Regional Distribution and Habitats of Brazilian Phlebotomine Species

Gustavo M. de Aguiar and Vanessa R. Vieira

Research on phlebotomine sand-fly fauna (Diptera, Phlebotominae) has been related to the diagnosis of diseases or the identification of their vectors involved in the transmission of pathogens to humans and other animals in certain regions. It is considered that, under natural conditions, these insects are distributed in stable and balanced communities with the variables of the ecosystem as a whole. Thus, it is assumed that the emergence of many epidemic species is directly linked to problems of human ecology caused by the accidental or planned inhabitation of humans into regions where the transmitters are still unknown.

Many studies on the geographic distribution of American sand flies have been published, especially in the last three decades when research on this important group of insects increased. Most studies, however, were limited to locations where these insects had been recorded. Barretto and Pessoa (1946) were the pioneers of systematization studies, and Martins and Morales-Farias (1972), Martins et al. (1978), Young and Duncan (1994), and Shimabukuro et al. (2017) carried out conclusive studies on American sand flies.

A proposal for the classification of Phlebotominae was presented by Galati (2003) who used the cladistics method in her study of American sand flies. Galati reclassified New World sand flies into 22 genera.

From >1000 species of sand flies described worldwide, approximately 10% are involved in the transmission of diseases to human and other mammals and are therefore considered potential vectors of etiological agents of leishmaniasis, arboviruses, and Bartonellosis (Rangel and Lainson 2009). From this proportion, 60% occur in the neotropical region. In Brazil, 279 species have been described so far, accounting for 31% of all species known to occur worldwide.

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Twenty-nine species occur in 5 Brazilian regions: North (N), Northeast (NE), Central West (CW), Southeast (SE), and South (S) and therefore are widely distributed.

Species Found in the Five Regions of Brazil

Species	Regions
Brumptomyia avellari (Costa Lima, 1932)	N, NE, CW, SE, S
Br. brumpti (Larrousse, 1920)	N, NE, CW, SE, S
Br. cunhai (Mangabeira, 1942a)	N, NE, CW, SE, S
Br. pintoi (Costa Lima, 1932)	N, NE, CW, SE, S
Evandromyia bacula (Martins, Falcão & Silva, 1965)	N, NE. CW, SE, S
Ev. cortelezzii (Brèthes, 1923)	N, NE, CW, SE, S
Ev. evandroi (Costa Lima & Antunes, 1936)	N, NE, CW, SE, S
Ev. lenti (Mangabeira, 1938)	N, NE, CW, SE, S
Ev. sallesi (Galvão & Coutinho, 1939)	N, NE, CW, SE, S
Lutzomyia longipalpis (Lutz & Neiva, 1912)	N, NE, CW, SE, S
Micropygomyia longipennis (Barretto, 1946)	N, NE, CW, SE, S
Mi. micropyga (Mangabeira, 1942a)	N, NE, CW, SE, S
Mi. oswaldoi (Mangabeira, 1942e)	N, NE, CW, SE, S
Mi. quinquefer (Dyar, 1929)	N, NE, CW, SE, S
Migonomyia migonei (França, 1920)	N, NE, CW, SE, S
Nyssomyia intermedia (Lutz & Neiva, 1912)	N, NE, CW, SE, S
Ny. whitmani (Antunes & Coutinho, 1939)	N, NE, CW, SE, S
Pintomyia christenseni (Young & Duncan, 1994)	N, NE, CW, SE, S
Pi. misionensis (Castro, 1959)	N, NE, CW, SE, S
Pi. monticola (Costa Lima, 1932)	N, NE, CW, SE, S
Psathyromyia aragaoi (Costa Lima, 1932)	N, NE, CW, SE, S
Pa. bigeniculata (Floch & Abonnenc, 1941)	N, NE, CW, SE, S
Pa. lutziana (Costa Lima, 1932)	N, NE, CW, SE, S
Pa. punctigeniculata (Floch & Abonnenc, 1944)	N, NE, CW, SE, S
Psychodopygus ayrozai (Barretto & Coutinho, 1940)	N, NE, CW, SE, S
Ps. geniculatus (Mangabeira, 1941c)	N, NE, CW, SE, S
Ps. hirsutus (Mangabeira, 1942a)	N, NE, CW, SE, S
Sciopemyia microps (Mangabeira, 1942a)	N, NE, CW, SE, S
Sc. sordellii (Shannon & Del Ponte, 1927)	N, NE, CW, SE, S

Another 37 species are also widely distributed and occur in four regions: the CW (36 species), the NE (35 species), the SE (34 species), the N (32 species), and the S (10 species).

Species Found in Four Regions of Brazil

Species	Regions
Bichromomyia flaviscutellata (Mangabeira, 1942a)	N, NE, CW, SE
Brumptomyia mangabeirai (Barretto & Coutinho, 1941a)	N, CW, SE, S
Br. nitzulescui (Costa Lima, 1932)	NE, CW, SE, S
Evandromyia bourrouli (Barretto & Coutinho, 1941b)	N, NE,CW, SE
Ev. carmelinoi (Ryan, Fraiha, Lainson & Shaw, 1986)	N, NE, CW, SE
Ev. corumbaensis (Galati, Nunes, Oshiro & Rego, 1989)	N, NE, CW, SE
Ev. infraspinosa (Mangabeira, 1941b)	N, NE, CW, SE
Ev. sericea (Floch & Abonnenc, 1944)	N, NE, CW, SE
Ev. teratodes (Martins, Falcão & Silva, 1964)	N, NE, CW, SE
Ev. termitophila (Martins, Falcão & Silva, 1964)	N, NE, CW, SE
Ev. walkeri (Newstead, 1914)	N, NE, CW, SE
Martinsmyia oliveirai (Martins, Silva & Falcão, 1970a)	N, NE, CW, SE
Micropygomyia peresi (Mangabeira, 1942a)	N, NE, CW, SE
Mi. trinidadensis (Newstead, 1922)	N, NE, CW, SE
Mi. villelai (Mangabeira, 1942)	N, NE, CW, SE
Migonemyia bursiformis (Floch & Abonnenc, 1944)	N, NE, CW, SE
Nyssomyia fraihai (Martins, Falcão & Silva, 1979)	N, NE, CW, SE
Ny. neivai (Pinto, 1926)	N, CW, SE, S
Ny. umbratilis (Ward & Fraiha, 1977)	N, NE, CW, S
Pintomyia damascenoi (Mangabeira, 1941d)	N, NE, CW, SE
Pi. fischeri (Pinto, 1926)	NE, CW, SE, S
Pi. pessoai (Coutinho & Barretto, 1940)	NE, CW, SE, S
Pi. serrana (Damasceno & Arouck, 1949)	N, NE, CW, SE
Pressatia choti (Floch & Abonnenc, 1941)	N, NE, CW, SE
Psathyromyia abonnenci (Floch & Chassignet, 1947)	N, NE, CW, S
Pa. barrettoi barrettoi (Mangabeira, 1942a)	N, NE, CW, SE
Pa. brasiliensis (Costa Lima, 1932)	N, NE, CW, SE
Pa. dendrophyla (Mangabeira, 1942a)	N, NE, CW, SE
Pa. hermanlenti (Martins, Silva & Falcão, 1970)	N, NE, CW, SE
Pa. lanei (Barretto & Coutinho, 1941)	NE, CW, SE, S
Pa. pascalei (Coutinho & Barretto, 1941c)	N, NE, SE, S
Psychodopygus carrerai (Barretto, 1946)	N, NE, CW, SE
Ps. davisi (Root, 1934)	N, NE, CW, SE
Ps. lloydi (Antunes, 1937)	NE, SE, CW, S
Ps. paraensis (Costa Lima, 1941)	N, NE, CW, SE
Trichophoromyia ubiquitalis (Mangabeira, 1942a)	N, NE, CW, SE
Tr. longispina (Mangabeira, 1942d)	N, NE, CW, SE

In 3 regions there are 41 species, mainly in the CW (35 species), the N (34 species), the NE (31), the SE (16 species), and the S (6 species).

Species Found in Three Regions of Brazil

Species	Regions
Bichromomyia olmeca nociva (Young & Arias, 1982)	N, NE, CW
Brumptomyia galindoi (Fairchild & Hertig, 1947)	CW, SE, S
Br. ortizi Martins, Silva & Falcão, 1971b	N, SE, S
Br. travassosi (Mangabeira, 1942g)	N, NE, SE
Evandromyia edwardsi (Mangabeira, 1941b)	NE, SE, S
Ev. monstruosa (Floch & Abonnenc, 1944)	N, NE, CW
Ev. pinottii (Damasceno & Arouck, 1956)	N, NE, CW
Ev. saulensis (Floch & Abonnenc, 1944)	N, NE, CW
Ev. wilsoni (Damasceno & Causey, 1945)	N, NE, CW
Expapillata cerradincola (Galati, Nunes, Oshiro & Dorval, 1995)	N, CW, SE
Lutzomyia cavernicola (Costa Lima, 1932)	N, CW, SE
Lu. cruzi (Mangabeira, 1938)	NE, CW, SE
Lu. dispar Martins & Silva , 1963	NE, CW, SE
Lu. gomezi (Nitzulescu, 1931)	N, NE, CW
Lu. renei (Martins, Falcão & Silva, 1957)	N, CW, SE
Lu. spathotrichia Martins, Falcão & Silva, 1963	N, NE, CW
Micropygomyia acanthopharynx (Martins, Falcão & Silva, 1962)	N, CW, SE
Mi. ferreirana (Barretto, Martins & Pellegrino, 1956)	CW, SE, S
Mi. pusilla (Dias, Martins, Falcão & Silva, 1986)	N, NE, CW
Mi. schreiberi (Martins, Falcão & Silva, 1955)	NE, SE, S
Mi. vonatzingeni Galati, 2007	N, CW, SE
Nyssomyia anduzei (Rozeboom, 1942)	N, NE, CW
Ny. antunesi (Coutinho, 1939)	N, NE, CW
Ny. richardwardi (Ready & Fraiha, 1981)	N, NE, CW
Pintomyia nevesi (Damasceno & Arouck, 1956)	N, NE, CW
Pressatia triacantha (Mangabeira, 1942c)	N, NE, CW
Pr. trispinosa (Mangabeira, 1942a)	N, NE, SE
Psathyromyia pelloni (Sherlock & Alencar, 1959)	NE, SE, S
Pa. runoides (Fairchild & Hertig, 1953)	N, CW, SE
Pa. scaffi (Damasceno & Arouck, 1956)	N, NE, CW
Psychodopygus amazonensis (Root, 1934)	N, NE, CW
Ps. bispinosus (Fairchild & Hertig, 1951)	N, NE, CW
Ps. chagasi (Costa Lima, 1941)	N, NE, CW
Ps. claustrei (Abonnenc, Léger & Fauran, 1979)	N, NE, CW
Ps. complexus (Mangabeira, 1941c)	N, NE, CW
Ps. guyanensis (Floch & Abonnenc, 1941)	N, CW, SE
Ps. squamiventris squamiventris (Lutz & Neiva, 1912)	N, NE, CW
Ps. wellcomei (Fraiha, Shaw & Lainson, 1971)	N, NE, CW
Sciopemyia servulolimai (Damasceno & Causey, 1945)	N, NE, CW
Viannamyia furcata (Mangabeira, 1941d)	N, NE, CW
Vi. tuberculata (Mangabeira, 1941d)	N, NE, CW

In 2 regions 66 species are listed. The N is more represented (45 species) followed by the CW (33 species), the SE 23 species), the NE (22 species), and the S (9 species).

Species Found in Two Regions of Brazil

Species	Regions
Bichromomyia inornata (Martins, Falcão & Silva, 1965)	N, NE
Bi. olmeca bicolor (Fairchild & Theodor, 1971)	N, CW
Brumptomyia bragai (Mangabeira & Sherlock, 1961)	NE, SE
Br. cardosoi (Barretto & Coutinho, 1941a)	SE, S
Br. figueiredoi Mangabeira & Sherlock, 1961	NE, SE
Br. guimaraesi (Coutinho & Barretto, 1941a)	SE, S
Br. pentacantha (Barretto, 1947)	N, CW
Br. troglodytes (Lutz, 1922)	SE, S
Br. virgensi Mangabeira & Sherlock, 1961	NE, CW
Deanemyia samueli (Deane, 1955)	N, NE
Edentomyia piauienses Galati, Andrade-Filho, Silva & Falcão, 2003	N, NE
Evandromyia andersoni (Le Point & Desjeux, 1988)	N, CW
Ev. begonae (Ortiz & Torres, 1975)	N, CW
Ev. brachyphalla (Mangabeira Fo, 1994)	N, NE
Ev. correalimai (Martins, Coutinho & Luz, 1970)	SE, S
Ev. costalimai (Mangabeira, 1942a)	NE, SE
Ev. dubitans (Sherlock, 1962)	N, CW
Ev. tupynambai (Mangabeira, 1942a)	NE, SE
Expapillata firmatoi (Barretto, Martins & Pellegrino, 1956)	SE, S
Lutzomyia almerioi Galati & Nunes, 1999	CW, SE
Lu. amarali Barretto & Coutinho, 1940	SE, S
Lu. carvalhoi (Damasceno, Causey & Arouck, 1945)	N, NE
Lu. evangelistai Martins & Fraiha, 1971	N, CW
Lu. falcata Young, Morales & Ferro, 1994	N, CW
Lu. flabellata Martins & Silva, 1964	N, CW
Lu. ischnacantha Martins, Souza & Falcão, 1962a	CW, SE
Lu. lichyi (Floch & Abonnenc, 1950)	N, CW
Lu. marinkellei Young, 1979	N, CW
Lu. sherlocki Martins, Silva & Falcão, 1971a	N, CW
Martinsmyia alphabetica (Fonseca, 1936)	SE, S
Mt. gasparviannai (Martins, Godoy & Silva ,1962b)	NE, SE
Mt. minasensis (Mangabeira, 1942a)	N, SE
Micropygomyia capixaba (Dias, Falcão, Silva & Martins, 1987)	NE, SE
Mi. echinatopharynx Andrade Filho, Galati, Andrade & Falcão, 2004	N, CW
Mi. pilosa (Damasceno & Causey, 1944)	N, NE

