

Rev. Inst. Med. Trop. Sao Paulo
55(6):407-410, November-December, 2013
doi: 10.1590/S0036-46652013000600006

PHLEBOTOMINE SANDFLIES IN RURAL LOCATIONS IN THE STATE OF PARANA, SOUTHERN BRAZIL

Simone Cristina Castanho Sabaini de MELO(1), Wilsandrei CELLA(2), Rubens MASSAFERA(3), Natália Maria Maciel Guerra SILVA(1),
Reinaldo MARQUI(4), Maria Dalva de Barros CARVALHO(5) & Ueslei TEODORO(5)

SUMMARY

This study reports the fauna and frequency of sandflies in domestic animal shelters, residences and other ecotopes in rural areas of the municipality of Bandeirantes, Paraná State. Sandflies were collected twice in eight rural villages by using Falcon traps from 8pm to 6am in 2008. In these localities 4,790 sandflies were collected, which were represented by ten sandfly species, prevailing of *Nyssomyia neivai* and *Nyssomyia whitmani* species. It was observed that animal shelters are the domestic ecotopes where there is the greatest frequency of these insects. The localities where the collections were made had the environmental characteristics that allow the persistence of transmission of parasites from the American tegumentary leishmaniasis. Although the fauna and the behavior of sandflies species are similar in different localities, the method of controlling these insects should be adjusted to the environmental characteristics of each one of the most diverse endemic areas of American tegumentary leishmaniasis in the municipalities of Paraná State.

KEYWORDS: Sandflies; American Tegumentary Leishmaniasis; *Leishmania*; Animal's shelter; Fauna; Control.

INTRODUCTION

The leishmaniasis condition is sited among the top five diseases that have a major impact on public health worldwide¹⁴. In Latin America, the cutaneous leishmaniasis (CL) has a strong impact on public health, especially in Brazil, where it occurs in every State¹². In the State of Paraná, CL is an endemic disease and it has been registered in more than 300 of the 399 municipalities¹⁰ including the municipality of Bandeirantes.

In Bandeirantes municipality, 232 autochthonous cases of TL were noted, with yearly occurrences from 1990 to 2009. As a result, this research on phlebotomine fauna and frequency in domiciliary, peridomiciliary and rural localities was conducted in order to provide detailed knowledge on the areas where the *leishmania* transmissions have happened that could be helpful when choosing the most effective method to control the vectors.

MATERIAL AND METHODS

Municipality description: The municipality of Bandeirantes is located in the North Pioneer mesoregion of Paraná and according to the Demographic Census conducted in 2010, has a population of 32,182 inhabitants, of which 28,382 are living in urban and 3,800 in rural areas. The vegetation type of the municipality is of semi-deciduous forest and the soil is a composite type (Red Podzol, Red Latosol and Red Nitosol). The climate is subtropical humid reaching in the coldest month averaged temperatures lower than 18 °C and in the warmest month averaging higher

than 22 °C. The municipality has an area of 44,527.9 hectares (ha), where only 872.9 ha are native forest. Nowadays, 80% of the municipality's territory is occupied by grain crops (soya and maize), alfalfa and sugar cane. According to Figure 1, the rural zone of Bandeirantes is divided into 17 districts, of which eight of them (Água da Jacutinga, Água das Perobas, São Paulo, Cabiúna, Água do Cateto, Água do Caixão, Água Vermelha and Água da Boa Pastora) were selected for collection of sandflies. In these districts in Água do Caixão and Água da Boa Pastora there were no reported cases of CL.

Rural neighborhoods where the phlebotomines were collected:

1. Água da Jacutinga (23° 05' S/50° 25' W). Two farms were selected from which to collect the samples: (3 irmãos Farm and Silva Farm). In the first one, the traps were installed in the woods 984.25m from a house (E1); in a chicken coop (E2); 9.84m from a house (E3), and in a pigsty 6.56m from this same house (E4). In the second farm, the traps were installed in a pigsty 64.04m from a house (E5); in the woods, 984.25m from the same house (E6); in a house made of wood which is used as chicken coop and is 6.56m from another house (E7), and in a banana plantation (E8). In both farms there are soybean and sugar cane plantations.

