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Phlebotomine sand flies (Diptera, Psychodidae) from Rio de Janeiro State, Brazil: Species distribution and potential vectors of leishmaniases

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ABSTRACT. Phlebotomine sand flies (Diptera, Psychodidae) from Rio de Janeiro State, Brazil: Species distribution and potential vectors of leishmaniases. Rio de Janeiro State, in Brazil, has endemic areas of both cutaneous and visceral leishmaniases. In these areas, entomologic surveillance actions are highly recommended by Brazil's Ministry of Health. The present work describes the results of sand fly captures performed by the Health Department of Rio de Janeiro State between 2009 and 2011 in several municipalities. An updated species list and distribution of phlebotomine sand flies in the state are provided based on an extensive literature review. Currently, the sand fly fauna of Rio de Janeiro State has 65 species, belonging to the genera *Brumptomyia* (8 spp.) and *Lutzomyia* (57 spp.). Distribution maps of potential leishmaniases vector species *Lutzomyia* (*Nyssomyia*) *intermedia*, *L. migonei*, *L.* (*N.*) *whitmani*, *L.* (*N.*) *flaviscutellata* and *L.* (*Lutzomyia*) *longipalpis* are provided and their epidemiological importance is discussed.

KEYWORDS. Insecta; monitoring; Phlebotominae; review; species list.

Brazil is the country with the highest estimated annual incidences of American Visceral Leishmaniasis (AVL) and American Cutaneous Leishmaniasis (ACL) (Alvar *et al.* 2012). Both AVL and ACL are widespread in the Brazilian territory, where their notification is mandatory (Brasil 2006, 2007). The current spread of these diseases in the country reveals a change in their epidemiological profiles, shifting from rural to periurban areas, with human cases recorded even in capital cities such as Campo Grande (Brazuna *et al.* 2012), Belo Horizonte (Passos *et al.* 1993) and Rio de Janeiro (Marzochi *et al.* 2009).

Back in 1912, Adolpho Lutz and Arthur Neiva described three sand fly species, speculating in their possible role as disease vectors (Lutz & Neiva 1912). Two of these species were captured in Rio de Janeiro State: i) *Lutzomyia* (*Lutzomyia*) *longipalpis* in Mangaratiba and Rio de Janeiro municipalities; ii) *Lutzomyia* (*Nyssomyia*) *intermedia* in Rio de Janeiro municipality, in the neighborhoods of Santa Teresa and Laranjeiras.

The earliest report of ACL human cases in Rio de Janeiro State was published by D'Utra e Silva (1915), but the first documented outbreak of the disease occurred later in 1921 in Rio de Janeiro municipality, with about 50 human cases recorded in "Santa Thereza Hill", an area that today corresponds to Laranjeiras, Cosme Velho and Santa Teresa neighborhoods (Cerqueira & Vasconcelos 1922). At the same time, Aragão (1922, 1927) noticed the high frequency of sand flies associated with areas of ACL human cases and demonstrated the importance of *L.* (*N.*) *intermedia* on the transmission of *Leishmania* (*Viannia*) *braziliensis*.

Other important ACL outbreaks occurred in 1974 in Jacarepaguá, also in Rio de Janeiro municipality (Lima *et al.* 1988), and in 1975 in Ilha Grande, in Angra dos Reis municipality (Araújo Filho & Coura 1981). Currently, ACL is widely spread in the state, with 1,951 autochthonous human cases recorded in the past 10 years (2002 to 2011) (Oliveira-Neto *et al.* 2000; Kawa & Sabroza 2002; Bustamante *et al.* 2009).