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Species	Regions
Mi. rorotaensis (Floch & Abonnenc, 1944)	N, NE
Mi. zikani (Barretto, 1950a)	N, SE
Migonomyia cerqueirai (Causey & Damasceno, 1945)	N, NE
Nyssomyia shawi (Fraiha, Ward & Ready, 1973)	N, CW
Ny. urbinattii Galati & Galvis, 2012	N, CW
Pintomyia bianchigalatiae (Andrade Filho, Aguiar, Dias & Falcão, 1999)	SE, S
Pi. mamedei (Oliveira, Afonso, Dias & Brazil, 1994)	CW, SE
Pi. odax (Fairchild & Hertig, 1961)	N, NE
Pi. pacae (Floch & Abonnenc, 1943)	N, NE
Pressatia equatorialis (Mangabeira, 1942a)	N, SE
Psathyromyia campbelli (Damasceno, Causey & Arouck, 1945)	N, CW
Pa. campograndensis (Oliveira, Andrade Filho, Falcão & Brazil, 2001)	N, CW
Pa. coutinhoi (Mangabeira, 1942a)	N, CW
Pa. dasymera (Fairchild & Hertig, 1961)	N, CW
Pa. dreisbachi (Causey & Damasceno, 1945)	N, CW
Pa. inflata (Floch & Abonnenc, 1944)	N, CW
Pa. limai (Fonseca, 1935)	SE, S
Pa. pradobarrientosi (Le Pont, Matias, Martinez & Dujardin, 2004)	N, CW
Psychodopygus arthuri (Fonseca, 1936)	NE, SE
Ps. corossoniensis (Le Pont & Pajot, 1978)	N, NE
Ps. lainsoni (Fraiha & Ward, 1964)	N, CW
Ps. llanosmartinsi (Fraiha & Ward, 1980)	N, CW
Ps. matosi (Barretto & Zago, 1956)	NE, SE
Sciopemyia fluviatilis (Floch & Abonnenc, 1944)	N, NE
Trichophoromyia auraensis (Mangabeira, 1942a)	N, CW
Th. clitella (Young & Perez, 1994)	N, CW
Th. octavioi (Vargas, 1949)	N, CW
Th. ruii (Arias & Young, 1982)	N, CW
Trichopygomyia dasypodogeton (Castro, 1939)	N, CW
Ty. rondonensis (Martins, Falcão & Silva, 1965)	N, CW
Ty. trichopyga (Floch & Abonnenc, 1945)	N, NE

In 1 region, 106 species were found: 64 species in the N, 23 species in the SE, 11 species in the CW, 5 species in the NE, and 3 species in the S.

Species Found in One Region of Brazil

Species	Regions
Bichromomyia reducta (Feliciangeli, Ramirez Pérez & Ramirez, 1988)	N
Brumptomyia angelae Galati, Santos & Silva, 2007	S
Br. carvalheiroi Shimabukuro, Marassa & Galati 2007	SE
Br. orlandoi Fraiha, Shaw & Lainson, 1970	CW
Br. spinosipes Floch & Abonnenc, 1943	N
De. appendiculata (Martins, Falcão & Silva, 1961)	SE
De. derelicta (Freitas & Barrett, 1999)	N
De. maruaga (Alves, Freitas & Barret, 2008)	N
De. ramirezi (Martins, Falcão, Silva & Miranda, 1982)	SE
Evandromyia aldafalcaoae (Santos, Andrade Filho & Honer, 2001)	CW
Ev. apurinan Shimabukuro, Figueira & Silva, 2013	N
Ev. bahiensis (Mangabeira & Sherlock, 1961)	NE
Ev. callipyga (Martins & Silva, 1965)	SE
Ev. gaucha Andrade Filho, Souza & Falcão, 2007	S
Ev. georgii (Freitas & Barrett, 2002)	N
Ev. grimaldii Andrade Filho, Pinto, Santos & Carvalho, 2009	SE
Ev. inpai (Young & Arias, 1977)	N
Ev. orcyi Oliveira, Sanguinette, Almeida & Andrade Filho, 2015	CW
Ev. petropolitana (Martins & Silva, 1968)	SE
Ev. rupicola (Martins, Godoy & Silva, 1962)	SE
Ev. sipani (Fernandez, Carbajal, Alexander & Need, 1994)	N
Ev. spelunca Carvalho, Brazil, Sanguinette & Andrade Filho, 2011	SE
Ev. tarapacaensis (Le Pont, Torres-Espejo & Galati, 1996)	N
Ev. tylophalla Andrade & Galati, 2012	SE
Ev. williamsi (Damasceno, Causey & Arouck, 1945)	N
Lutzomyia alencari Martins, Souza & Falcão, 1962	SE
Lu. araracuarensis (Morales & Minter, 1981)	N
Lu. caligata Martins, Falcão & Silva, 1965	N
Lu. castroi (Barretto & Coutinho, 1941c)	SE
Lu. cruciata (Coquillett, 1907)	CW
Lu. cultellata Barrett, Feitas, Albuquerque & Guerrero, 1996	N
Lu. elizabethrangelae Vilela, Azevedo e Godoy, 2015	N
Lu. falquetoi Pinto & Santos, 2007	SE
Lu. forattinii Galati, Rego, Nunes & Teruya, 1985	CW
Lu. gaminarai (Cordero, Vogelsang & Cossio, 1928)	S
Lu. ischyracantha Martins, Falcão & Silva, 1962b	SE
Lu. souzalopesi Martins, Silva & Falcão, 1970b	SE
Martinsmyia brisolai (Le Pont & Desjeux, 1987)	CW
Mt. cipoensis (Martins, Falcão & Silva, 1964)	SE
Mt. reginae Carvalho, Brazil, Sanguinette & Andrade Filho, 2010	N
Mt. waltoni (Arias, Freitas & Barret, 1984)	N

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Species	Regions
Micropygomyia breviducta (Barretto, 1950)	SE
Mi. cayennensis (Floch & Abonnenc, 1941)	N
Mi. chassigneti (Floch & Abonnenc, 1944)	N
Mi. mangabeirana (Martins, Falcão & Silva, 1963)	N
Mi. petari Galati, Marassá & Andrade, 2003	SE
Migonomyia moucheti (Pajot & Le Pont, 1923)	N
Mg. rabelloi (Galati & Gomes, 1992)	SE
Mg. vaniae Galati, Fonseca & Marassá, 2007	SE
Ny. delsionatali Galati & Galvis, 2012	CW
Ny. pajoti (Abonnenc, Léger & Fauran, 1979)	N
Ny. singularis (Costa Lima, 1932)	SE
Ny. sylvicola (Floch & Abonnenc, 1944)	N
Pi. gruta (Ryan, 1986)	N
Pi. kuscheli (Le Pont, Martinez, Torrez-Espejo, Dujardin, 1998)	CW
Pi. naiffi (Freitas & Oliveira, 2013)	N
Pi. orestes (Fairchild & Trapido, 1950)	NE
Pr. calcarata (Martins & Silva, 1964)	N
*Pr. duncanae (*Le Pont, Martinez, Torrez-Espejo & Dujardin, 1998)	N
Pr. dysponeta (Fairchild & Hertig, 1952)	CW
Pa. abunaensis (Martins, Falcão & Silva, 1965)	N
Pa. baratai Sábio, Andrade & Galati, 2016	SE
Pa. barretti Alves & Freitas, 2015	N
Pa. digitata (Damasceno & Arouck, 1950)	NE
Pa. elizabethdorvalae Brilhante, Sábio & Galati, 2017	N
Pa. naftalekatzi (Falcão, Andrade Filho, Almeida, Brandão-Filho, 2000)	NE
Pa. pifanoi (Ortiz, 1972)	N
Pa. ribeirensis Sábio, Andrade & Galati, 2014	SE
Pa. souzacastroi (Damasceno & Causey, 1944)	N
Ps. bernalei (Osorno-Mesa, Morales & Osorno, 1967)	N
Ps. douradoi (Fé, Freitas & Barrett, 1998)	N
Ps. fairchildi (Barretto, 1966)	SE
Ps. leonidasdeanei (Fraiha, Ryan, Ward, Lainson & Shaw, 1987)	N
Ps. nicaraguensis (Fairchild & Hertig, 1961)	CW
Ps. panamensis (Shannon, 1926)	N
Ps. squamiventris maripaensis (Floch & Abonnenc, 1946)	N
Ps. yucumensis (Le Pont, Caillard, Tibayrenc & Desjeux, 1986)	N
Sc. nematoducta (Young & Arias, 1984)	N
Sc. pennyi (Arias & Freitas, 1981)	N
Sc. preclara (Young & Arias, 1984)	N
Th. adelsonsouzai Santos, Silva, Barata, Andrade & Galati, 2013	N
Th. brachipyga (Mangabeira, 1942a)	N
Th. castanheirai (Damasceno, Causey & Arouck, 1945)	N
Th. dunhami (Causey & Damasceno, 1945)	N

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Species	Regions
Th. eurypyga (Martins, Falcão & Silva, 1963)	N
Th. flochi (Abonnenc & Chassignet, 1948)	N
Th. gibba (Young & Arias, 1994)	N
Th. howardi (Young, 1979)	CW
Th. ininii (Floch & Abonnenc, 1943)	N
Th. lopesi (Damasceno, Causey & Arouck, 1945)	N
Th. loretoensis (Llanos, 1964)	N
Th. meirai (Causey & Damasceno, 1945)	N
Th. melloi (Causey & Damasceno, 1945)	N
Th. readyi (Ryan, 1986)	N
Th. reinerti (Young & Duncan, 1994)	N
Th. rostrans (Summers, 1912)	N
Th. ruifreitasi Oliveira, Teles, Medeiros, Camargo & Pessoa, 2015	N
Th. uniniensis Ladeia-Andrade, Fé, Sanguinette & Andrade Filho, 2014	N
Th. viannamartinsi (Sherlock & Guitton, 1970)	NE
Ty. conviti (Ramírez, Pérez, Martins & Ramírez, 1976)	N
Ty. elegans (Martins, Llanos & Silva, 1976)	N
Ty. pinna (Feliciangeli, Ramirez Pérez & Ramirez, 1989)	N
Ty. ratcliffei (Arias, Ready & Freitas, 1983)	N
Ty. wagleyi (Causey & Damasceno, 1945)	N
Vi. caprina (Osorno-Mesa, Morales e Osorno, 1972)	N
Vi. fariasi (Damasceno, Causey & Arouck, 1945)	N

The N has 204 species, of which 64 are endemic; the CW has 144 species, and 11 are endemic; the SE has 125 species, with 23 of them being endemic; the NE has 122 species, and 5 are endemic; and the S has 57 species, and 3 of them are endemic.

Brazilian sand flies are listed in Table 1 by region and state. The states with the greatest number of species (in parentheses) are listed by region as follows: N: Amazonas (141), Pará (135), Rondônia (125), Acre (95), Roraima (83), Tocantins (73), and Amapá (70); NE: Maranhão (92), Bahia (60), Pernambuco (41), Ceará (28), Piauí (22), Rio Grande do Norte (17), Paraíba (10), Alagoas (9), and Sergipe (7); CW: Mato Grosso (127), Mato Grosso do Sul (65), Goiás (56), and Distrito Federal (31); SE: Minas Gerais (96), São Paulo (77), Rio de Janeiro (65), and Espírito Santo (64); and S: Paraná (54), Rio Grande do Sul (23), and Santa Catarina (17).

Locally distributed species are those known to occupy very restricted areas, sometimes only the type locality. As research progresses, the situation tends to change with the expansion of the area of dispersion. For example, *Lu. cavernicola*, which for several years was restricted to the type locality, a cave of Maquiné in the state of Minas Gerais, was recently captured in other localities of Minas Gerais, Goiás, and the state of Tocantins. However, it was always found in calcareous caves.

Discontinuously distributed species are those recorded in places very distant from each other. For example, *Pa. runoides* occurs in Panamá and Costa Rica

Table 1 Brazilian phlebotomine species by region and state

Region	State	Species	
N	Acre	*Bi. flaviscutellata*	*Pr. calcarata*
		Bi. olmeca bicolor	*Pr. choti*
		Bi. reducta	*Pr. duncanae*
		Br. avellari	*Pr. triacantha*
		Br. pentacantha	*Pa. abonnenci*
		Ev. andersoni	*Pa. abunaensis*
		Ev. bacula	*Pa. aragaoi*
		Ev. begonae	*Pa. bigeniculata*
		Ev. bourrouli	*Pa. brasiliensis*
		Ev. cortelezzii	*Pa. campbelli*
		Ev. evandroi	*Pa. dendrophyla*
		Ev. georgii	*Pa. dreisbachi*
		Ev. infraspinosa	*Pa. elizabethdorvalae*
		Ev. monstruosa	*Pa. lutziana*
		Ev. sallesi	*Pa. pradobarrientosi*
		Ev. saulensis	*Pa. punctigeniculata*
		Ev. sericea	*Pa. runoides*
		Ev. tarapacaensis	*Pa. scaffi*
		Ev. termitophila	*Ps. amazonensis*
		Ev. walkeri	*Ps. ayrozai*
		Ev. williamsi	*Ps. bispinosus*
		Ev. wilsoni	*Ps. carrerai*
		Lu. flabellata	*Ps. chagasi*
		Lu. gomezi	*Ps. corossoniensis*
		Lu. sherlocki	*Ps. davisi*
		Mi. acanthopharynx	*Ps. geniculatus*
		Mi. longipennis	*Ps. guyanensis*
		Mi. micropyga	*Ps. hirsutus*
		Mi. peresi	*Ps. lainsoni*
		Mi. pilosa	*Ps. llanosmartinsi*
		Mi. pusilla	*Ps. paraensis*
		Mi. trinidadensis	*Ps. yucumensis*
		Mi. villelai	*Sc. fluviatilis*
		Mg. migonei	*Sc. preclara*
		Ny. anduzei	*Sc. servulolimai*
		Ny. antunesi	*Sc. sordellii*
		Ny. fraihai	*Th. auraensis*
		Ny. richardwardi	*Th. brachipyga*
		Ny. shawi	*Th. flochi*
		Ny. sylvicola	*Th. ininii*
		Ny. umbratilis	*Th. melloi*
		Ny. whitmani	*Th. ruifreitasi*

(continued)

Table 1 (continued)