2. Água das Perobas (23° 14' S/50° 18' W). Samples were collected in Peroba Farm. The traps were installed in sites (E1, E2 and E4) which were located behind the houses (E3, E5, E6, E9) where traps were also installed; in chicken coops (E7, E8) 6.56m from these houses, and in the woods, 984.25m from the same houses.

Financial support given by CNPq (Proc. 410550/2006-0).

(1) Universidade Estadual do Norte do Paraná *Campus* Luiz Meneghel. E-mails: simonecastanho@uenp.edu.br, natyguerra@uenp.edu.br

(2) Universidade Paranaense *Campus* Cianorte. E-mail: wilsandrei_bio@hotmail.com

(3) Núcleo de Entomologia de Jacarezinho. Secretaria de Estado da Saúde do Paraná. E-mail: rubensmassafera-@hotmail.com

(4) Secretaria Municipal de Saúde de Bandeirantes. E-mail: reimarquibio@hotmail.com

(5) Universidade Estadual de Maringá. E-mails: mdbcarvalho@uem.br, uteodoro@uem.br

Correspondence to: Simone C. Castanho S. de Melo, R. São Paulo 801, Vila Paraíso, 86360-000 Bandeirantes, PR, Brasil. E-mail: simonecastanho@uenp.edu.br

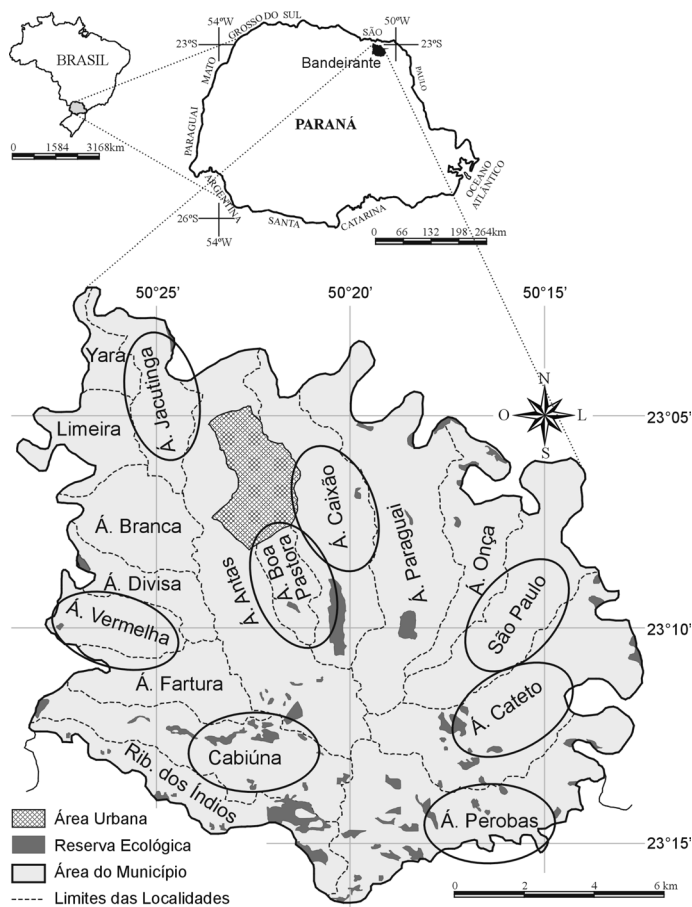


Fig. 1 - Água da Jacutinga, Água das Perobas, São Paulo, Cabiúna, Água do Cateto, Água Vermelha, Água do Caixão and Água da Boa Pastora localities, where Phlebotomine sandflies were collected in the city of Bandeirantes, State of Paraná, Brazil.

3. São Paulo (23° 10'S/50° 16'W). Samples were collected in three farms: Santo Antônio, Boa Esperança and Santa Rita. In the first one, the traps were installed in a house (E1) and in a pigsty (E2) 164.04m from a house. In the second farm, the collection was taken in a chicken coop (E3) 6.56m from a house; in a pigsty (E4) 16.4m from a house; in a chicken coop (E5) 9.84m from the same house, and in a corral (E6) 16.4m from another house. In Santa Rita Farm, the samples were collected in a chicken coop (E7) 9.84m from a house; 3.8m from a pigsty (E8); in a house (E9), and in a chicken coop (E10) 6.56m from a house.