According to the literature, the main ACL vector in Rio de Janeiro State is *L.* (*N.*) *intermedia*, with *L. migonei* being considered as secondary vector, especially in Rio de Janeiro municipality (Araújo Filho *et al.* 1981; Rangel *et al.* 1986; Pita-Pereira *et al.* 2005). Other potential vector species have been registered in endemic areas of the state, such as *L.* (*N.*) *whitmani*, *L.* (*N.*) *flaviscutellata*, *L.* (*Pintomyia*) *fischeri* and *L.* (*P.*) *pessoai* (Araújo Filho *et al.* 1981; Rangel *et al.* 1984, 1986, 1990; Souza *et al.* 2002).

The number of human cases of AVL in the state is much lower than ACL cases. In the same 10-year period (2002 to 2011), 49 autochthonous human cases were recorded. It was in the late 1970s that the first AVL autochthonous case was recorded: a then deceased 55 year old man who lived in Bangu (Rio de Janeiro municipality) (Salazar *et al.* 1979). Currently, in the state, the disease has been registered in several municipalities, but most human cases are concentrated in Rio de Janeiro, around the Pedra Branca Massif, and in continental slopes of the Gericinó Massif, in Bangu, Senador Camará, Realengo, Campo Grande, Guaratiba, Barra de Guaratiba, Barra da Tijuca, Grumari, Vargem Grande, Camo-

rim, Curicica, Taquara and Gericinó neighborhoods (Marzochi *et al.* 2009). The main vector of *Leishmania* (*Leishmania*) *infantum chagasi* in Brazil, *L.* (*Lutzomyia*) *longipalpis*, was also already detected in Rio de Janeiro State on several studies (Araújo Filho *et al.* 1981; Souza *et al.* 1981, 2003a; Marzochi *et al.* 1985, 2009).

Brazil's Ministry of Health recommends that every leishmaniases outbreak must be surveyed for occurrence of sand fly vectors (Brasil 2006, 2007). When planning an entomologic survey of a particular area, it is essential to know if the area has been surveyed before and which sand fly species have been detected there. Most recent studies on the distribution of sand flies from Brazil list 53 species occurring in Rio de Janeiro State (CIPA Group 1999; Aguiar & Medeiros 2003; Galati 2003). The last publication on the sand fly fauna from the state in a finer scale was Martins *et al.* (1978). Here, an updated sand fly species list and distribution in Rio de Janeiro State is provided, based on the entomologic surveillance activities of the Health Department of Rio de Janeiro State and an extensive literature review.

MATERIAL AND METHODS

Entomologic surveys have been done systematically by the Health Department of Rio de Janeiro State. Whenever a new human case of leishmaniasis is notified, sand fly captures are performed to survey the probable area of infection and detect potential vector species. Sand flies were captured with CDC (Sudia & Chamberlain 1962) or HP (Pugedo *et al.* 2005) light traps, following recommendations by Brazil's Ministry of Health (Brasil 2006, 2007). Species identification was based on the taxonomic key of Young & Duncan (1994).

Literature search was performed on the following online databases: Medline (http://www.ncbi.nlm.nih.gov/pubmed/), Scopus (http://www.scopus.com), Scielo (http://www.scielo.org), *Biblioteca Virtual em Saúde* (http://regional.bvsalud.org) and Google Scholar (http://scholar.google.com). Thesis databases from *Fundação Oswaldo Cruz* were also consulted (http://www.arca.fiocruz.br). Every reference that was not available online was searched on two libraries from *Fundação Oswaldo Cruz*: *Biblioteca de Ciências Biomédicas* (http://www.fiocruz.br/bibcb) and *Biblioteca de Saúde Pública* (http://www.fiocruz.br/bibsp). Each retrieved reference was carefully reviewed for sand fly records from Rio de Janeiro State, and a database was compiled with species records by municipality.

Distribution maps were created for potential vectors of *Leishmania* spp. and leishmaniases human cases recorded by the Health Department of Rio de Janeiro State between years 2002 and 2011. Maps were designed with the municipality territorial division of IBGE (2010), in ArcGIS 10 software.

As expected, during this review, different species nomenclatures were found. In order to facilitate text comprehension, every sand fly species name was adapted to the nomenclature proposed by Young & Duncan (1994).

