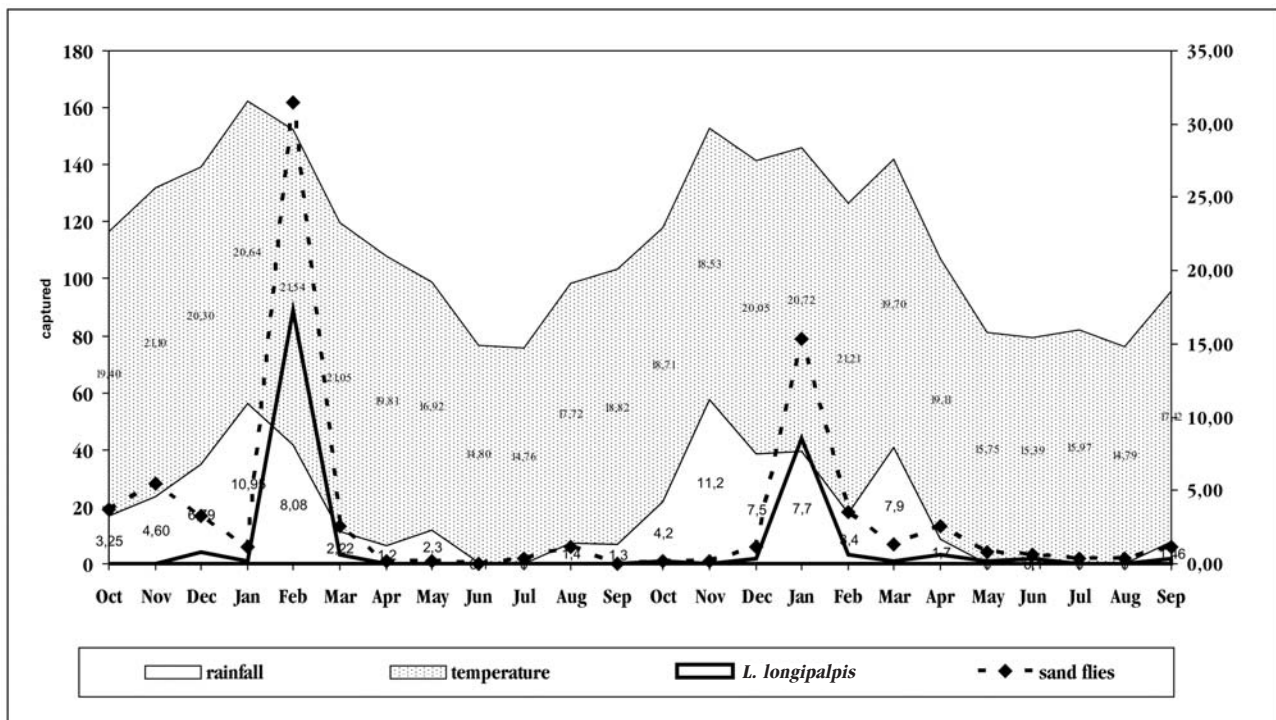


Figure 1 - Monthly distribution of phlebotomines in Belo Horizonte, together with mean monthly rainfall (mm) and minimum and maximum temperatures (°C) from October 1997 to September 1999.

DISCUSSION

Collection of phlebotomines by district. In general, the distribution of *L. longipalpis* coincides with that of AVL and this association is used in epidemiological research to validate autochthonous cases^{3,6}.

Based on data from the Secretaria Municipal de Saúde de Belo Horizonte (Belo Horizonte City Health Secretary), the E and NE districts are classified as areas of high prevalence of canine AVL with the occurrence of human cases and the Barreiro district, as an area of low prevalence of canine AVL with no human cases reported.

In the collection of phlebotomines from each of these districts, the presence of *L. longipalpis* in the E and NE recorded while in the Barreiro district no occurrence of this species was registered during this study.

Distribution of phlebotomines by species and gender.

When comparing phlebotomines with other families of Nematocera of medical and veterinary importance, we were amazed by the lack of knowledge regarding the breeding sites of this insect and its relation to the domiciliary and peridomiciliary habitat.

In this study, a greater abundance of males was observed in the collections, and regarding *L. longipalpis*, a significantly higher percentage of males (83%) than females (17%) were collected during this study.

This phenomenon of varied forms between species may be subject to the normal activities of these insects, to the habits of their domestic host animals and of insect populations, among other factors that should be investigated further.

The presence of *L. intermedia*, *L. whitmani* and *L. migonei* were recorded, which have been incriminated as vectors of *Le. braziliensis*, the etiological agent of American cutaneous leishmaniasis (ACL).

Frequency of phlebotomines according to collection habitat. Phlebotomines, as vectors of pathogens, also constitute an appreciable biting nuisance. The dimensions of the problem caused by these insects, particularly *L. longipalpis*, are apparent in the massive collections of this species carried out in Ceará and Bahia¹¹.

According to Mangabeira Filho⁷, in Ceará, *L. longipalpis* was the only species collected inside houses.

Leon⁶ observed that in Guatemala, phlebotomines are more attracted to the peridomicile when there are animals in the immediate vicinity of the houses.

Lutzomyia longipalpis is a common species in and around houses and feeds avidly on humans^{3,5,10,12}.

The highest percentage of phlebotomines was observed in collections realized outdoors (*i.e.*, in the peridomicile). However, we emphasize that *L. longipalpis* was among the most frequent species that presented the highest percentage inside houses (intradomicile). The endophilic capacity of the *L. longipalpis* population observed in this study seems to be very high.

These results suggest that the probability of AVL intradomicile transmission in the E and NE districts, in Belo Horizonte is high, and that the spraying of houses should have an impact on the *Le. chagasi* transmission.

Monthly distribution of phlebotomines. The greatest abundance of *L. longipalpis* in the three districts corresponds to the periods in which the rainfall is highest. As expected, this species was least abundant during the driest periods¹¹.

Other authors have affirmed that the highest density of phlebotomines corresponds to a high precipitation, reaching maximum values shortly after the end of the rainy season, with periods of cool and mild temperatures being most suited for the activity of this insect^{1,2,13,15}.

In Belo Horizonte, we observed that the highest numbers of sand flies, including *L. longipalpis*, occurred in the period of the highest rainfall combined with the highest mean temperatures.

The most striking feature of the data is the parallels of the seasonal curves of phlebotomine abundance and of *L. longipalpis*, in particular, during the two years of the study, as well as the correlation between the abundance of *L. longipalpis* and the incidence of human AVL cases in the city.

The data obtained suggest that the most favorable period of the year to start *L. longipalpis* control is during the months of October, November and December, with the onset of weather conditions that favor the increase of sand fly populations.

Thus, the Serviço Municipal de Controle de Zoonoses (Municipal Service for the Control of Zoonosis) could optimize the use of resources prioritizing the cycle of insecticides application in areas where AVL needs to be controlled and at the time of year indicated in this study. The results reported here and the data obtained in continued research will further support a program of integrated control.

The frequency of phlebotomines in the habitats where they were collected emphasizes the high endophilic capacity of *L. longipalpis* and suggests that the probability of AVL intradomiciliary transmission is high, consequently the spraying of houses should have an impact on the transmission of *Le. chagasi*.

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