4. Cabiúna. (23° 13'S/50° 23'W). The phlebotomine collection was taken in Durval Mariquito Farm, Lazarini Farm and in Santa Maria Farm. In the first one, the collection was taken in a pigsty (E1) 16.4m from a house (E4 and E5), where traps were also installed. In the woods (E2) 164.04m from these houses; in a chicken coop (E3) 9.84m from those houses. In Lazarini Farm, the samples were collected in a house (E6) and in a chicken coop (E7) 6.56m from E6 and 1,148.29m from the woods. In Santa Maria farm, the collection was taken in a house (E8), in a pigsty (E9) 6.56m from a house and 984.25m from the woods and in a chicken coop (E10).

5. Água do Cateto (23° 12'S/50° 18'W). The collection was taken

in Cateto Nomura Farm in houses (E1, E2, E5, E8 and E9); in chicken coops close to these houses (E3, E4 and E7); in a pigsty (E6) near these same houses, and in a corral (E10). Considering all the localities where the work was done, this one has the largest residual area, which is located approximately 656.17m from the residences.

6. Água Vermelha (23° 09'S/50° 26'W). The collect was done in Boa Vista Farm in houses (E1, E2, E6 and E8); chicken coops (E3 and E9); in pigsty (E4) 196.85m from the woods (E5), in a hangar (E7), and in a dam shore (E10) 6.56m from the woods.

7. Água do Caixão (23° 06'S/50° 20'W). The collections were done in Tanaka Farm, in two houses (E1, E6); in a chicken Coop (E2); in a corral linked to a pigsty (E3); in a duck barn (E4); in canebrakes (E5, E8); in a pigsty (E7) and in hangars (E9, E10). The house (E1) was 6.56m from the chicken coop (E2) and the corral linked to the pigsty (E3). The pigsty was located 6.56m from E6.

8. Água da Boa Pastora (23° 08'S/50° 22'W). The phlebotomines collection was done in São Luiz Farm, Francisco Marques and Bela Manhã Farms. In the first one, in a chicken coop (E1) and in a house (E2). In Francisco Marques Farm, the collection was done in a goat barn (E3); in a pigsty (E4); in a house (E5) and in a chicken coop (E6). In the last one, in a pigsty (E7); in a chicken coop (E8) and in two houses (E9, E10).

Collection and phlebotomines identification: The phlebotomines were caught in 15 localities distributed between eight rural neighborhoods. During area selection, in order to implement the capture, six disease registers in humans were found in two of these areas and in two of them there was no occurrence. The collection was done with a light trap, from 8pm to 6am, from January to March and September to December of 2008, and it consisted of two collections per locality (20 hours).

The number of traps installed in each locality varied from eight to ten because of each house's availability and other ecotopes in the peridomestic area. The collected specimens were sacrificed in chloroform and then kept in cardboard boxes containing mothballs. Phlebotomines were prepared and identified in the Medical Entomology Laboratory of 19th Health Dept. of Jacarezinho, Parana State. The nomenclature follows GALATI³ and abbreviation follows MARCONDES⁶.

RESULTS

A total of 4,790 phlebotomines, belonging to 11 species, were collected: *Nyssomyia neivai*, *Nyssomyia whitmani*, *Pintomyia pessoai*, *Migonemyia migonei*, *Pintomyia fischeri*, *Evandromyia cortelezzi*, *Micropygomyia ferreirana*, *Expapillata firmatoi*, *Brumptomyia brumpti*, *Evandromyia sallesi* and *Brumptomyia cunhai*. The hourly average (HA) of total phlebotomines collected was 239.5 (Table 1).

In the Água do Cateto, Água da Boa Pastora and Água das Perobas neighborhoods 79.6% (HA = 190.20) of its total was collected. The most frequent species collected were *Ny. neivai* (HA = 104.70), *Ny. whitmani* (HA = 96.95) and *Pi. pessoai* (HA = 26.25) (Table 1).