RESULTS

Between 2009 and 2011, 22 municipalities were surveyed by the Health Department of Rio de Janeiro: Armação dos Búzios, Barra Mansa, Cambuci, Campos dos Goytacazes, Cantagalo, Duas Barras, Itaguaí, Itaperuna, Itatiaia, Macaé, Miguel Pereira, Porciúncula, Porto Real, Rio Bonito, Rio de Janeiro, Santa Maria Madalena, São Fidélis, Trajano de Moraes, Três Rios, Valença, Vassouras and Volta Redonda. In these surveys, 25 sand fly species were detected: *Brumptomyia brumpti*, *B. nitzulescui, Lutzomyia* (*L.*) *longipalpis, L.* (*L.*) *ischyracantha, L.* (*L.*) *alencari, L.* (*S.*) *sordellii, L. edwardsi, L. migonei, L. sallesi, L. tupynambai, L. termitophila, L. firmatoi, L. walkeri, L.* (*P.*) *pessoai, L.* (*P.*) *fischeri, L.* (*P.*) *bianchigalatiae, L. aragaoi, L.* (*T.*) *longispina, L.* (*N.*) *whitmani, L.* (*N.*) *intermedia, L.* (*P.*) *davisi, L.* (*P.*) *hirsuta hirsuta, L.* (*P.*) *ayrozai, L. quinquefer* and *L. oswaldoi*.

The literature review resulted in a database with 61 sand fly species from 70 references, including 64 published articles, 2 dissertations, 2 monographs, 1 research report and 1 book chapter.

Rio de Janeiro sand fly fauna consists of 65 species, from genus *Brumptomyia* (8 spp.) and *Lutzomyia* (57 spp.). The *Lutzomyia* species was represented by nine subgenus and five species groups, as well as two ungrouped species. Species list and distribution by municipality is provided next. New records for the state, when compared with previous distribution reviews (Martins *et al.* 1968; CIPA Group 1999; Aguiar & Medeiros 2003; Galati 2003) are marked with (*). Type localities are marked with (**) and doubtful records with (***).

Genus *Brumptomyia* França & Parrot, 1921 (8 spp.):

B. avellari (Costa Lima, 1932): Angra dos Reis (Rendeiro 2007), Bom Jesus do Itabapoana (Rezende *et al.* 2009), Cardoso Moreira (Mangabeira Filho 1942b; Martins *et al.* 1978), Itaguaí (Aguiar *et al.* 1996).

B. brumpti (Larrousse, 1920)*: Campos dos Goytacazes, Mangaratiba (Novo *et al.* 2013), Miguel Pereira, Petrópolis (Souza *et al.* 2002, 2005a), Rio de Janeiro (Gouveia *et al.* 2012), São Fidélis, Três Rios, Valença.

B. cardosoi (Barretto & Coutinho, 1941): Duque de Caxias (Martins *et al.* 1978), Magé (Aguiar *et al.* 1985c; Aguiar & Vilela 1987), Nova Iguaçu (Martins *et al.* 1978), Petrópolis (Souza *et al.* 2002, 2005a), Valença (Martins *et al.* 1978).

B. cunhai (Mangabeira, 1942): Angra dos Reis (Araújo Filho *et al.* 1981; Carvalho *et al.* 2013), Itaguaí (Aguiar *et al.* 1996), Maricá (Rodrigues *et al.* 2013), Niterói (Rodrigues *et al.* 2013), Nova Iguaçu (Martins *et al.* 1978), Rio de Janeiro (Souza *et al.* 2000), Saquarema (Brazil *et al.* 2011).