Region	State	Species	
		Pi. christenseni	*Th. ubiquitalis*
		Pi. damascenoi	*Ty. dasypodogeton*
		Pi. naiffi	*Ty. elegans*
		Pi. nevesi	*Vi. furcata*
		Pi. odax	*Vi. tuberculata*
		Pi. serrana	
	Amapá	*Bi. flaviscutellata*	*Ev. saulensis*
		Br. cunhai	*Ev. sericea*
		Br. travassosi	*Ev. walkeri*
		Ev. bourrouli	*Ev. williamsi*
		Ev. brachyphalla	*Lu. carvalhoi*
		Ev. evandroi	*Lu. evangelistai*
		Ev. infraspinosa	*Lu. gomezi*
		Ev. inpai	*Lu. longipalpis*
		Ev. monstruosa	*Lu. spathotrichia*
N	Amapá	*Mi. chassigneti*	*Pa. campograndensis*
		Mi. longipennis	*Pa. dendrophyla*
		Mi. micropyga	*Pa. dreisbachi*
		Mi. oswaldoi	*Pa. inflata*
		Mi. pilosa	*Pa. lutziana*
		Mi. pusilla	*Pa. scaffi*
		Mi. rorotaensis	*Ps. amazonensis*
		Mi. trinidadensis	*Ps. ayrozai*
		Mg. migonei	*Ps. bispinosus*
		Ny. anduzei	*Ps. chagasi*
		Ny. antunesi	*Ps. claustrei*
		Ny. fraihai	*Ps. davisi*
		Ny. pajoti	*Ps. geniculatus*
		Ny. richardwardi	*Ps. guyanensis*
		Ny. umbratilis	*Ps. hirsutus*
		Ny. whitmani	*Ps. paraensis*
		Pi. christenseni	*Ps. squamiventris maripaensis*
		Pi. damascenoi	*Ps. squamiventris squamiventris*
		Pi. pacae	*Sc. fluviatilis*
		Pi. serrana	*Sc. sordellii*
		Pr. choti	*Th. brachipyga*
		Pr. trispinosa	*Th. ininii*
		Pa. abonnenci	*Th. ubiquitalis*
		Pa. aragaoi	*Ty. trichopyga*
		Pa. bigeniculata	*Vi. furcata*
		Pa. campbelli	*Vi. tuberculata*

(continued)

Table 1 (continued)

Region	State	Species	
	Amazonas	*Bi. flaviscutellata*	*Mi. peresi*
		Bi. inornata	*Mi. pilosa*
		Bi. olmeca bicolor	*Mi. pusilla*
		Bi. olmeca nociva	*Mi. rorotaensis*
		Bi. reducta	*Mi. trinidadensis*
		Br. brumpti	*Mg. bursiformis*
		Br. pentacantha	*Mg. cerqueirai*
		Br. pintoi	*Mg. migonei*
		De. maruaga	*Mg. moucheti*
		Ev. andersoni	*Ny. anduzei*
		Ev. apurinan	*Ny. antunesi*
		Ev. bacula	*Ny. fraihai*
		Ev. begonae	*Ny. pajoti*
		Ev. bourrouli	*Ny. richardwardi*
		Ev. dubitans	*Ny. shawi*
		Ev. evandroi	*Ny. umbratilis*
		Ev. georgii	*Ny. whitmani*
		Ev. infraspinosa	*Pi. christenseni*
		Ev. inpai	*Pi. damascenoi*
		Ev. monstruosa	*Pi. pacae*
		Ev. pinottii	*Pi. serrana*
		Ev. saulensis	*Pr. choti*
		Ev. sericea	*Pr. triacantha*
		Ev. sipani	*Pr. trispinosa*
		Ev. tarapacaensis	*Pa. abonnenci*
		Ev. walkeri	*Pa. abunaensis*
		Ev. williamsi	*Pa. aragaoi*
		Ev. wilsoni	*Pa. barretti*
		Lu. araracuarensis	*Pa. barrettoi barrettoi*
		Lu. caligata	*Pa. bigeniculata*
		Lu. cultellata	*Pa. brasiliensis*
		Lu. evangelistai	*Pa. campbelli*
		Lu. falcata	*Pa. campograndensis*
		Lu. flabellata	*Pa. coutinhoi*
		Lu. gomezi	*Pa. dasymera*
		Lu. marinkellei	*Pa. dendrophyla*
		Lu. sherlocki	*Pa. dreisbachi*
		Lu. spathotrichia	*Pa. inflata*
		Mt. oliveirai	*Pa. lutziana*
		Mi. cayennensis cayennensis	*Pa. pifanoi*
		Mi. chassigneti	*Pa. punctigeniculata*
		Mi. longipennis	*Pa. runoides*

(continued)

Table 1 (continued)

Region	State	Species	
		Mi. micropyga	*Pa. scaffi*
N	Amazonas	*Pa. souzacastroi*	*Th. castanheirai*
		Ps. amazonensis	*Th. dunhami*
		Ps. ayrozai	*Th. eurypyga*
		Ps. bernalei	*Th. flochi*
		Ps. bispinosus	*Th. gibba*
		Ps. carrerai	*Th. ininii*
		Ps. chagasi	*Th. lopesi*
		Ps. claustrei	*Th. meirai*
		Ps. complexus	*Th. melloi*
		Ps. corossoniensis	*Th. octavioi*
		Ps. davisi	*Th. readyi*
		Ps. douradoi	*Th. rostrans*
		Ps. geniculatus	*Th. ruii*
		Ps. guyanensis	*Th. ubiquitalis*
		Ps. hirsutus	*Th. uniniensis*
		Ps. llanosmartinsi	*Ty. conviti*
		Ps. paraensis	*Ty. dasypodogeton*
		Ps. squamiventris maripaensis	*Ty. longispina*
		Ps. squamiventris squamiventris	*Ty. pinna*
		Ps. wellcomei	*Ty. ratcliffei*
		Sc. fluviatilis	*Ty. rondonensis*
		Sc. nematoducta	*Ty. trichopyga*
		Sc. pennyi	*Ty. wagleyi*
		Sc. preclara	*Vi. caprina*
		Sc. servulolimai	*Vi. fariasi*
		Sc. sordellii	*Vi. furcata*
		Th. auraensis	*Vi. tuberculata*
		Th. brachipyga	
	Pará	*Bi. flaviscutellata*	*Mi. cayennensis cayennensis*
		Bi. olmeca bicolor	*Mi. longipennis*
		Bi. olmeca nociva	*Mi. mangabeirana*
		Br. avellari	*Mi. micropyga*
		Br. brumpti	*Mi. oswaldoi*
		Br. cunhai	*Mi. peresi*
		Br. mangabeirai	*Mi. pilosa*
		Br. ortizi	*Mi. pusilla*
		Br. pentacantha	*Mi. rorotaensis*
		Br. pintoi	*Mi. trinidadensis*
		Br. spinosipes	*Mi. villelai*

(continued)

Table 1 (continued)

Region	State	Species	
		Br. travassosi	*Mi. vonatzingeni*
		De. derelicta	*Mi. zikani*
		De. samueli	*Mg. bursiformis*
		Ed. piauienses	*Mg. cerqueirai*
		Ev. baculaa	*Mg. migonei*
		Ev. begonae	*Ny. anduzei*
		Ev. bourrouli	*Ny. antunesi*
		Ev. brachyphalla	*Ny. intermedia*
		Ev. carmelinoi	*Ny. fraihai*
		Ev. dubitans	*Ny. neivai*
		Ev. evandroi	*Ny. pajoti*
		Ev. georgii	*Ny. richardwardi*
		Ev. infraspinosa	*Ny. shawi*
		Ev. inpai	*Ny. sylvicola*
		Ev. lenti	*Ny. umbratilis*
		Ev. monstruosa	*Ny. urbinattii*
		Ev. pinottii	*Ny. whitmani*
		Ev. saulensis	*Pi. christenseni*
		Ev. sericea	*Pi. damascenoi*
		Ev. tarapacaensis	*Pi. gruta*
		Ev. termitophila	*Pi. monticola*
		Ev. walkeri	*Pi. nevesi*
		Ev. williamsi	*Pi. pacae*
		Lu. carvalhoi	*Pi. serrana*
		Lu. evangelistai	*Pr. choti*
		Lu. gomezi	*Pr. equatorialis*
		Lu. longipalpis	*Pr. triacantha*
		Lu. sherlocki	*Pr. trispinosa*
		Lu. spathotrichia	*Pa. abonnenci*
		Mt. oliveirai	*Pa. aragaoi*
N	Pará	*Pa. barrettoi barrettoi*	*Ps. paraensis*
		Pa. bigeniculata	*Ps. squamiventris maripaensis*
		Pa. brasiliensis	*Ps. squamiventris squamiventris*
		Pa. campbelli	*Ps. wellcomei*
		Pa. coutinhoi	*Sc. fluviatilis*
		Pa. dendrophyla	*Sc. microps*
		Pa. dreisbachi	*Sc. servulolimai*
		Pa. hermanlenti	*Sc. sordellii*
		Pa. inflata	*Th. adelsonsouzai*
		Pa. lutziana	*Th. auraensis*
		Pa. pifanoi	*Th. brachipyga*

(continued)

Table 1 (continued)

Region	State	Species	
		Pa. punctigeniculata	*Th. castanheirai*
		Pa. scaffi	*Th. eurypyga*
		Ps. amazonensis	*Th. melloi*
		Ps. ayrozai	*Th. octavioi*
		Ps. bispinosus	*Th. readyi*
		Ps. carrerai	*Th. reinerti*
		Ps. chagasi	*Th. ruii*
		Ps. claustrei	*Th. ubiquitalis*
		Ps. complexus	*Ty. dasypodogeton*
		Ps. corossoniensis	*Ty. longispina*
		Ps. davisi	*Ty. rondonensis*
		Ps. geniculatus	*Ty. trichopyga*
		Ps. guyanensis	*Vi. fariasi*
		Ps. hirsutus	*Vi. furcata*
		Ps. lainsoni	*Vi. tuberculata*
		Ps. leonidasdeanei	
	Rondônia	*Bi. flaviscutellata*	*Mi. oswaldoi*
		Bi. inornata	*Mi. peresi*
		Bi. olmeca nociva	*Mi. pilosa*
		Bi. reducta	*Mi. pusilla*
		Br. avellari	*Mi. rorotaensis*
		Br. brumpti	*Mi. trinidadensis*
		Br. cunhai	*Mi. villelai*
		Br. pentacantha	*Mg. cerqueirai*
		Br. pintoi	*Mg. migonei*
		Br. travassosi	*Ny. anduzei*
		Ev. bacula	*Ny. antunesi*
		Ev. begonae	*Ny. fraihai*
		Ev. bourrouli	*Ny. pajoti*
		Ev. brachyphalla	*Ny. richardwardi*
		Ev. evandroi	*Ny. shawi*
		Ev. georgii	*Ny. umbratilis*
		Ev. infraspinosa	*Ny. whitmani*
		Ev. inpai	*Pi. christenseni*
		Ev. lenti	*Pi. damascenoi*
		Ev. monstruosa	*Pi. gruta*
		Ev. pinottii	*Pi. nevesi*
		Ev. saulensis	*Pi. odax*
		Ev. sericea	*Pi. pacae*
		Ev. tarapacaensis	*Pi. serrana*
		Ev. termitophila	*Pr. calcarata*
		Ev. walkeri	*Pr. choti*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. williamsi	*Pr. triacantha*
		Ev. wilsoni	*Pr. trispinosa*
		Lu. caligata	*Pa. abonnenci*
		Lu. carvalhoi	*Pa. abunaensis*
		Lu. evangelistai	*Pa. aragaoi*
		Lu. flabellata	*Pa. barrettoi barrettoi*
		Lu. gomezi	*Pa. bigeniculata*
		Lu. longipalpis	*Pa. brasiliensis*
		Lu. marinkellei	*Pa. campbelli*
		Lu. sherlocki	*Pa. coutinhoi*
		Lu. spathotrichia	*Pa. dasymera*
		Mt. waltoni	*Pa. dendrophyla*
		Mi. acanthopharynx	*Pa. dreisbachi*
		Mi. cayennensis cayennensis	*Pa. inflata*
		Mi. longipennis	*Pa. lutziana*
		Mi. micropyga	*Pa. punctigeniculata*
N	Rondônia	*Pa. runoides*	*Sc. servulolimai*
		Pa. scaffi	*Sc. sordellii*
		Ps. amazonensis	*Th. auraensis*
		Ps. ayrozai	*Th. brachipyga*
		Ps. bispinosus	*Th. castanheirai*
		Ps. carrerai	*Th. clitella*
		Ps. chagasi	*Th. eurypyga*
		Ps. claustrei	*Th. flochi*
		Ps. complexus	*Th. loretoensis*
		Ps. corossoniensis	*Th. melloi*
		Ps. davisi	*Th. octavioi*
		Ps. geniculatus	*Th. readyi*
		Ps. hirsutus	*Th. ruii*
		Ps. lainsoni	*Th. ubiquitalis*
		Ps. leonidasdeanei	*Ty. dasypodogeton*
		Ps. llanosmartinsi	*Ty. longispina*
		Ps. paraensis	*Ty. rondonensis*
		Ps. squamiventris squamiventris	*Ty. trichopyga*
		Ps. wellcomei	*Vi. furcata*
		Ps. yucumensis	*Vi. tuberculata*
		Sc. fluviatilis	
	Roraima	*Bi. flaviscutellata*	*Pi. pacae*
		Bi. olmeca bicolor	*Pi. serrana*
		Br. avellari	*Pr. choti*
		Br. pintoi	*Pr. triacantha*

(continued)

Table 1 (continued)