In its total neighborhood set 1,788 (HA = 89.40) phlebotomines were collected in 20 chicken coops, 1,350 (HA = 67.50) in 15 piggeries and 973 (HA = 48.65) in 26 house porches (Table 2).

Tabela 1

Phlebotomine sandflies species collected in rural localities in the city of Bandeirantes, State of Paraná, from January to December of 2008

Specie/Zone/Hourly Average	AJ	HA	AP	HA	SP	HA	CA	HA	AC	HA	AV	HA	AX	HA	AB	HA	Total	HA
<i>Nyssomyia neivai</i>	104	5.20	99	4.95	112	5.60	10	0.50	1,144	57.20	192	9.60	48	2.40	385	19.25	2,093	104.70
<i>Nyssomyia whitmani</i>	31	1.55	135	6.75	113	5.65	21	1.05	968	48.40	210	10.50	21	1.05	440	22.00	1,939	96.95
<i>Pintomyia pessoai</i>	21	1.05	388	19.40	6	0.30	-	-	51	2.55	16	0.80	-	-	43	2.15	525	26.25
<i>Migonemyia migonei</i>	7	0.35	23	1.15	11	0.55	3	0.15	53	2.65	4	0.20	1	0.05	10	0.50	112	5.60
<i>Pintomyia fischeri</i>	6	0.30	27	1.35	2	0.10	-	-	35	1.75	6	0.30	-	-	1	0.05	71	3.55
<i>Evandromyia cortelezzii</i>	4	0.20	4	0.20	-	-	-	-	-	-	-	-	-	-	-	-	8	0.40
<i>Micropygomyia ferreirana</i>	12	0.60	2	0.10	1	0.05	-	-	-	-	-	-	-	-	-	-	15	0.75
<i>Expapillata firmatoi</i>	8	0.40	-	-	-	-	-	-	-	-	3	0.15	-	-	-	-	11	0.55
<i>Brumptomyia cunhai</i>	-	-	7	0.35	-	-	-	-	-	-	-	-	-	-	-	-	7	0.35
<i>Brumptomyia brumpti</i>	1	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.05
<i>Evandromyia sallesi</i>	1	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.05
Total	195	9.75	685	34.25	245	12.25	34	1.70	2,251	112.55	431	21.55	70	3.50	879	43.95	4,790	239.50

AJ = Água da Jacutinga; AP = Água das Perobas; SP = São Paulo; CA = Cabiúna; AC = Água do Cateto; AV = Água Vermelha; AX = Água do Caixão; AB = Água da Boa Pastora; HA = Hourly Average.

Tabela 2

Phlebotomine sandflies collected in several environments, in rural localities in the city of Bandeirantes, State of Paraná, from January to December of 2008

Environments/sites	AJ	HA	AP	HA	SP	HA	CA	HA	AC	HA	AV	HA	AX	HA	AB	HA	Total	HA
Hennery	49	2.45	11	0.55	76	3.80	1	0.05	1,563	78.15	14	0.70	2	0.10	85	4.25	1,788	89.40
Piggery	103	5.15	152	7.60	46	2.30	-	-	292	14.60	235	11.75	31	1.55	491	24.55	1,350	67.50
Houses	15	0.75	139	6.95	3	0.15	13	0.65	391	19.55	169	8.45	-	-	243	12.15	973	48.65
Woods	28	1.40	383	19.15	-	-	20	1.00	-	-	4	0.20	-	-	-	-	435	21.75
Corrals	-	-	-	-	120	6.00	-	-	-	-	-	-	-	-	-	-	120	6.00
Goat shelter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	3.00	60	3.00
Corral/Piggery	-	-	-	-	-	-	-	-	-	-	-	-	29	1.45	-	-	29	1.45
Banana tree	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	0.65
Mango tree	-	-	-	-	-	-	-	-	5	0.25	-	-	-	-	-	-	5	0.25
Water reservoir margin	-	-	-	-	-	-	-	-	-	-	5	0.25	-	-	-	-	5	0.25
Sheds	-	-	-	-	-	-	-	-	-	-	4	0.20	2	0.10	-	-	6	0.30
Bamboo plantation	-	-	-	-	-	-	-	-	-	-	-	-	4	0.20	-	-	4	0.20
Duck shelter	-	-	-	-	-	-	-	-	-	-	-	-	2	0.10	-	-	2	0.10
Total	195	9.75	685	34.25	245	12.25	34	1.70	2,251	112.55	431	21.55	70	3.50	879	43.95	4,790	239.50

AJ = Água da Jacutinga; AP = Água das Perobas; SP = São Paulo; CA = Cabiúna; AC = Água do Cateto; AV = Água Vermelha; AX = Água do Caixão; AB = Água da Boa Pastora; HA = Hourly Average.