B. guimaraesi (Coutinho & Barretto, 1941): Angra dos Reis (Rendeiro 2007), Casimiro de Abreu (Souza *et al.* 2001), Itaguaí (Aguiar *et al.* 1996), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar *et al.* 1985c; Aguiar & Vilela 1987), Mesquita (Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Paraty (Carvalho *et al.* 1995, 2000), Petrópolis (Souza *et al.* 2002, 2005a), Rio de Janeiro (Cabrera *et al.* 2003), Saquarema (Brazil *et al.* 2011).

B. nitzulescui (Costa Lima, 1932): Angra dos Reis (Araújo Filho *et al.* 1981; Carvalho *et al.* 2013), Duque de Caxias (Martins *et al.* 1978), Itaguaí, Mesquita (Meneses *et al.* 2002), Niterói (Rodrigues *et al.* 2013), Nova Iguaçu (Martins *et al.* 1978), Rio de Janeiro (Gouveia *et al.* 2012), Valença (Martins *et al.* 1978).

B. pintoi (Costa Lima, 1932): Cardoso Moreira (Martins *et al.* 1978).

B. troglodytes (Lutz, 1922): Itatiaia (Afonso *et al.* 2007), Magé (Aguiar *et al.* 1985c; Aguiar & Vilela 1987), Nova Iguaçu (Martins *et al.* 1978).

Genus *Lutzomyia* França, 1924 (57 spp.):

Subgenus *L. (Lutzomyia)* França, 1924 (5 spp.):

L. (*L.*) *amarali* (Barretto & Coutinho, 1940): Bom Jesus do Itabapoana (Rezende *et al.* 2009), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar *et al.* 1985c), Petrópolis (Martins *et al.* 1978; Souza *et al.* 2002, 2005a).

L. (*L.*) *longipalpis* (Lutz & Neiva, 1912): Angra dos Reis (Araújo Filho & Sherlock 1981; Araújo Filho *et al.* 1981; Carvalho *et al.* 2013), Armação dos Búzios, Barra Mansa, Casimiro de Abreu (Souza *et al.* 2001), Itaguaí (Aguiar *et al.* 1987, 1996), Macaé (Martins *et al.* 1978), Mangaratiba (Lutz & Neiva 1912; Novo *et al.* 2013), Mesquita (Rangel *et al.* 1990; Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Niterói (Rodrigues *et al.* 2013), Paraty (Moutinho *et al.* 2010), Petrópolis (Souza *et al.* 2002), Rio Bonito (Brazil *et al.* 1989), Rio de Janeiro (Lutz & Neiva 1912; Fundação Oswaldo Cruz 1974; Martins *et al.* 1978; Lima *et al.* 1981; Souza *et al.* 1981, 2003b; Rangel *et al.* 1986; Cabrera *et al.* 2003; Brazil 2013), São Fidélis, Saquarema (Brazil *et al.* 2011, 2012), Valença, Volta Redonda.

L. (*L.*) *ischyracantha** Martins, Falcão & Silva, 1962: São Fidélis.

L. (*L.*) *alencari* Martins, Souza & Falcão, 1962: São Fidélis.

L. (*L.*) *gasparviannai* Martins, Godoy & Silva, 1962: Nova Iguaçu** (Martins *et al.* 1962b, 1978).

Subgenus *L. (Sciopemyia)* Barretto, 1962 (2 spp.):

L. (*S.*) *sordellii* (Shannon & Del Ponte, 1927): Armação dos Búzios, Macaé, Rio de Janeiro (Oliveira *et al.* 1995; Gouveia *et al.* 2012), Três Rios.

L (*S.*) *microps* (Mangabeira, 1942): Angra dos Reis (Carvalho *et al.* 2013), Magé (Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a; Aguiar & Vilela 1987), Mangaratiba (Martins *et al.* 1978), Niterói (Rodrigues *et al.* 2013), Nova Iguaçu** (Mangabeira Filho 1942a; Martins *et al.* 1978), Petrópolis (Martins *et al.* 1962a, 1978; Souza *et al.* 2002, 2005a).