Region	State	Species	
		Br. spinosipes	*Pr. trispinosa*
		Br. travassosi	*Pa. abonnenci*
		Ev. begonae	*Pa. aragaoi*
		Ev. carmelinoi	*Pa. barrettoi barrettoi*
		Ev. dubitans	*Pa. bigeniculata*
		Ev. evandroi	*Pa. brasiliensis*
		Ev. georgii	*Pa. campbelli*
		Ev. infraspinosa	*Pa. campograndensis*
		Ev. inpai	*Pa. dendrophyla*
		Ev. monstruosa	*Pa. dreisbachi*
		Ev. saulensis	*Pa. lutziana*
		Ev. sericea	*Pa. punctigeniculata*
		Ev. walkeri	*Pa. runoides*
		Ev. williamsi	*Pa. scaffi*
		Lu. gomezi	*Ps. amazonensis*
		Lu. lichyi	*Ps. ayrozai*
		Lu. longipalpis	*Ps. carrerai*
		Lu. sherlocki	*Ps. chagasi*
		Lu. spathotrichia	*Ps. claustrei*
		Mt. oliveirai	*Ps. davisi*
		Mt. waltoni	*Ps. hirsutus*
		Mi. cayennensis cayennensis	*Ps. panamensis*
		Mi. longipennis	*Ps. paraensis*
		Mi. mangabeirana	*Ps. squamiventris maripaensis*
		Mi. micropyga	*Ps. squamiventris squamiventris*
		Mi. peresi	*Sc. sordellii*
		Mi. pusilla	*Th. brachipyga*
		Mi. rorotaensis	*Th. eurypyga*
		Mi. trinidadensis	*Th. octavioi*
		Mg. bursiformis	*Th. ruii*
		Ny. anduzei	*Th. ubiquitalis*
		Ny. antunesi	*Ty. dasypodogeton*
		Ny. fraihai	*Ty. longispina*
		Ny. richardwardi	*Ty. pinna*
		Ny. umbratilis	*Ty. trichopyga*
		Ny. whitmani	*Vi. furcata*
		Pi. christenseni	*Vi. tuberculata*
		Pi. damascenoi	
	Tocantins	*Bi. flaviscutellata*	*Ev. brachyphalla*
		Br. avellari	*Ev. carmelinoi*
		Br. brumpti	*Ev. cortelezzii*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. bacula	*Ev. corumbaensis*
		Ev. begonae	*Ev. evandroi*
		Ev. bourrouli	*Ev. lenti*
N	Tocantins	*Ev. pinottii*	*Ny. whitmani*
		Ev. sallesi	*Pi. christenseni*
		Ev. saulensis	*Pi. damascenoi*
		Ev. teratodes	*Pi. misionensis*
		Ev. termitophila	*Pr. choti*
		Ev. walkeri	*Pa. abonnenci*
		Ex. cerradincola	*Pa. aragaoi*
		Lu. cavernicola	*Pa. bigeniculata*
		Lu. elizabethrangelae	*Pa. brasiliensis*
		Lu. gomezi	*Pa. campbelli*
		Lu. longipalpis	*Pa. dasymera*
		Lu. renei	*Pa. dendrophyla*
		Lu. sherlocki	*Pa. dreisbachi*
		Mt. minasensis	*Pa. hermanlenti*
		Mt. oliveirai	*Pa. lutziana*
		Mt. reginae	*Pa. pascalei*
		Mi. acanthopharynx	*Pa. punctigeniculata*
		Mi. echinatopharynx	*Pa. runoides*
		Mi. longipennis	*Ps. ayrozai*
		Mi. micropyga	*Ps. claustrei*
		Mi. oswaldoi	*Ps. complexus*
		Mi. peresi	*Ps. davisi*
		Mi. quinquefer	*Ps. hirsutus*
		Mi. rorotaensis	*Ps. llanosmartinsi*
		Mi. trinidadensis	*Ps. paraensis*
		Mi. villelai	*Sc. microps*
		Mi. vonatzingeni	*Sc. sordellii*
		Mg. migonei	*Ty. dasypodogeton,*
		Ny. antunesi	*Vi. furcata*
		Ny. intermedia	*Vi. tuberculata*
		Ny. richardwardi	
NE	Alagoas	*Ev. evandroi*	*Mg. migonei*
		Ev. lenti	*Ny. intermedia*
		Ev. termitophila	*Ny. whitmani*
		Lu. longipalpis	*Pa. brasiliensis*
		Mi. quinquefer	
	Bahia	*Bi. flaviscutellata*	*Ny. intermedia*
		Br. avellari	*Ny. whitmani*
		Br. bragai	*Pi. damascenoi*

(continued)

Table 1 (continued)

Region	State	Species	
		Br. cunhai	*Pi. fischeri*
		Br. figueiredoi	*Pi. misionensis*
		Br. virgensi	*Pi. monticola*
		Ev. bahiensis	*Pi. pessoai*
		Ev. cortelezzii	*Pi. serrana*
		Ev. costalimai	*Pr. choti*
		Ev. edwardsi	*Pa. aragaoi*
		Ev. evandroi	*Pa. barrettoi barrettoi*
		Ev. lenti	*Pa. bigeniculata*
		Ev. sallesi	*Pa. brasiliensis*
		Ev. sericea	*Pa. digitata*
		Ev. termitophila	*Pa. lanei*
		Ev. tupynambai	*Pa. lutziana*
		Lu. gomezi	*Pa. pascalei*
		Lu. longipalpis	*Pa. pelloni*
		Mt. gasparviannai	*Ps. ayrozai*
		Mi. capixaba	*Ps. bispinosus*
		Mi. oswaldoi	*Ps. carrerai*
		Mi. peresi	*Ps. davisi*
		Mi. quinquefer	*Ps. hirsutus*
		Mi. schreiberi	*Ps. matosi*
		Mi. trinidadensis	*Sc. microps*
		Mi. villelai	*Th. viannamartinsi*
		Mg. cerqueirai	*Ty. longispina*
		Mg. migonei	*Ty. trichopyga*
		Ny. anduzei	*Vi. furcata*
		Ny. fraihai	*Vi. tuberculata*
	Ceará	*Bi. flaviscutellata*	*Ev. evandroi*
		De. samueli	*Ev. lenti*
		Ev. cortelezzii	*Ev. sallesi*
NE	Ceará	*Ev. saulensis*	*Mg. bursiformis*
		Ev. sericea	*Mg. migonei*
		Ev. walkeri	*Ny. umbratilis*
		Lu. cruzi	*Ny. whitmani*
		Lu. longipalpis	*Pi. fischeri*
		Mi. oswaldoi	*Pa. bigeniculata*
		Mi. peresi	*Pa. brasiliensis*
		Mi. quinquefer	*Pa. abonnenci*
		Mi. schreiberi	*Ps. wellcomei*
		Mi. trinidadensis	*Sc. servulolimai*
		Mi. villelai	*Sc. sordellii*
	Maranhão	*Bi. flaviscutellata*	*Ny. intermedia*

(continued)

Table 1 (continued)

Region	State	Species	
		Bi. inornata	*Ny. richardwardi*
		Bi. olmeca nociva	*Ny. umbratilis*
		Br. avellari	*Ny. whitmani*
		Br. brumpti	*Pi. christenseni*
		Br. pintoi	*Pi. damascenoi*
		Br. travassosi	*Pi. nevesi*
		De. samueli	*Pi. odax*
		Ev. bacula	*Pi. orestes*
		Ev. bourrouli	*Pi. pacae*
		Ev. brachyphalla	*Pi. serrana*
		Ev. carmelinoi	*Pr. choti*
		Ev. cortelezzii	*Pr. triacantha*
		Ev. corumbaensis	*Pr. trispinosa*
		Ev. edwardsi	*Pa. abonnenci*
		Ev. evandroi	*Pa. aragaoi*
		Ev. infraspinosa	*Pa. bigeniculata*
		Ev. lenti	*Pa. brasiliensis*
		Ev. monstruosa	*Pa. dendrophyla*
		Ev. pinottii	*Pa. hermanlenti*
		Ev. sallesi	*Pa. lutziana*
		Ev. saulensis	*Pa. punctigeniculata*
		Ev. teratodes	*Pa. scaffi*
		Ev. termitophila	*Ps. amazonensis*
		Ev. walkeri	*Ps. arthuri*
		Ev. wilsoni	*Ps. ayrozai*
		Lu. carvalhoi	*Ps. carrerai*
		Lu. dispar	*Ps. chagasi*
		Lu. gomezi	*Ps. claustrei*
		Lu. longipalpis	*Ps. complexus*
		Lu. spathotrichia	*Ps. corossoniensis*
		Mt. oliveirai	*Ps. davisi*
		Mi. longipennis	*Ps. geniculatus*
		Mi. micropyga	*Ps. hirsutus*
		Mi. oswaldoi	*Ps. lloydi*
		Mi. peresi	*Ps. paraensis*
		Mi. pilosa	*Ps. squamiventris squamiventris*
		Mi. pusilla	*Ps. wellcomei*
		Mi. quinquefer	*Sc. fluviatilis*
		Mi. rorotaensis	*Sc. microps*
		Mi. trinidadensis	*Sc. servulolimai*
		Mi. villelai	*Sc. sordellii*

(continued)

Table 1 (continued)

Region	State	Species	
		Mg. bursiformis	*Th. ubiquitalis*
		Mg. migonei	*Th. viannamartinsi*
		Ny. anduzei	*Vi. furcata*
		Ny. antunesi	*Vi. tuberculata*
	Paraíba	*Ev. evandroi*	*Mi. schreiberi*
		Ev. lenti	*Mg. migonei*
		Ev. tupynambai	*Ny. intermedia*
		Ev. walkeri	*Ny. whitmani*
		Lu. longipalpis	*Pa. bigeniculata*
	Pernambuco	*Bi. flaviscutellata*	*Ev. walkeri*
		Br. nitzulescui	*Lu. longipalpis*
		Ev. cortelezzii	*Mi. capixaba*
		Ev. evandroi	*Mi. micropyga*
		Ev. lenti	*Mi. oswaldoi*
		Ev. sallesi	*Mi. peresi*
		Ev. tupynambai	*Mi. quinquefer*
NE	Pernambuco	*Mi. schreiberi*	*Ps. amazonensis*
		Mi. villelai	*Ps. ayrozai*
		Mg. migonei	*Ps. claustrei*
		Ny. intermedia	*Ps. complexus*
		Ny. umbratilis	*Ps. squamiventris squamiventris*
		Ny. whitmani	*Ps. wellcomei*
		Pi. fischeri	*Sc. fluviatilis*
		Pr. choti	*Sc. servulolimai*
		Pa. abonnenci	*Sc. sordellii*
		Pa. aragaoi	*Th. viannamartinsi*
		Pa. barrettoi barrettoi	*Ty. longispina*
		Pa. bigeniculata	*Vi. furcata*
		Pa. brasiliensis	*Vi. tuberculata*
		Pa. naftalekatzi	
	Piauí	*Br. avellari*	*Mt. oliveirai*
		De. samueli	*Mi. oswaldoi*
		Ed. piauienses	*Mi. peresi*
		Ev. carmelinoi	*Mi. quinquefer*
		Ev. evandroi	*Mi. rorotaensis*
		Ev. lenti	*Mi. villelai*
		Ev. saulensis	*Mg. bursiformis*
		Ev. termitophila	*Ny. intermedia*
		Ev. walkeri	*Ny. whitmani*
		Lu. dispar	*Pa. bigeniculata*

(continued)

Table 1 (continued)

Region	State	Species	
		Lu. longipalpis	*Sc. sordellii*
	Rio Grande do Norte	*De. samueli*	*Mi. quinquefer*
		Ev. evandroi	*Mi. trinidadensis*
		Ev. lenti	*Mi. villelai*
		Ev. sallesi	*Mg. migonei*
		Ev. walkeri	*Ny. intermedia*
		Lu. longipalpis	*Ny. whitmani*
		Mi. capixaba	*Ps. wellcomei*
		Mi. oswaldoi	*Sc. sordellii*
		Mi. peresi	
	Sergipe	*Ev. lenti*	*Ny. intermedia*
		Ev. sallesi	*Ny. whitmani*
		Lu. longipalpis	*Pr. choti*
		Mi. villelai	
CW	Distrito Federal	*Bi. flaviscutellata*	*Ny. intermedia*
		Br. avellari	*Ny. neivai*
		Br. pintoi	*Ny. whitmani*
		Ev. bacula	*Pi. christenseni*
		Ev. bourrouli	*Pi. fischeri*
		Ev. corumbaensis	*Pi. kuscheli*
		Ev. evandroi	*Pi. monticola*
		Ev. lenti	*Pa. aragaoi*
		Ev. sallesi	*Pa. bigeniculata*
		Ev. saulensis	*Pa. brasiliensis*
		Ev. teratodes	*Pa. lutziana*
		Ev. termitophila	*Pa. pradobarrientosi*
		Lu. ischnacantha	*Ps. davisi*
		Lu. longipalpis	*Sc. servulolimai*
		Mi. acanthopharynx	*Sc. sordellii*
		Mi. longipennis	
	Goiás	*Bi. flaviscutellata*	*Ev. walkeri*
		Br. avellari	*Ex. firmatoi*
		Br. pintoi	*Lu. cavernicola*
		Ev. bacula	*Lu. cruzi*
		Ev. bourrouli	*Lu. dispar*
		Ev. carmelinoi	*Lu. gomezi*
		Ev. cortelezzii	*Lu. longipalpis*
		Ev. corumbaensis	*Lu. renei*
		Ev. evandroi	*Mt. oliveirai*
		Ev. lenti	*Mi. acanthopharynx*
		Ev. monstruosa	*Mi. longipennis*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. sallesi	*Mi. micropyga*
		Ev. saulensis	*Mi. oswaldoi*
		Ev. teratodes	*Mi. peresi*
		Ev. termitophila	*Mi. quinquefer*
CW	Goiás	*Mi. trinidadensis*	*Pa. abonnenci*
		Mi. villelai	*Pa. aragaoi*
		Mg. bursiformis	*Pa. barrettoi barrettoi*
		Mg. migonei	*Pa. bigeniculata*
		Ny. intermedia	*Pa. brasiliensis*
		Ny. neivai	*Pa. campbelli*
		Ny. whitmani	*Pa. hermanlenti*
		Pi. christenseni	*Pa. lutziana*
		Pi. damascenoi	*Pa. punctigeniculata*
		Pi. fischeri	*Ps. davisi*
		Pi. misionensis	*Ps. lainsoni*
		Pi. monticola	*Ps. squamiventris squamiventris*
		Pi. pessoai	*Sc. sordellii*
	Mato Grosso	*Bi. flaviscutellata*	*Mi. trinidadensis*
		Bi. olmeca bicolor	*Mi. villelai*
		Bi. olmeca nociva	*Mg. bursiformis*
		Br. avellari	*Mg. migonei*
		Br. brumpti	*Ny. anduzei*
		Br. cunhai	*Ny. antunesi*
		Br. mangabeirai	*Ny. delsionatali*
		Br. nitzulescui	*Ny. fraihai*
		Br. orlandoi	*Ny. intermedia*
		Br. pentacantha	*Ny. richardwardi*
		Br. pintoi	*Ny. shawi*
		Ev. aldafalcaoae	*Ny. umbratilis*
		Ev. andersoni	*Ny. urbinattii*
		Ev. bacula	*Ny. whitmani*
		Ev. begonae	*Pi. christenseni*
		Ev. bourrouli	*Pi. damascenoi*
		Ev. carmelinoi	*Pi. fischeri*
		Ev. cortelezzii	*Pi. nevesi*
		Ev. corumbaensis	*Pi. serrana*
		Ev. dubitans	*Pr. choti*
		Ev. evandroi	*Pr. dysponeta*
		Ev. infraspinosa	*Pr. triacantha*
		Ev. lenti	*Pa. abonnenci*
		Ev. monstruosa	*Pa. abunaensis*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. pinottii	*Pa. aragaoi*
		Ev. sallesi	*Pa. barrettoi barrettoi*
		Ev. saulensis	*Pa. bigeniculata*
		Ev. sericea	*Pa. brasiliensis*
		Ev. teratodes	*Pa. campbelli*
		Ev. termitophila	*Pa. campograndensis*
		Ev. walkeri	*Pa. coutinhoi*
		Ev. wilsoni	*Pa. dasymera*
		Ex. cerradincola	*Pa. dendrophyla*
		Lu. cruciata	*Pa. dreisbachi*
		Lu. cruzi	*Pa. hermanlenti*
		Lu. dispar	*Pa. inflata*
		Lu. evangelistai	*Pa. lutziana*
		Lu. falcata	*Pa. pradobarrientosi*
		Lu. flabellata	*Pa. punctigeniculata*
		Lu. gomezi	*Pa. runoides*
		Lu. lichyi	*Pa. scaffi*
		Lu. longipalpis	*Ps. amazonensis*
		Lu. marinkellei	*Ps. ayrozai*
		Lu. sherlocki	*Ps. bispinosus*
		Lu. spathotrichia	*Ps. carrerai*
		Mt. brisolai	*Ps. chagasi*
		Mt. oliveirai	*Ps. claustrei*
		Mi. acanthopharynx	*Ps. complexus*
		Mi. echinatopharynx	*Ps. davisi*
		Mi. ferreirana	*Ps. geniculatus*
		Mi. longipennis	*Ps. guyanensis*
		Mi. micropyga	*Ps. hirsutus*
		Mi. oswaldoi	*Ps. lainsoni*
		Mi. peresi	*Ps. llanosmartinsi*
		Mi. pusilla	*Ps. nicaraguensis*
		Mi. quinquefer	*Ps. paraensis*
CW	Mato Grosso	*Ps. wellcomei*	*Th. ruii*
		Sc. microps	*Th. ubiquitalis*
		Sc. servulolimai	*Ty. dasypodogeton*
		Sc. sordellii	*Ty. longispina*
		Th. auraensis	*Ty. rondonensis*
		Th. clitella	*Vi. furcata*
		Th. howardi	*Vi. tuberculata*
		Th. octavioi	
	Mato Grosso do Sul	*Bi. flaviscutellata*	*Mi. pusilla*