DISCUSSION

The eleven species collected in several districts of the municipality of Bandeirantes has already been described in several municipalities of Paraná State^{7,11-12}, including in Peroba Farm (Água das Perobas locality)⁸.

The *Ny. neivai*, *Ny. whitmani*, *Mi. migonei*, *Pi. pessoai* and *Pi. fischeri* phlebotomines have a very common occurrence in many endemic areas of CL in Paraná State^{1,11-12}, demonstrating that these species of phlebotomine

sand flies present genetic characteristics that allow them to adapt to anthropogenic environments with distinct levels of changes and due to “a sort of” spatial, olfactory memory and/or to the host fidelity that direct them to recognize environments of blood supply, rest and reproduction². The first four species were already marked with natural infection by protozoa of *Leishmania* genus in other regions of Brazil, showing the potential of vector insects in natural and anthropogenic environments^{4,6}. The natural infection of *Ny. whitmani* was observed in Paraná State⁴ and *Ny. neivai* in Paraná and Santa Catarina States^{5,9}.

In the majority of the districts where the phlebotomine collections were made in bad hygiene condition homes the presence of humidity and organic matter in the soil (leaves, fruits, domestic animal feces, food and vegetal waste) of domestic animals shelters and residences in the neighborhoods of remaining forests was noticed in the peridomicile. These factors are crucial for the formation of phlebotomine breeding sites that invade domiciles^{6,10,13}, increasing the vulnerability of the inhabitants to the CL.

CONCLUSION

In the neighborhoods where the collections were done, 10 phlebotomines species were found, and, among those, *Ny. neivai* and *Ny. whitmani* were the main ones. Domestic animal shelters are the ecotopes where these insects frequency occurs the most. The localities where the collections were done have environmental characteristics that allow *Leishmania* transmission persistence.

Even though fauna and phlebotomines species behavior are similar in many localities, the control method of these insects has to be adjusted to the environmental characteristics of each CL endemic area in Paraná municipalities.

The detailed knowledge on the localities where there is leishmaniasis transmission chain gives the public health administration the option to choose more efficient methods in order to control the spread of the disease. The municipalities have not maintained their promise when it comes to the endemic control of diseases that involve vectors, and it shows the demand for changes in Ministry of Health policies. The increase of cases of diseases related to these insects shows the need to capacitate community health agents for vector vigilance development activities.

RESUMO

Flebotomíneos em localidades rurais do Estado do Paraná, Sul do Brasil

Relatam-se, neste trabalho, a fauna e frequência de flebotomíneos em abrigos de animais domésticos, residências e outros ecótopos em áreas rurais do município de Bandeirantes, Estado do Paraná. Os flebotomíneos foram coletados em oito bairros rurais, com armadilhas de Falcão, duas vezes em cada bairro, das 20 às 6 horas, em 2008. No conjunto dos bairros coletaram-se 4.790 flebotomíneos, representados por dez espécies, com predomínio de *Nyssomyia neivai* e *Nyssomyia whitmani*. Os abrigos dos animais domésticos são os ecótopos onde há maior frequência desses insetos. As localidades onde as coletas foram realizadas têm características ambientais que permitem a persistência da transmissão de parasitos da leishmaniose tegumentar americana. Apesar da fauna e do comportamento das espécies de flebotomíneos serem semelhantes nas diversas localidades, o método de controle desses insetos deve ser ajustado às características ambientais de cada uma das mais diversas áreas endêmicas de leishmaniose tegumentar americana, nos municípios do Paraná.