Species Group *Migonei* Theodor, 1965 (11 spp.):

L. lenti (Mangabeira, 1938): Bom Jesus do Itabapoana (Rezende *et al.* 2009), Carmo (Alves 2007), Macaé (Martins *et al.* 1978), Rio de Janeiro (Oliveira *et al.* 1995).

L. edwardsi (Mangabeira, 1941): Angra dos Reis (Araújo Filho *et al.* 1981; Rendeiro 2007; Carvalho *et al.* 2013), Bom Jardim (Souza *et al.* 2003a), Duque de Caxias (Martins *et al.* 1978), Itaguaí (Aguiar *et al.* 1996), Itatiaia (Martins *et al.* 1978; Afonso *et al.* 2007), Magé (Aguiar *et al.* 1985c; Aguiar & Vilela 1987), Mangaratiba (Martins *et al.* 1978; Novo *et al.* 2013), Maricá (Rodrigues *et al.* 2013), Mesquita (Rangel *et al.* 1990), Niterói (Rodrigues *et al.* 2013), Nova Iguaçu** (Martins *et al.* 1978; Mangabeira Filho 1941), Paraty (Aguiar *et al.* 1993; Costa *et al.* 2004; Carvalho *et al.* 1995, 2000), Petrópolis (Martins *et al.* 1962a; Martins *et al.* 1978; Souza *et al.* 2002, 2005a), Rio de Janeiro (Cabrera *et al.* 2003; Souza *et al.* 2003b; Gouveia *et al.* 2012), Silva Jardim (Souza *et al.* 2001), Valença (Martins *et al.* 1978), Vassouras.

L. migonei (França, 1920): Angra dos Reis (Araújo Filho *et al.* 1981; Martins *et al.* 1978; Rendeiro 2007; Souza *et al.* 2009; Carvalho *et al.* 2013), Bom Jardim (Souza *et al.* 2003a), Bom Jesus do Itabapoana (Rezende *et al.* 2009), Cambuci, Cantagalo, Carmo (Alves 2007), Casimiro de Abreu (Souza *et al.* 2001), Duque de Caxias (Martins *et al.* 1978), Itaguaí (Aguiar *et al.* 1987, 1996), Itatiaia (Afonso *et al.* 2007), Macaé (Martins *et al.* 1978), Magé (Martins *et al.* 1978), Mangaratiba (Costa Lima 1932; Martins *et al.* 1978; Novo *et al.* 2013), Mesquita (Rangel *et al.* 1990; Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Miguel Pereira, Niterói (Brazil *et al.* 1989; Brazil *et al.* 1991; Rodrigues *et al.* 2013), Nova Iguaçu (Martins *et al.* 1978), Paracambi (Santos 1998), Paraty (Aguiar *et al.* 1993; Carvalho *et al.* 1995, 2000; Costa *et al.* 2004; Moutinho *et al.* 2010), Petrópolis (Barretto & Zago Filho 1956; Martins *et al.* 1962a, 1978; Souza *et al.* 2002, 2005a), Resende (Martins *et al.* 1978), Rio Bonito (Martins *et al.* 1978; Brazil *et al.* 1989), Rio de Janeiro (Aragão 1927; Costa Lima 1932; Fundação Oswaldo Cruz 1974; Martins *et al.* 1978; Lima *et al.* 1981, 1988; Souza *et al.* 1981, 2000, 2003b; Rangel *et al.* 1986; Cabrera *et al.* 2003; Pita-Pereira *et al.* 2005; Gouveia *et al.* 2012), Santa Maria Madalena, São Fidélis, Saquarema (Brazil *et al.* 2011), Seropédica (Cardoso *et al.* 2009), Valença, Vassouras (Martins *et al.* 1978).

L. cortelezzii (Brèthes, 1923)*: Mangaratiba (Novo *et al.* 2013), Mesquita (Rangel *et al.* 1990), Niterói (Rodrigues *et al.* 2013), Nova Iguaçu (Santana 2003), Rio de Janeiro (Souza *et al.* 1981), Rio de Janeiro (Souza *et al.* 2003b).