(continued)

Table 1 (continued)

Region	State	Species	
		Br. avellari	*Mi. quinquefer*
		Br. brumpti	*Mi. villelai*
		Br. cunhai	*Mi. vonatzingeni*
		Br. galindoi	*Mg. bursiformis*
		Br. nitzulescui	*Mg. migonei*
		Br. pintoi	*Ny. antunesi*
		Ev. aldafalcaoae	*Ny. intermedia*
		Ev. bourrouli	*Ny. neivai*
		Ev. carmelinoi	*Ny. whitmani*
		Ev. cortelezzii	*Pi. christenseni*
		Ev. corumbaensis	*Pi. damascenoi*
		Ev. evandroi	*Pi. fischeri*
		Ev. lenti	*Pi. kuscheli*
		Ev. orcyi	*Pi. mamedei*
		Ev. sallesi	*Pi. misionensis*
		Ev. saulensis	*Pi. monticola*
		Ev. teratodes	*Pi. pessoai*
		Ev. termitophila	*Pa. aragaoi*
		Ev. walkeri	*Pa. bigeniculata*
		Ex. cerradincola	*Pa. brasiliensis*
		Lu. almerioi	*Pa. campbelli*
		Lu. cruzi	*Pa. campograndensis*
		Lu. dispar	*Pa. hermanlenti*
		Lu. forattinii	*Pa. lanei*
		Lu. longipalpis	*Pa. lutziana*
		Lu. renei	*Pa. punctigeniculata*
		Mt. oliveirai	*Ps. claustrei*
		Mi. acanthopharynx	*Ps. davisi*
		Mi. ferreirana	*Ps. lloydi*
		Mi. longipennis	*Sc. sordellii*
		Mi. oswaldoi	*Vi. furcata*
		Mi. peresi	
SE	Espírito Santo	*Bi. flaviscutellata*	*Mi. breviducta*
		Br. avellari	*Mi. capixaba*
		Br. bragai	*Mi. ferreirana*
		Br. cardosoi	*Mi. quinquefer*
		Br. cunhai	*Mi. schreiberi*
		Br. figueiredoi	*Mi. zikani*
		Br. guimaraesi	*Mg. migonei*
		Br. nitzulescui	*Ny. fraihai*
		Br. troglodytes	*Ny. intermedia*
		Ev. callipyga	*Ny. whitmani*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. cortelezzii	*Pi. bianchigalatiae*
		Ev. costalimai	*Pi. damascenoi*
		Ev. edwardsi	*Pi. fischeri*
		Ev. evandroi	*Pi. mamedei*
		Ev. grimaldii	*Pi. misionensis*
		Ev. lenti	*Pi. monticola*
		Ev. petropolitana	*Pi. pessoai*
		Ev. sallesi	*Pi. serrana*
		Ev. sericea	*Pr. choti*
		Ev. termitophila	*Pr. equatorialis*
		Ev. tupynambai	*Pa. barrettoi barrettoi*
		Ex. firmatoi	*Pa. bigeniculata*
		Lu. alencari	*Pa. lanei*
		Lu. amarali	*Pa. limai*
		Lu. falquetoi	*Pa. lutziana*
		Lu. longipalpis	*Pa. pascalei*
		Lu. souzalopesi	*Pa. pelloni*
		Mt. gasparviannai	*Ps. ayrozai*
SE	Espírito Santo	*Ps. davisi*	*Ps. matosi*
		Ps. fairchildi	*Sc. microps*
		Ps. geniculatus	*Sc. sordellii*
		Ps. hirsutus	*Ty. longispina*
	Minas Gerais	*Bi. flaviscutellata*	*Mi. ferreirana*
		Br. avellari	*Mi. longipennis*
		Br. brumpti	*Mi. micropyga*
		Br. cardosoi	*Mi. oswaldoi*
		Br. cunhai	*Mi. peresi*
		Br. guimaraesi	*Mi. quinquefer*
		Br. mangabeirai	*Mi. schreiberi*
		Br. nitzulescui	*Mi. trinidadensis*
		Br. ortizi	*Mi. villelai*
		Br. pintoi	*Mi. vonatzingeni*
		Br. travassosi	*Mg. migonei*
		Br. troglodytes	*Ny. intermedia*
		De. appendiculata	*Ny. neivai*
		De. ramirezi	*Ny. whitmani*
		Ev. bacula	*Pi. bianchigalatiae*
		Ev. callipyga	*Pi. christenseni*
		Ev. carmelinoi	*Pi. damascenoi*
		Ev. cortelezzii	*Pi. fischeri*
		Ev. corumbaensis	*Pi. mamedei*
		Ev. costalimai	*Pi. misionensis*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. edwardsi	*Pi. monticola*
		Ev. evandroi	*Pi. pessoai*
		Ev. lenti	*Pi. serrana*
		Ev. petropolitana	*Pr. choti*
		Ev. rupicola	*Pr. equatorialis*
		Ev. sallesi	*Pa. aragaoi*
		Ev. spelunca	*Pa. baratai*
		Ev. teratodes	*Pa. barrettoi barrettoi*
		Ev. termitophila	*Pa. bigeniculata*
		Ev. tupynambai	*Pa. brasiliensis*
		Ev. tylophalla	*Pa. dendrophyla*
		Ev. walkeri	*Pa. hermanlenti*
		Ex. cerradincola	*Pa. lanei*
		Ex. firmatoi	*Pa. limai*
		Lu. alencari	*Pa. lutziana*
		Lu. amarali	*Pa. pascalei*
		Lu. cavernicola	*Pa. pelloni*
		Lu. ischnacantha	*Pa. runoides*
		Lu. ischyracantha	*Ps. ayrozai*
		Lu. longipalpis	*Ps. carrerai*
		Lu. renei	*Ps. davisi*
		Mt. cipoensis	*Ps. fairchildi*
		Mt. gasparviannai	*Ps. hirsutus*
		Mt. minasensis	*Ps. lloydi*
		Mt. oliveirai	*Ps. matosi*
		Mi. acanthopharynx	*Sc. microps*
		Mi. breviducta	*Sc. sordellii*
		Mi. capixaba	*Ty. longispina*
	Rio de Janeiro	*Bi. flaviscutellata*	*Ev. tupynambai*
		Br. avellari	*Ev. walkeri*
		Br. brumpti	*Ex. firmatoi*
		Br. cardosoi	*Lu. alencari*
		Br. cunhai	*Lu. amarali*
		Br. guimaraesi	*Lu. ischyracantha*
		Br. nitzulescui	*Lu. longipalpis*
		Br. pintoi	*Mt. gasparviannai*
		Br. troglodytes	*Mt. minasensis*
		Ev. cortelezzii	*Mi. capixaba*
		Ev. costalimai	*Mi. ferreirana*
		Ev. edwardsi	*Mi. longipennis*
		Ev. lenti	*Mi. micropyga*
		Ev. petropolitana	*Mi. oswaldoi*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. rupicola	*Mi. peresi*
		Ev. sallesi	*Mi. quinquefer*
		Ev. termitophila	*Mi. schreiberi*
SE	Rio de Janeiro	*Mg. migonei*	*Pa. pascalei*
		Ny. intermedia	*Pa. pelloni*
		Ny. whitmani	*Ps. arthuri*
		Pi. bianchigalatiae	*Ps. ayrozai*
		Pi. fischeri	*Ps. carrerai*
		Pi. mamedei	*Ps. davisi*
		Pi. misionensis	*Ps. fairchildi*
		Pi. monticola	*Ps. geniculatus*
		Pi. pessoai	*Ps. hirsutus*
		Pi. serrana	*Ps. lloydi*
		Pa. aragaoi	*Ps. matosi*
		Pa. barrettoi barrettoi	*Ps. paraensis*
		Pa. bigeniculata	*Sc. microps*
		Pa. brasiliensis	*Sc. sordellii*
		Pa. lanei	*Ty. longispina*
		Pa. lutziana	
	São Paulo	*Bi. flaviscutellata*	*Mg. migonei*
		Br. avellari	*Mg. rabelloi*
		Br. bragai	*Mg. vaniae*
		Br. brumpti	*Ny. fraihai*
		Br. cardosoi	*Ny. intermedia*
		Br. carvalheiroi	*Ny. neivai*
		Br. cunhai	*Ny. singularis*
		Br. galindoi	*Ny. whitmani*
		Br. guimaraesi	*Pi. bianchigalatiae*
		Br. mangabeirai	*Pi. christenseni*
		Br. nitzulescui	*Pi. fischeri*
		Br. ortizi	*Pi. misionensis*
		Br. pintoi	*Pi. monticola*
		Br. troglodytes	*Pi. pessoai*
		Ev. bourrouli	*Pi. serrana*
		Ev. carmelinoi	*Pr. choti*
		Ev. correalimai	*Pr. trispinosa*
		Ev. cortelezzii	*Pa. aragaoi*
		Ev. edwardsi	*Pa. baratai*
		Ev. lenti	*Pa. barrettoi barrettoi*
		Ev. petropolitana	*Pa. bigeniculata*
		Ev. rupicola	*Pa. brasiliensis*
		Ev. sallesi	*Pa. hermanlenti*

(continued)

Table 1 (continued)

Region	State	Species	
		Ev. termitophila	*Pa. lanei*
		Ex. firmatoi	*Pa. limai*
		Lu. alencari	*Pa. lutziana*
		Lu. almerioi	*Pa. pascalei*
		Lu. amarali	*Pa. pelloni*
		Lu. castroi	*Pa. punctigeniculata*
		Lu. dispar	*Pa. ribeirensis*
		Lu. longipalpis	*Ps. arthuri*
		Mt. alphabetica	*Ps. ayrozai*
		Mi. ferreirana	*Ps. geniculatus*
		Mi. longipennis	*Ps. guyanensis*
		Mi. micropyga	*Ps. hirsutus*
		Mi. petari	*Ps. lloydi*
		Mi. quinquefer	*Sc. microps*
		Mi. schreiberi	*Sc. sordellii*
		Mg. bursiformis	
S	Paraná	*Br. angelae*	*Ev. edwardsi*
		Br. avellari	*Ev. evandroi*
		Br. brumpti	*Ev. lenti*
		Br. cardosoi	*Ev. sallesi*
		Br. Cunhai	*Ex. firmatoi*
		Br. galindoi	*Lu. amarali*
		Br. guimaraesi	*Lu. gaminarai*
		Br. mangabeirai	*Lu. longipalpis*
		Br. nitzulescui	*Mt. alphabetica*
		Br. ortizi	*Mi. ferreirana*
		Br. troglodytes	*Mi. longipennis*
		Ev. bacula	*Mi. micropyga*
		Ev. correalimai	*Mi. oswaldoi*
		Ev. cortelezzii	*Mi. quinquefer*
S	Paraná	*Mg. migonei*	*Pa. baratai*
		Ny. intermedia	*Pa. bigeniculata*
		Ny. neivai	*Pa. lanei*
		Ny. umbratilis	*Pa. limai*
		Ny. whitmani	*Pa. lutziana*
		Pi. bianchigalatiae	*Pa. pascalei*
		Pi. christenseni	*Pa. pelloni*
		Pi. fischeri	*Pa. punctigeniculata*
		Pi. misionensis	*Ps. ayrozai*
		Pi. monticola	*Ps. geniculatus*
		Pi. pessoai	*Ps. hirsutus*
		Pa. abonnenci	*Ps. lloydi*

(continued)

Table 1 (continued)