ACKNOWLEDGEMENTS

To the Healthcare agents of the Entomology Group of the municipality of Jacarezinho/Secretary of Health of the State of Paraná, Mr. Hélio

Aparecido Barbosa, Nivaldo Paulino, and Valdeci Aparecido Fagundes for their assistance in collection and identification of sandflies and to the Technical in Health Surveillance, Mr. Edson Carlos Capi in supporting the orientation process of the localities where the collections were made.

REFERENCES

1. Andrade-Filho JD, Galati EAB, Falcão AL. *Nyssomyia intermedia* (Lutz & Neiva, 1912) and *Nyssomyia neivai* (Pinto, 1926) (Diptera: Psychodidae: Phlebotominae) geographical distribution and epidemiological importance. *Mem Inst Oswaldo Cruz*. 2007;102:481-7.
2. Freitas JS, Reinhold-Castro KR, Casanova C, Silva JP, Previdelli I, Teodoro U. Memória espacial e/ou olfativa em flebotomíneos em área endêmica de leishmaniose tegumentar americana, sul do Brasil. *Rev Soc Bras Med Trop*. 2009;42:151-5.
3. Galati EAB. Morfologia e taxonomia. In: Rangel EF, Lainson R, editores. *Flebotomíneos do Brasil*. Rio de Janeiro: Editora Fiocruz; 2003. p. 23-51.
4. Luz E, Membrive N, Castro EA, Dereure J, Pratlong F, Dedet JA, et al. *Lutzomyia whitmani* (Diptera: Psychodidae) as vector of *Leishmania (V. braziliensis)* in Paraná State, Southern Brazil. *Ann Trop Med Parasitol*. 2000;94:623-31.
5. Marcondes CB, Bittencourt IA, Stoco PH, Eger I, Grisard EC, Steindel M. Natural infection of *Nyssomyia neivai* (Pinto, 1926) (Diptera: Psychodidae, Phlebotominae) by *Leishmania (Viannia)* spp. in Brazil. *Trans R Soc Trop Med Hyg*. 2009;103:1093-7.
6. Marcondes CB. A proposal of generic and subgeneric abbreviations for phlebotomine sandflies (Diptera: Psychodidae: Phlebotominae) of the world. *Entomol News*. 2007;118:351-6.
7. Massafera R, Silva AM, Carvalho AP, Santos DR, Galati EAB, Teodoro U. Fauna de flebotomíneos do município de Bandeirantes, no Estado do Paraná. *Rev Saúde Pública*. 2005;39:571-7.
8. Membrive NA, Rodrigues G, Membrive U, Monteiro WM, Neitzke HC, Lonardoni MVC, et al. Flebotomíneos de municípios do norte do Estado do Paraná, sul do Brasil. *Entomol Vec*. 2004;11:673-80.
9. Oliveira DM. Padronização de técnicas moleculares para o diagnóstico e epidemiologia de leishmaniose tegumentar americana. [dissertação]. Maringá: Universidade Estadual de Maringá; 2009.
10. Reinhold-Castro KR, Scodro RB, Dias-Sversutti AC, Neitzke HC, Rossi RM, Kühl JB, et al. Avaliação de medidas de controle de flebotomíneos. *Rev Soc Bras Med Trop*. 2008;41:269-76.
11. Silva AM, Camargo NJ, Santos DR, Massafera R, Ferreira AC, Posta C, et al. Diversidade, distribuição e abundância de flebotomíneos (Diptera: Psychodidae) no Paraná. *Neotrop Entomol*. 2008;37:209-25.
12. Teodoro U, Santos DR, Santos AR, Oliveira O, Poiani LP, Silva AM, et al. Informações preliminares sobre flebotomíneos do norte do Paraná. *Rev Saúde Pública*. 2006;40:327-30.
13. Teodoro U, Santos DR, Santos AR, Oliveira O, Santos ES, Neitzke HC, et al. Avaliação de medidas de controle de flebotomíneos no Município de Lobato, Estado do Paraná, Sul do Brasil. *Cad Saúde Pública*. 2006;22:451-5.
14. World Health Organization. Leishmaniasis: magnitude of the problem. [cited 2008 Nov 08]. Available from: <http://www.who.int/leishmaniasis/burden/magnitude>

Received: 15 August 2012

Accepted: 15 April 2013