L. sallesi (Galvão & Coutinho, 1939): Barra Mansa, Cambuci, Cantagalo, Itaperuna, Itatiaia (Afonso *et al.* 2007), Mesquita (Meneses *et al.* 2002), Niterói (Brazil *et al.* 1991), Nova Iguaçu (Santana 2003), Petrópolis (Martins *et al.* 1962a, 1978), Porciúncula, Resende (Martins *et al.* 1978), Rio de Janeiro (Oliveira *et al.* 1995; Souza *et al.* 2003b), São Fidélis, Valença.

L. tupynambai (Mangabeira, 1942): Angra dos Reis (Carvalho *et al.* 2013; Souza *et al.* 2009), Campos dos Goytacazes (Martins *et al.* 1978), Cardoso Moreira** (Mangabeira Filho 1942a), Itatiaia (Afonso *et al.* 2007), Mangaratiba (Martins *et al.* 1978), Maricá (Rodrigues *et al.* 2013), Niterói (Rodrigues *et al.* 2013), Paraty (Moutinho *et al.* 2010), Petrópolis (Martins *et al.* 1962a, 1978; Souza *et al.* 2002, 2005a), São Fidélis.

L. costalimai (Mangabeira, 1942): Bom Jardim (Souza *et al.* 2003a), Campos dos Goytacazes (Martins *et al.* 1978), Cardoso Moreira** (Mangabeira Filho 1942a), Mangaratiba (Martins *et al.* 1978), Petrópolis (Souza *et al.* 2002, 2005a), Rio de Janeiro (Souza *et al.* 2003b).

L. petropolitana Martins & Silva, 1968: Petrópolis** (Martins & Silva 1968; Martins *et al.* 1978).

L. termitophila Martins, Falcão & Silva, 1964: Angra dos Reis (Carvalho *et al.* 2013), Cambuci, Petrópolis (Souza *et al.* 2002), Petrópolis (Souza *et al.* 2005a), Rio de Janeiro (Oliveira *et al.* 1995).

L. firmatoi (Barretto, Martins & Pellegrino, 1956): Angra dos Reis (Carvalho *et al.* 2013), Bom Jardim (Souza *et al.* 2003a), Itaguaí (Aguiar *et al.* 1996), Mangaratiba (Novo *et al.* 2013), Mesquita (Rangel *et al.* 1990), Miguel Pereira, Niterói (Brazil *et al.* 1989), Nova Iguaçu (Martins *et al.* 1978), Paraty (Aguiar *et al.* 1993; Moutinho *et al.* 2010), Petrópolis (Souza *et al.* 2002, 2005a), Rio de Janeiro (Souza *et al.* 1981, 2000, 2003b; Rangel *et al.* 1986; Lima *et al.* 1988), São Pedro da Aldeia (Martins *et al.* 1978).

L. walkeri (Newstead, 1914)*: São Fidélis.

Species Group *Verrucarum* Theodor, 1965 (1 sp.):

L. serrana (Damasceno & Arouck, 1949): Mesquita (Meneses *et al.* 2002), Nova Iguaçu (Martins *et al.* 1978).

Subgenus *L. (Pintomyia)* Costa Lima, 1932 (3 spp.):

L. (*P.*) *pessoai* (Coutinho & Barretto, 1940): Angra dos Reis (Rendeiro 2007), Itaguaí (Aguiar *et al.* 1987, 1996), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a, 1985b; Aguiar & Vilela 1987), Mangaratiba (Martins *et al.* 1978), Niterói (Brazil *et al.* 1989, 1991), Paracambi (Santos 1998), Paraty (Aguiar *et al.* 1993), Petrópolis (Barretto & Zago Filho 1956; Martins *et al.* 1978; Souza *et al.* 2002, 2005a), Rio de Janeiro (Souza *et al.* 2000, 2003b), Saquarema (Brazil *et al.* 2011), Vassouras.