Region	State	Species	
		Pa. aragaoi	*Sc. sordellii*
	Rio Grande do Sul	*Br. cunhai*	*Mg. migonei*
		Br. nitzulescui	*Ny. intermedia*
		Br. pintoi	*Ny. neivai*
		Ev. correalimai	*Ny. whitmani*
		Ev. cortelezzii	*Pi. fischeri*
		Ev. gaucha	*Pi. misionensis*
		Ex. firmatoi	*Pi. monticola*
		Lu. gaminarai	*Pi. pessoai*
		Lu. longipalpis	*Pa. bigeniculata*
		Mt. alphabetica	*Pa. lanei*
		Mi. ferreirana	*Pa. pascalei*
		Mi. schreiberi	
	Santa Catarina	*Br. brumpti*	*Pi. fischeri*
		Br. nitzulescui	*Pi. monticola*
		Br. troglodytes	*Pi. pessoai*
		Ev. edwardsi	*Pa. bigeniculata*
		Ex. firmatoi	*Pa. lanei*
		Mt. alphabetica	*Pa. pelloni*
		Mg. migonei	*Ps. ayrozai*
		Ny. intermedia	*Sc. microps*
		Ny. neivai	

Genus *Bichromomyia* Artemiev, 1991; *Brumptomyia* França & Parrot, 1921; *Deanemyia* Galati, 1995; *Edentomyia* Galati, Andrade Filho, Silva & Falcão, 2003; *Evandromyia* Mangabeira, 1941; *Expapillata* Galati, 1995; *Lutzomyia* França, 1924; *Martinsmyia* Galati, 1995; *Micropygomyia* Barretto, 1962; *Migonemyia* Galati, 1995; *Nyssomyia* Barretto, 1962; *Pintomyia* Costa Lima, 1932; *Pressatia* Mangabeira, 1942; *Psathyromyia* Barretto, 1962; *Psychodopygus* Mangabeira, 1941; *Sciopemyia* Barretto, 1962; *Trichophoromyia* Barretto, 1962; *Trichopygomyia* Barretto, 1962; *Viannamyia* Mangabeira, 1941

Bi. – Bichromomyia, *Br. – Brumptomyia*, *De. – Deanemyia*, *Ed. – Edentomyia*, *Ev. – Evandromyia*, *Ex. – Expapillata*, *Lu. – Lutzomyia*, *Mt. – Martinsmyia*, *Mi. – Micropygomyia*, *Mg. – Migonemyia*, *Ny. – Nyssomyia*, *Pi. – Pintomyia*, *Pr. – Pressatia*, *Pa. – Psathyromyia, Ps. – Psychodopygus*, *Sc. – Sciopemyia*, *Th. – Trichophoromyia*, *Ty. – Trichopygomyia*, *Vi. – Viannamyia*

(Fairchild and Hertig 1959) and Rondônia, which is on the border of Brazil with Bolívia (Martins et al. 1965), and in the CW and SE regions. The reason for discontinuity may be associated with the lack of more systematized investigations in the intermediate regions.

Food preferences of sand flies are also predominant factors that directly influence their dispersion. Species of the genus *Brumptomyia*, in their totality, suck the blood of armadillos (Dasypodidae) and are always found in armidillo burrows and only incidentally outside of them. Thus, it can be said that where armidillos do not occur, there are no representatives of the genus.

In short, the more specialized the species, the smaller its range of dispersion and the greater its dependence on habitats that are equally specialized. In contrast, the more generalized the species, the greater its range, particularly by way of its adaptation to less specialized or more diversified habitats.

Habitats of the Brazilian Phlebotomine Species

Sand flies belong to the order Diptera (Psychodidae, Phlebotominae), and, like most Diptera, they are holometabolous insects. The immature forms inhabit terrestrial habitat, developing in places rich in decomposing organic matter, especially that of a vegetal nature. They have cryptozoic habits and are sensitive to changes in temperature and humidity, with a predominantly twilight activity and/or nocturnal period, when they leave their shelters to feed themselves. Males and females feed on carbohydrates, especially nectars and aphid secretions, but only females are hematophagous, which is the precondition for the maturation of their ovaries, with some species being suitable for the spread of pathogens (Brazil and Brazil 2003).

Sand flies occur essentially in wild environments. However, some vector species are adapting to deforested areas and places of human habitation as well as occupying urban environments and peripheries of large cities. The adaptation of these vectors to new habitats, especially those environmentally impacted, indicates a new scenario of transmission of leishmaniasis (Rangel and Vilela 2008; Carvalho et al. 2014).

The types of shelters used by adult sand flies vary according to microhabitat, season, relative humidity, and species. Due to their thin coating, they shelter in places where they can protect themselves from sudden changes in the environment. Thus, they take refuge in places with good moisture content, decomposing organic matter, little or no light, and air movement, that is, in places that protect them from desiccation. Proper refuge spots in particular are fallen leaves in the forest soil, burrows of wild animals, trunks of trees and tabular roots, hollows of trees, crevices in rocks, and caves, etc. In anthropic environments, artificial shelters include shaded and damp areas and shelters for domestic animals such as chicken coops, pigpens, corrals, and others (Aguiar and Vilela 1987; Brazil and Brazil 2003).

To determine the microclimate factors important for sand-fly shelters, Scorza et al. (1968a, 1968b, 1968c) studied the habits of several species of sand flies in the ecotypes of the rainforest zone of Venezuela. The investigators concluded that, during the dry season, the temperature in the shelters is greater than that of the external environment, and it increases during the rainy season. The relative humidity in the shelters, both in the rainy and dry seasons, is always greater than that of the external environment. Another important factor is that, although temperature changes are gradual, the increase in relative humidity is abrupt. Thus, although the temperature remains stable throughout the year, the relative humidity undergoes major changes, which would lead—according to the investigators—to the appearance of sand flies. The relative humidity of the air is therefore the determining factor for the mainte-

nance of these insects in their shelters. The survival of the immature forms in these biotopes during the dry season causes the emergence of adults during the first rains because of the increased humidity. Finally, temperature influences the survival of both the immature and adult forms with the temperature being stable in the shelters, remaining increased during the dry season, and decreasing during the rainy season.

Depending more on the microclimate from places—such as burrows, tree hollows, caves and cracks in rocks—than on the general climatic conditions of the region, certain sand-fly species can overcome efficient barriers to other groups of animals and thereby bind fauna of different zoogeographic regions (Lewis 1965). For example, *Br. pintoi* occurs, like all species of the genus *Brumptomyia*, in armadillo (Dasypodidae) burrows in zones of permanently flooded forest and low altitudes, *e.g.*, the states of Pará and Amazonas. It also occurs in savannas with prolonged droughts and at altitudes of 1000 m, *e.g.*, the state of Minas Gerais.

Most sand-fly species inhabit the Hylian Amazon forests, which are divided into three types: "terra firme," "igapó," and "várzea." These forests occupy about 40% of the Brazilian territorial area representing an area of 3.5 million km^2. In addition to forests of various types, the Hylian Amazon forests are formed of fields and savannas.

In the state of Amapá, on the island of Marajó, and on other islands throughout the Amazonian plain with no forest area, dense herbaceous vegetation occurs, especially tall grasses able to withstand periodic floods.

Savannas in the Amazon forest occur as "islands" of savanoid vegetation distributed in four lines: (1) the first follows the coast and the savannas of Marajó and is considered the most important; (2) the second line is along the lower Amazonas river in the state of Pará; (3) the third is located between the upper courses of the Jari and Trombetas rivers and has the same physiognomy of savannas of Central Brazil but differing in floristic composition; and (4) the fourth line is located in the fields and savannas in the south of the states of Pará and Amazonas, the mid-Tapajós river, and between the Purus and Madeira rivers.

North Eastern "caatinga" vegetation extends throughout the states of Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Sergipe, Alagoas, Bahia, and certain parts of northern Minas Gerais and occupies around 11% of the national territory.

The fields of the Brazilian Central Plateau—especially the savannas of Minas Gerais, Tocantins, Goiás, and Mato Grosso, which occupy "islands of vegetation" in the Amazon and "tabuleiro" vegetation in the NE region—cover an area of approximately 23% of the Brazilian territory.

The Atlantic Forests extend along the Brazilian coast, from north to south, in a band that goes inland depending on the location, especially the relief. Great anthropic action decreased the forest to only 6% across its range from Rio Grande do Norte to Rio Grande do Sul. In the South region, fields and woods of various types, including Araucaria of temperate character, predominate. This vegetation covers 14% of the national territory.

The remaining 6% of the Brazilian vegetation includes the palm tree forests of Maranhão, Piauí, and Ceará; the Mato Grosso Pantanal wetland; the mangroves,

dunes, and "restingas" of almost all the coast; the rupestrian fields from some the sierras of Minas Gerais and Goiás; the continental aquatic vegetation (fresh water); and the vegetation of the marshes.

The rainforest offers the widest variety of shelters and is therefore the site of the largest number of sand flies. Shelters that become excessively moist are abandoned. However, they can be re-occupied when conditions become favourable again.

The forest soil is home to many species of sand flies including *Psychodopygus ayrozai*, *Bichromomyia flaviscutellata, Bi. olmeca bicolor,* and *Bi. olmeca nociva*. These and other species are also found in shrubs and plants, especially when the forest floor becomes too moist.

A great number of sand flies is wild and only infest humans and domestic animals when they penetrate the forest or when houses are near. Some species, however, live in association with humans and their domestic animals; however, contrary to the behaviour of some Culicidae, sand flies cannot yet be considered fully domiciled. Two factors influence the domiciliation process of these insects: the habitat modifications by humans and the adaptive power of the species to the new environment (Aguiar et al. 2014; Vieira et al. 2015).

Anthropic environmental changes have led to substantial alterations in the profile of sand-fly fauna, thus allowing greater adaptation of these insects to the human environment. This has caused some species to disappear, whereas others adapt to the new circumstances as represented by residual forests or cultivated areas, proximity to human homes, in rural areas, or on the outskirts of urban areas with or without rural characteristics (Rangel and Lainson 2009; Aguiar et al. 2014). The use of insecticides, in addition to the proportion of the species in relation to dominance, is also an altering factor in the biodiversity of sand-fly fauna and the size of the population (Teodoro et al. 1999).

Barretto (1943) divided sand-fly species into three categories: (1) wild: living in forests or in non-forest regions but only accidentally found associated with humans and domestic animals; (2) semi-domestic: living outside human and domestic animal habitations and only seeking these to obtain blood repast; and (3) domestic: living in association with humans and domestic animals inside or near dwellings.

All Brazilian sand flies are listed in alphabetical order in Table 2, which also highlights their main habitats and regions of occurrence. Species marked with an asterisk are involved in the transmission of leishmaniasis to humans and animals.

1.	Fallen leaves in forest soil	2.	Armadillo burrows	N -	North
3.	Burrows of other wild animals	4.	Tree trunks and tabular roots	NE-	Northeast
5.	Tree hollows	6.	Treetops	CW-	Central West
7.	Crevices in rocks	8.	Caves	SE -	Southeast
9.	Forest without specified location	10.	Marginal areas	S -	South
11.	Annexes of domestic animals (chicken coops, pigpens, corrals etc.)	12.	Outer and inner walls of human dwellings		

Table 2 Brazilian phlebotomine species, main habitats and regions of occurrence

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Bi. flaviscutellata (Mangabeira 1942a)*	•	•		•							•	•	N, NE, CW, SE
Bi. inornata (Martins, Falcão & Silva, 1965)									•		•		N, NE
Bi. olmeca bicolor (Fairchild & Theodor, 1971)*	•			•	•								N, CW
Bi. olmeca nociva (Young & Arias, 1982)*	•												N, NE, CW
Bi. reducta (Feliciangeli, Ramirez Pérez & Ramirez, 1988)									•				N
Br. angelae Galati, Santos & Silva, 2007									•				S
Br. avellari (Costa Lima, 1932)	•	•					•	•		•	•		N, NE, CW, SE, S
Br. bragai (Mangabeira & Sherlock, 1961)		•											NE, SE
Br. brumpti (Larrousse, 1920)		•		•			•	•		•	•		N, NE, CW, SE, S
Br. cardosoi (Barretto & Coutinho, 1941a)		•											SE, S
Br. carvalheiroi Shimabukuro, Marassa & Galati 2007									•				SE
Br. cunhai (Mangabeira, 1942a)	•	•								•			N, NE, CW, SE, S
Br. figueiredoi Mangabeira & Sherlock, 1961		•											NE, SE
Br. galindoi (Fairchild & Hertig, 1947)		•		•			•	•					CW, SE, S
Br. guimaraesi (Coutinho & Barretto, 1941a)	•	•		•						•			SE, S
Br. mangabeirai (Barretto & Coutinho, 1941a)		•								•			N, CW, SE, S
Br. nitzulescui (Costa Lima, 1932)	•	•											NE, CW, SE, S
Br. orlandoi Fraiha, Shaw & Lainson, 1970		•											CW
Br. ortizi Martins, Silva & Falcão, 1971b		•											N, SE, S
Br. pentacantha (Barretto, 1947)		•		•									N, CW
Br. pintoi (Costa Lima, 1932)	•	•	•										N, NE, CW, SE, S
Br. spinosipes Floch & Abonnenc, 1943									•				N
Br. travassosi (Mangabeira 1942g)		•	•										N, NE, SE
Br. troglodytes (Lutz, 1922)		•					•	•					SE, S
Br. virgensi Mangabeira & Sherlock, 1961		•											NE, CW
De. appendiculata (Martins, Falcão & Silva, 1961)							•	•					SE