L. (*P.*) *fischeri* (Pinto, 1926): Angra dos Reis (Martins *et al.* 1978; Rendeiro 2007; Souza *et al.* 2009), Bom Jardim (Souza *et al.* 2003a), Bom Jesus do Itabapoana (Rezende *et al.* 2009), Cantagalo, Casimiro de Abreu (Souza *et al.* 2001), Duque de Caxias (Martins *et al.* 1978), Itaguaí (Aguiar *et al.* 1987, 1996), Magé (Martins *et al.* 1978; Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a, 1985b, 1985c, 1986; Aguiar & Vilela 1987), Mangaratiba (Novo *et al.* 2013), Mesquita (Rangel *et al.* 1990), Niterói (Brazil *et al.* 1989, 1991), Nova Iguaçu (Martins *et al.*

1978), Paracambi (Santos 1998), Paraty (Aguiar *et al.* 1993; Carvalho *et al.* 1995, 2000; Costa *et al.* 2004; Moutinho *et al.* 2010), Petrópolis (Barretto & Zago Filho 1956; Martins *et al.* 1962a, 1978; Souza *et al.* 2002, 2005a), Resende (Martins *et al.* 1978), Rio Bonito (Brazil *et al.* 1989), Rio de Janeiro (Fundação Oswaldo Cruz 1974; Martins *et al.* 1978; Lima *et al.* 1981; Souza *et al.* 1981, 2000, 2003b; Rangel *et al.* 1986; Gouveia *et al.* 2012), Saquarema (Brazil *et al.* 2011), Valença, Vassouras (Martins *et al.* 1978).

L. (*P.*) *bianchigalatiae* (Andrade-Filho, Aguiar, Dias & Falcão, 1999): Itaguaí (Andrade Filho *et al.* 1999); Itatiaia (Afonso *et al.* 2007); Magé (Andrade Filho *et al.* 1999); Mangaratiba (Novo *et al.* 2013); Mesquita (Meneses *et al.* 2002); Niterói (Rodrigues *et al.* 2013); Saquarema (Brazil *et al.* 2011), Valença.

Subgenus *L. (Pressatia)* Mangabeira, 1942 (1 sp.):

L. (*P.*) *mamedei* Oliveira, Afonso, Dias & Brazil, 1994: Paraty (Carvalho *et al.* 1995, 2000), Rio de Janeiro** (Oliveira *et al.* 1994, 1995).

Species Group *Rupicola* Lewis *et al.*, 1977 (1 sp.):

L. rupicola Martins, Godoy & Silva, 1962: Angra dos Reis (Carvalho *et al.* 2013), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar *et al.* 1985c), Petrópolis** (Martins *et al.* 1962a, 1978).

Subgenus *L. (Psathyromyia)* Barretto, 1962 (2 spp.):

L. (*P.*) *lutziana* (Costa Lima, 1932): Cardoso Moreira (Martins *et al.* 1978), Macaé (Martins *et al.* 1978), Magé (Martins *et al.* 1978), Mesquita (Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Nova Iguaçu (Martins *et al.* 1978), Paraty (Carvalho *et al.* 1995, 2000), Petrópolis (Souza *et al.* 2005a), Rio de Janeiro (Gouveia *et al.* 2012).

L. (*P.*) *shannoni* (Dyar, 1929): Angra dos Reis (Rendeiro 2007), Casimiro de Abreu (Souza *et al.* 2001), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a, 1985b, 1985c, 1986), Mesquita (Rangel *et al.* 1990), Nova Iguaçu (Martins *et al.* 1978), Paracambi (Santos 1998), Paraty (Aguiar *et al.* 1993), Petrópolis (Barretto & Zago Filho 1956), Petrópolis (Martins *et al.* 1962a, 1978; Souza *et al.* 2002, 2005a), Resende (Martins *et al.* 1978), Rio de Janeiro (Martins *et al.* 1978), Silva Jardim (Souza *et al.* 2001).