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
De. derelicta (Freitas & Barrett, 1999)									•	•			N
De. maruaga (Alves, Freitas & Barret, 2008)								•					N
De. ramirezi (Martins, Falcão, Silva & Miranda, 1982)							•						SE
De. samueli (Deane, 1955)											•	•	N, NE
Edentomyia piauienses Galati, Andrade-Filho, Silva & Falcão, 2003								•					N, NE
Ev. aldafalcaoae (Santos, Andrade Filho & Honer, 2001)									•				CW
Ev. andersoni (Le Point & Desjeux, 1988)									•				N, CW
Ev. apurinan Shimabukuro, Figueira & Silva, 2013											•		N
Ev. bacula (Martins, Falcão & Silva, 1965)		•	•						•	•			N, NE. CW, SE, S
Ev. bahiensis (Mangabeira & Sherlock, 1961)	•	•	•								•		NE
Ev. begonae (Ortiz & Torres, 1975)				•	•						•		N, CW
Ev. bourrouli (Barretto & Coutinho, 1941b)		•								•			N, NE, CW, SE
Ev. brachyphalla (Mangabeira Fo, 1994)									•				N, NE
Ev. callipyga (Martins & Silva , 1965)		•	•										SE
Ev. carmelinoi (Ryan, Fraiha, Lainson & Shaw, 1986)		•	•						•				N, NE, CW, SE
Ev. correalimai (Martins, Coutinho & Luz , 1970)			•	•									SE, S
Ev. cortelezzii (Brèthes, 1923)				•		•				•	•	•	N, NE, CW, SE, S
Ev. corumbaensis (Galati, Nunes, Oshiro & Rego, 1989)							•	•			•	•	N, NE, CW, SE
Ev. costalimai (Mangabeira, 1942a)		•	•	•			•						NE, SE
Ev. dubitans (Sherlock, 1962)				•	•					•		•	N, CW
Ev. edwardsi (Mangabeira, 1941b)			•							•	•		NE, SE, S
Ev. evandroi (Costa Lima & Antunes, 1936)									•				N, NE, CW, SE, S
Ev. gaucha Andrade Filho, Souza & Falcão, 2007									•				S
Ev. georgii (Freitas & Barrett, 2002)									•				N
Ev. grimaldii Andrade Filho, Pinto, Santos & Carvalho, 2009									•				SE

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Ev. infraspinosa (Mangabeira, 1941b)		•	•	•							•		N, NE, CW, SE
Ev. inpai (Young & Arias, 1977)									•				N
Ev. lenti (Mangabeira, 1938)			•							•	•	•	N, NE, CW, SE, S
Ev. monstruosa (Floch & Abonnenc, 1944)		•	•	•							•		N, NE, CW
Ev. orcyi Oliveira, Sanguinette, Almeida & Andrade Filho, 2015											•		CW
Ev. petropolitana (Martins & Silva, 1968)				•	•		•						SE
Ev. pinottii (Damasceno & Arouck, 1956)				•	•								N, NE, CW
Ev. rupicola (Martins, Godoy & Silva, 1962)							•						SE
Ev. sallesi (Galvão & Coutinho, 1939)				•	•		•	•			•	•	N, NE, CW, SE, S
Ev. saulensis (Floch & Abonnenc, 1944)				•	•								N, NE, CW
Ev. sericea (Floch & Abonnenc, 1944)									•				N, NE, CW, SE
Ev. sipani (Fernandez, Carbajal, Alexander & Need, 1994)									•	•			N
Ev. spelunca Carvalho, Brazil, Sanguinette & Andrade Filho, 2011								•					SE
Ev. tarapacaensis (Le Pont, Torres-Espejo & Galati, 1996)									•				N
Ev. teratodes (Martins, Falcão & Silva, 1964)			•										N, NE, CW, SE
Ev. termitophila (Martins, Falcão & Silva, 1964)		•	•				•				•		N, NE, CW, SE
Ev. tupynambai (Mangabeira, 1942a)		•	•	•						•			NE, SE
Ev. tylophalla Andrade & Galati, 2012									•				SE
Ev. walkeri (Newstead, 1914)				•	•					•			N, NE, CW, SE
Ev. williamsi (Damasceno, Causey & Arouck, 1945)				•									N
Ev. wilsoni (Damasceno & Causey, 1945)		•		•									N, NE, CW
Ex. cerradincola (Galati, Nunes, Oshiro & Dorval, 1995)									•				N, CW, SE
Ex. firmatoi (Barretto, Martins & Pellegrino, 1956)				•						•	•		SE, S
Lu. alencari Martins, Souza & Falcão, 1962							•						SE
Lu. almerioi Galati & Nunes, 1999				•			•						CW, SE
Lu. amarali Barretto & Coutinho, 1940				•			•						SE, S

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Lu. araracuarensis (Morales & Minter, 1981)									•				N
Lu. caligata Martins, Falcão & Silva, 1965				•									N
Lu. carvalhoi (Damasceno, Causey & Arouck, 1945)				•									N, NE
Lu. castroi (Barretto & Coutinho, 1941c)									•				SE
Lu. cavernicola (Costa Lima, 1932)							•	•					N, CW, SE
Lu. cruciata (Coquillett, 1907)										•	•		CW
Lu. cruzi (Mangabeira, 1938)*							•	•			•	•	NE, CW, SE
Lu. cultellata Barrett, Feitas, Albuquerque & Guerrero, 1996									•				N
Lu. dispar Martins & Silva , 1963							•	•					NE, CW, SE
Lu. elizabethrangelae Vilela, Azevedo e Godoy, 2015								•					N
Lu. evangelistai Martins & Fraiha, 1971				•									N, CW
Lu. falcata Young, Morales & Ferro, 1994				•	•								N, CW
Lu. falquetoi Pinto & Santos, 2007									•				SE
Lu. flabellata Martins & Silva, 1964				•									N, CW
Lu. forattinii Galati, Rego, Nunes & Teruya, 1985							•	•			•	•	CW
Lu. gaminarai (Cordero, Vogelsang & Cossio, 1928)							•						S
Lu. gomezi (Nitzulescu, 1931)*			•	•	•	•					•	•	N, NE, CW
Lu. ischnacantha Martins, Souza & Falcão, 1962a							•	•					CW, SE
Lu. ischyracantha Martins, Falcão & Silva, 1962b							•						SE
Lu. lichyi (Floch & Abonnenc, 1950)				•	•					•			N, CW
Lu. longipalpis (Lutz & Neiva, 1912)*				•	•		•	•		•	•	•	N, NE, CW, SE, S
Lu. marinkellei Young, 1979				•									N, CW
Lu. renei (Martins, Falcão & Silva, 1957)							•	•					N, CW, SE
Lu. sherlocki Martins, Silva & Falcão, 1971a				•									N, CW
Lu. souzalopesi Martins, Silva & Falcão, 1970b				•									SE
Lu. spathotrichia Martins, Falcão & Silva, 1963				•					•				N, NE, CW
Mt. alphabetica (Fonseca, 1936)									•			•	SE, S
Mt. brisolai (Le Pont & Desjeux, 1987)									•				CW

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Mt. Cipoensis (Martins, Falcão & Silva, 1964)							•						SE
Mt. Gasparviannai (Martins, Godoy & Silva ,1962b)									•				NE, SE
Mt. Minasensis (Mangabeira, 1942a)									•				N, SE
Mt. Oliveirai (Martins, Silva & Falcão, 1970a)							•	•				•	N, NE, CW, SE
Mt. Reginae Carvalho, Brazil, Sanguinette & Andrade Filho, 2010								•					N
Mt. Waltoni (Arias, Freitas & Barret, 1984)				•									N
Mi. acanthopharynx (Martins, Falcão & Silva, 1962)				•			•	•					N, CW, SE
Mi. breviducta (Barretto, 1950)									•				SE
Mi. capixaba (Dias, Falcão, Silva & Martins, 1987)									•	•			NE, SE
Mi. cayennensis (Floch & Abonnenc, 1941)			•	•	•								N
Mi. chassigneti (Floch & Abonnenc, 1944)									•				N
Mi. echinatopharynx Andrade Filho, Galati, Andrade & Falcão, 2004									•				N, CW
Mi. ferreirana (Barretto, Martins & Pellegrino, 1956)		•	•	•			•				•		CW, SE, S
Mi. longipennis (Barretto, 1946)				•							•		N, NE, CW, SE, S
Mi. mangabeirana (Martins, Falcão & Silva, 1963)	•	•		•									N
Mi. micropyga (Mangabeira, 1942a)		•	•	•	•						•		N, NE, CW, SE, S
Mi. oswaldoi (Mangabeira, 1942e)				•	•						•	•	N, NE, CW, SE, S
Mi. peresi (Mangabeira, 1942a)		•	•	•			•	•		•	•	•	N, NE, CW, SE
Mi. petari Galati, Marassá & Andrade, 2003									•				SE
Mi. pilosa (Damasceno & Causey, 1944)			•	•	•								N, NE
Mi. pusilla (Dias, Martins, Falcão & Silva, 1986)				•									N, NE, CW
Mi. quinquefer (Dyar, 1929)				•	•		•			•	•		N, NE, CW, SE, S
Mi. rorotaensis (Floch & Abonnenc, 1944)				•									N, NE
Mi. schreiberi (Martins, Falcão & Silva ,1955)				•						•	•	•	NE, SE, S
Mi. trinidadensis (Newstead, 1922)				•	•						•	•	N, NE, CW, SE

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Mi. villelai (Mangabeira, 1942)				•			•	•	•		•		N, NE, CW, SE
Mi. vonatzingeni Galati, 2007									•				N, CW, SE
Mi. zikani (Barretto, 1950a)									•				N, SE
Mg. bursiformis (Floch & Abonnenc, 1944)		•		•					•				N, NE, CW, SE
Mg. cerqueirai (Causey & Damasceno, 1945)		•	•	•						•			N, NE
Mg. migonei (França, 1920)*				•	•		•			•	•	•	N, NE, CW, SE, S
Mg. moucheti (Pajot & Le Pont, 1923)									•				N
Mg. rabelloi (Galati & Gomes, 1992)									•	•			SE
Mg.vaniae Galati, Fonseca & Marassá, 2007									•	•	•	•	SE
Nyssomyia anduzei (Rozeboom, 1942)*				•						•	•		N, NE, CW
Ny. antunesi (Coutinho, 1939)*		•	•	•		•				•	•		N, NE, CW
Ny. delsionatali Galati & Galvis, 2012										•			CW
Ny. fraihai (Martins, Falcão & Silva, 1979)				•		•				•	•		N, NE, CW, SE
Ny. intermedia (Lutz & Neiva, 1912)*									•	•	•	•	N, NE, CW, SE, S
Ny. neivai (Pinto, 1926)*								•	•	•	•	•	N, CW, SE, S
Ny. pajoti (Abonnenc, Léger & Fauran, 1979)									•				N
Ny. richardwardi (Ready & Fraiha, 1981)				•		•							N, NE, CW
Ny. shawi (Fraiha, Ward & Ready, 1973)									•				N, CW
Ny. singularis (Costa Lima, 1932)									•				SE
Ny. sylvicola (Floch & Abonnenc, 1944)									•				N
Ny. umbratilis (Ward & Fraiha, 1977)*				•		•							N, NE, CW, S
Ny. urbinattii Galati & Galvis, 2012									•	•			N, CW
Ny. whitmani (Antunes & Coutinho, 1939)*				•	•	•				•	•	•	N, NE, CW, SE, S
Pi. bianchigalatiae (Andrade Filho, Aguiar, Dias & Falcão, 1999)									•		•	•	SE, S
Pi. christenseni (Young & Duncan ,1994)				•	•								N, NE, CW, SE, S
Pi. damascenoi (Mangabeira, 1941d)			•	•					•				N, NE, CW, SE

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Pi. fischeri (Pinto, 1926)*				•	•	•				•	•	•	NE, CW, SE, S
Pi. gruta (Ryan, 1986)							•	•					N
Pi. kuscheli (Le Pont, Martinez, Torrez-Espejo, Dujardin, 1998)									•				CW
Pi. mamedei (Oliveira, Afonso, Dias & Brazil, 1994)									•				CW, SE
Pi. misionensis (Castro, 1959)				•		•							N, NE, CW, SE, S
Pi. monticola (Costa Lima, 1932)				•	•	•				•	•		N, NE, CW, SE, S
Pi. naiffi (Freitas & Oliveira, 2013)										•			N
Pi. nevesi (Damasceno & Arouck, 1956)				•							•		N, NE, CW
Pi. odax (Fairchild & Hertig, 1961)				•									N, NE
Pi. orestes (Fairchild & Trapido, 1950)									•				NE
Pi. pacae (Floch & Abonnenc, 1943)			•										N, NE
Pi. pessoai (Coutinho & Barretto, 1940)*				•	•	•				•	•	•	NE, CW, SE, S
Pi. serrana (Damasceno & Arouck, 1949)		•	•	•	•					•	•		N, NE, CW, SE
Pressatia calcarata (Martins & Silva, 1964)				•									N
Pr. choti (Floch & Abonnenc, 1941)		•	•	•	•						•		N, NE, CW, SE
Pr. duncanae (Le Pont, Martinez, Torrez-Espejo & Dujardin, 1998)									•				N
Pr. dysponeta (Fairchild & Hertig, 1952)									•				CW
Pr. equatorialis (Mangabeira, 1942a)		•	•	•							•		N, SE
Pr. triacantha (Mangabeira, 1942c)		•	•	•									N, NE, CW
Pr. trispinosa (Mangabeira, 1942a)		•	•	•									N, NE, SE
Pa. abonnenci (Floch & Chassignet, 1947)				•									N, NE, CW, S
Pa. abunaensis (Martins, Falcão & Silva, 1965)	•	•											N
Pa. aragaoi (Costa Lima, 1932)		•		•	•								N, NE, CW, SE, S
Pa. baratai Sábio, Andrade & Galati, 2016									•				SE
Pa. barretti Alves & Freitas, 2015				•									N
Pa. barrettoi barrettoi (Mangabeira, 1942a)		•	•										N, NE, CW, SE

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Pa. bigeniculata (Floch & Abonnenc, 1941)				•	•	•			•	•	•	•	N, NE, CW, SE, S
Pa. brasiliensis (Costa Lima, 1932)		•		•	•								N, NE, CW, SE
Pa. campbelli (Damasceno, Causey & Arouck, 1945)				•									N, CW
Pa. campograndensis (Oliveira, Andrade Filho, Falcão & Brazil, 2001)									•				N, CW
Pa. coutinhoi (Mangabeira, 1942a)		•	•	•									N, CW
Pa. dasymera (Fairchild & Hertig, 1961)				•	•								N, CW
Pa. dendrophyla (Mangabeira, 1942a)			•	•	•						•		N, NE, CW, SE
Pa. digitata (Damasceno & Arouck, 1950)					•								NE
Pa. dreisbachi (Causey & Damasceno, 1945)		•		•	•					•			N, CW
Pa. elizabethdorvalae Brilhante, Sábio & Galati, 2017									•	•			N
Pa. hermanlenti (Martins, Silva & Falcão, 1970)		•	•	•									N, NE, CW, SE
Pa. inflata (Floch & Abonnenc, 1944)		•	•										N, CW
Pa. lanei (Barretto & Coutinho, 1941)					•	•				•	•		NE, CW, SE, S
Pa. lutziana (Costa Lima, 1932)	•	•	•	•									N, NE, CW, SE, S
Pa. naftalekatzi (Falcão, Andrade Filho, Almeida, Brandão-Filho, 2000)											•		NE
Pa. pascalei (Coutinho & Barretto, 1941c)		•	•										N, NE, SE, S
Pa. pelloni (Sherlock & Alencar, 1959)									•		•		NE, SE, S
Pa. limai (Fonseca, 1935)				•		•							SE, S
Pa. pifanoi (Ortiz, 1972)									•				N
Pa. pradobarrientosi (Le Pont, Matias, Martinez & Dujardin, 2004)									•				N, CW
Pa. punctigeniculata (Floch & Abonnenc, 1944)				•						•	•		N, NE, CW, SE, S
Pa. ribeirensis Sabio, Andrade & Galati, 2014									•				SE
Pa. runoides (Fairchild & Hertig, 1953)		•	•	•									N, CW, SE
Pa. scaffi (Damasceno & Arouck, 1956)				•									N, NE, CW
Pa. souzacastroi (Damasceno & Causey, 1944)				•	•								N

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Psychodopygus amazonensis (Root, 1934)									•	•		•	N, NE, CW
Ps. arthuri (Fonseca, 1936)									•		•	•	NE, SE
Ps. ayrozai (Barretto & Coutinho, 1940)*	•			•						•			N, NE, CW, SE, S
Ps. bernalei (Osorno-Mesa, Morales & Osorno, 1967)									•				N
Ps. bispinosus (Fairchild & Hertig, 1951)									•				N, NE, CW
Ps. carrerai (Barretto, 1946)	•									•			N, NE, CW, SE
Ps. chagasi (Costa Lima, 1941)									•		•		N, NE, CW
Ps. claustrei (Abonnenc, Léger & Fauran, 1979)									•	•			N, NE, CW
Ps. complexus (Mangabeira, 1941c)*									•		•		N, NE, CW
Ps. corossoniensis (Le Pont & Pajot, 1978)									•				N, NE
Ps. davisi (Root, 1934)	•	•	•	•						•		•	N, NE, CW, SE
Ps. douradoi (Fé, Freitas & Barrett, 1998)									•				N
Ps. fairchildi (Barretto, 1966)							•						SE
Ps. geniculatus (Mangabeira, 1941c)		•							•	•			N, NE, CW, SE, S
Ps. guyanensis (Floch & Abonnenc, 1941)									•		•	•	N, CW, SE
Ps. hirsutus (Mangabeira, 1942a)			•	•		•				•			N, NE, CW, SE, S
Ps. lainsoni (Fraiha & Ward, 1964)									•				N, CW
Ps. leonidasdeanei (Fraiha, Ryan, Ward, Lainson & Shaw, 1987)									•				N
Ps. llanosmartinsi (Fraiha & Ward, 1980)									•				N, CW
Ps. lloydi (Antunes, 1937)									•	•	•	•	NE, SE, CW, S
Ps. matosi (Barretto & Zago, 1956)				•	•					•			NE, SE
Ps. nicaraguensis (Fairchild & Hertig, 1961)									•				CW
Ps. panamensis (Shannon, 1926)									•				N
Ps. paraensis (Costa Lima, 1941)*		•									•		N, NE, CW, SE
Ps. squamiventris maripaensis (Floch & Abonnenc, 1946)									•				N

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Ps. squamiventris squamiventris (Lutz & Neiva, 1912)*									•		•	•	N, NE, CW
Ps. wellcomei (Fraiha, Shaw & Lainson, 1971)*									•				N, NE, CW
Ps. yucumensis (Le Pont, Caillard, Tibayrenc & Desjeux, 1986)									•				N
Sc. fluviatilis (Floch & Abonnenc, 1944)									•			•	N, NE
Sc. microps (Mangabeira, 1942a)	•		•	•			•						N, NE, CW, SE, S
Sc. nematoducta (Young & Arias, 1984)									•				N
Sc. pennyi (Arias & Freitas, 1981)									•				N
Sc. preclara (Young & Arias, 1984)									•				N
Sc. servulolimai (Damasceno & Causey, 1945)			•	•									N, NE, CW
Sc. sordellii (Shannon & Del Ponte, 1927)			•	•	•		•	•			•	•	N, NE, CW, SE, S
Th. adelsonsouzai Santos, Silva, Barata, Andrade & Galati, 2013									•				N
Th. auraensis (Mangabeira, 1942a)		•	•	•							•		N, CW
Th. brachipyga (Mangabeira, 1942a)		•	•	•							•	•	N
Th. castanheirai (Damasceno, Causey & Arouck, 1945)		•		•		•					•		N
Th. clitella (Young & Perez, 1994)										•			N, CW
Th. dunhami (Causey & Damasceno, 1945)				•									N
Th. eurypyga (Martins, Falcão & Silva, 1963)				•									N
Th. flochi (Abonnenc & Chassignet, 1948)									•				N
Th. gibba (Young & Arias, 1994)									•				N
Th. howardi (Young, 1979)									•				CW
Th. ininii (Floch & Abonnenc, 1943)									•				N
Th. lopesi (Damasceno, Causey & Arouck, 1945)									•	•			N
Th. loretoensis (Llanos, 1964)									•				N
Th. meirai (Causey & Damasceno, 1945)		•		•									N
Th. melloi (Causey & Damasceno, 1945)		•	•										N
Th. octavioi (Vargas, 1949)		•	•										N, CW
Th. readyi (Ryan, 1986)			•										N
Th. reinerti (Young & Duncan, 1994)									•				N
Th. rostrans (Summers, 1912)									•				N
Th. ruifreitasi Oliveira, Teles, Medeiros, Camargo & Pessoa, 2015									•				N
Th. ruii (Arias & Young, 1982)			•										N, CW

(continued)

Table 2 (continued)

Species	Habitats												Regions
	1	2	3	4	5	6	7	8	9	10	11	12	
Th. ubiquitalis (Mangabeira, 1942a)*		•	•	•	•								N, NE, CW, SE
Th. uniniensis Ladeia-Andrade, Fé, Sanguinette & Andrade Filho, 2014									•				N
Th. viannamartinsi (Sherlock & Guitton, 1970)		•		•			•						NE
Ty. conviti (Ramírez, Pérez, Martins & Ramírez, 1976)									•				N
Ty. dasypodogeton (Castro, 1939)		•	•	•									N, CW
Ty. elegans (Martins, Llanos & Silva, 1976)									•	•			N
Ty. longispina (Mangabeira, 1942d)		•	•	•	•								N, NE, CW, SE
Ty. pinna (Feliciangeli, Ramirez Pérez & Ramirez, 1989)									•				N
Ty. ratcliffei (Arias, Ready & Freitas, 1983)									•				N
Ty. rondonensis (Martins, Falcão & Silva, 1965)									•				N, CW
Ty. trichopyga (Floch & Abonnenc, 1945)			•										N, NE
Ty. wagleyi (Causey & Damasceno, 1945)	•	•	•										N
Vi. caprina (Osorno-Mesa, Morales e Osorno, 1972)								•					N
Vi. fariasi (Damasceno, Causey & Arouck, 1945)		•											N
Vi. furcata (Mangabeira, 1941d)	•	•	•	•						•			N, NE, CW
Vi. tuberculata (Mangabeira, 1941d)*		•	•	•	•						•	•	N, NE, CW

*Species found to be vectors of *Leishmania* to human and animals

Brazilian sand flies can be found mainly in 12 different habitats. Following guidance from Barretto (1943), 9 of them (1–9) can be considered wild habitats: (1) fallen leaves in forest soil, (2) armadillo burrows, (3) burrows of other wild animals, (4) tree trunks and tabular roots, (5) tree hollows, (6) treetops, (7) crevices in rocks, (8) caves, and (9) forest without specified location. Three of them (10–12) are semi-domestic and domestic habitats with human influence: (10) marginal areas, (11) annexes of domestic animals, and (12) outer and inner walls of human dwellings. From 279 recorded species, 178 (63.8%) essentially have wild habitats, and contact with humans is restricted to when humans enter the natural environment to perform activities related to agriculture, forestry, mining, and highway and hydroelectric construction, among other professionals who are directly in contact with the forest. The remaining 101 species (36.2%) are distributed among marginal areas (10)

represented by cultivated or pastoral areas and residual forests; the annexes of domestic animals (11) such as chicken coops, pigpens, corrals, kennels, etc.; and the outer and inner walls of human dwellings (12). These can be the annexes of domestic animals (pigpens, chicken coops, corrals, etc.) in near-habitat areas (cultivated areas) or even in the residual woodlands close to houses. Of the 22 species found to be vectors of *Leishmania* to human and animals, 17 are present in the human environment, *Bi. flaviscutellata*, *Lu. cruzi*, *Lu. gomezi*, *Lu. longipalpis*, *Mg. migonei*, *Ny. anduzei*, *Ny. antunesi*, *Ny. intermedia*, *Ny. neivai*, *Ny. whitmani*, *Pi. fischeri*, *Pi. pessoai*, *Ps. ayrozai*, *Ps. complexus*, *Ps. paraensis*, *Ps. squamiventris*, and *Vi. tuberculata*. Only 5—*Bi. olmeca bicolor*, *Bi. olmeca nociva*, *Ny. umbratilis*, *Ps. wellcomei*, and *Th. ubiquitalis*—are, to date, essentially wild. Five regions have wide distribution of *Lu. longipalpis*, *Mg. migonei*, *Ny. intermedia*, *Ny. whitmani*, and *Ps. ayrozai*. In four regions (N, NE, CW, SE), *Bi. flaviscutellata*, *Ps. paraensis*, and *Th. ubiquitalis* are reported to occur without records in the South region; *Ny. umbratilis* (N, NE, CW, S) without records in the SE region; *Ny. neivai* (N, CW, SE, S) without records in the NE region; and *Pi. fischeri* and *Pi. pessoai* in the North region (NE, CW, SE, S). In 3e regions, *Bi. olmeca nociva*, *Lu. gomezi, Ny. anduzei, Ny. antunesi, Ps. complexus*, *Ps. squamiventris squamiventris*, *Ps. wellcomei*, and *Vi. tuberculata,* (N, NE, CW) and *Lu. cruzi* (NE, CW, SE) occur. In two regions, *Bi. olmeca bicolor* (N, CW) and are known to occur (Table 2).

Leishmaniasis (cutaneous and visceral) is among the diseases that have a major impact on human health. They are considered emerging endemic diseases with a clear territorial expansion. They are included in the list of the Compulsory Notification Diseases System of the Ministry of Health with records in all Brazilian regions. Brazil is the country with the highest prevalence of these diseases in the Americas in both visceral and cutaneous forms (Brasil 2014, 2017; WHO 2010).

The classic profile of leishmaniasis is defined as wild animal zoonoses, which affect humans when they come into contact with the primary cycle in areas of preserved forests, such as in the Amazon, “cerrado” (savannas), and remnants of the Atlantic Forest. They have gradually expanded to rural and deforested areas and to the outskirts of cities. In some Brazilian states, there is a visible process of urbanization (Lainson 1983, 1988; Rangel 1995; Aguiar et al. 2014; Brasil 2017).

Some cycles of American cutaneous leishmaniasis (ACL) transmission deserve to be highlighted, such as the *Leishmania* (*Viannia*) *braziliensis* cycle, which is more widely dispersed in Brazil and is responsible for cutaneous and mucosal forms. Its main vectors are *Mg. migonei*, *Ny. intermedia*, *Ny. neivai*, *Ny. whitmani* and *Ps. wellcomei*. It is worth noting that a severe form of ACL, anergic diffuse leishmaniasis, caused by *Leishmania* (*Leishmania*) *amazonensis* and conveyed by *Bi. flaviscutellata*, was associated for some time with the wetlands of the Amazônia Legal, especially in the states of Pará and Maranhão. Currently, human cases have been registered in the SE, CW, and NE regions, a factor of evident geographical expansion process (Aguiar and Medeiros 2003; Rangel and Lainson 2009). A clinical condition of ACL, restricted to the Amazon, is represented by multiple lesions caused by *Leishmania* (*V.*) *guyanensis* and conveyed by *Ny. umbratilis* (Lainson & Shaw 2005; Rangel & Lainson 2009).

Currently, according to the control and safety strategies of the Ministry of Health, there are three epidemiological patterns of ACL. The first is wild, and transmission occurs in primary vegetation aeas where the disease is characterized as a wild animal zoonosis. The second is wild/occupational and leisure (affected areas) and is associated with disorderly exploitation of the forest and the clearing of forests for different purposes with the approach of humans to the wild cycles. Finally, there is the rural, peri-urban, and areas of ancient colonization related to migratory processes, occupying hillsides and agglomerates in urban centres, which are always linked to secondary or residual forests (Brasil 2017).

American visceral leishmaniasis (AVL) was associated with the rural environment and the outskirts of large cities. However, this epidemiological profile has been changing in some Brazilian regions where the parasitosis is already urbanized. According to the Ministry of Health's AVL Surveillance and Control Manual (2014), two epidemiological standards are defined: (1) the classical pattern associated with the rural environment, outskirts of cities, and low socioeconomic level; and (2) the recent pattern found in the urban environment in medium and large cities.

The most important vector of the etiologic agent of AVL in the Americas is *Lu. longipalpis*, which has been shown to be highly capable of occupying new environments (Brasil 2014).

Thus, leishmaniasis has a close relationship between micro-ecological conditions and links of the epidemiological chain with environmental, natural, or human-induced changes—especially the approximation of humans to wild zoonotic cycles—that directly influence its incidence and expansion. In several Brazilian regions, transmission occurs in areas that are practically deforested. In the peri-urban environment, there are changes in the epidemiological scenario, in which the sand flies, endowed with food eclecticism, would be able to transmit the parasite to humans and other synanthropic and domestic mammals (Lainson and Rangel 2005; WHO 2010). Migratory flow should be considered as an impacting component in the epidemiology of leishmaniasis. Such scenarios—particularly in the NE, CW, SE, and South regions of the country—have been studied (Rangel and Lainson 2009).

The most adapted species to environments that suffered intense anthropic action and that rarely occur in wild environments are *Ny. intermedia* and *Mg. migonei*. The first is the species with a greater capacity for domiciliation and greater adaptation to environments modified by humans. Its presence is always associated with banana crop. In the SE and South regions, its presence in forest areas is practically non-existent (Aguiar et al. 2014).

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