Species Group *Aragaoi* Theodor, 1965 (4 spp.):

L. barrettoi barrettoi (Mangabeira, 1942): Angra dos Reis (Rendeiro 2007), Casimiro de Abreu (Souza *et al.* 2001), Itaguaí (Aguiar *et al.* 1996), Magé (Aguiar *et al.* 1985c; Aguiar & Vilela 1987), Mesquita (Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Petrópolis (Martins *et al.* 1962a, 1978; Souza *et al.* 2002, 2005a), Rio de Janeiro (Rangel *et al.* 1986), Silva Jardim (Souza *et al.* 2001).

L. pascalei (Coutinho & Barretto, 1940): Angra dos Reis (Araújo Filho *et al.* 1981; Carvalho *et al.* 2013), Itatiaia (Afonso *et al.* 2007), Mesquita (Meneses *et al.* 2002), Nova Iguaçu (Martins *et al.* 1978), Paraty (Aguiar *et al.* 1993).

L. aragaoi (Costa Lima, 1932): Angra dos Reis (Rendeiro 2007), Magé (Aguiar & Vilela 1987), Três Rios.

L. brasiliensis (Costa Lima, 1932): Cardoso Moreira (Martins *et al.* 1978).

Species Group *Lanei* Theodor, 1965 (2 spp.):

L. pelloni (Sherlock & Alencar, 1959): Angra dos Reis (Souza *et al.* 2009; Carvalho *et al.* 2013), Bom Jardim (Souza *et al.* 2003a), Duque de Caxias (Martins *et al.* 1978), Magé (Martins *et al.* 1978), Mangaratiba (Martins *et al.* 1978; Novo *et al.* 2013), Niterói (Brazil *et al.* 1989), Nova Iguaçu (Martins *et al.* 1978), Rio de Janeiro (Fundação Oswaldo Cruz 1974; Rangel *et al.* 1986; Lima *et al.* 1988; Souza *et al.* 2000, 2003b; Gouveia *et al.* 2012).

L. lanei (Barretto & Coutinho, 1941): Angra dos Reis (Araújo Filho *et al.* 1981), Itaguaí (Aguiar *et al.* 1996), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar *et al.* 1985c), Mangaratiba (Martins *et al.* 1978), Maricá (Rodrigues *et al.* 2013), Mesquita (Rangel *et al.* 1990; Meneses *et al.* 2002), Niterói (Rodrigues *et al.* 2013), Nova Iguaçu (Martins *et al.* 1978), Petrópolis (Barretto & Zago Filho 1956), Petrópolis (Martins *et al.* 1962a, 1978), Resende (Martins *et al.* 1978), Rio de Janeiro (Rangel *et al.* 1986).

Subgenus *L. (Trichopygomyia)* Barretto, 1962 (1 sp.):

L. (*T.*) *longispina* (Mangabeira, 1942)*: Valença.

Subgenus *L. (Nyssomyia)* Barretto, 1962 (3 spp.):

L. (*N.*) *flaviscutellata* (Mangabeira, 1942): Angra dos Reis (Araújo Filho *et al.* 1981; Carvalho *et al.* 2013), Nova Iguaçu (Martins *et al.* 1978), Petrópolis (Martins *et al.* 1962a, 1978).

L. (*N.*) *whitmani* (Antunes & Coutinho, 1939): Angra dos Reis (Rendeiro 2007), Bom Jardim (Souza *et al.* 2003a), Bom Jesus do Itabapoana (Rezende *et al.* 2009), Cantagalo, Carmo (Alves 2007), Casimiro de Abreu (Souza *et al.* 2001), Itaguaí (Aguiar *et al.* 1987, 1996), Itaperuna, Itatiaia, Mesquita (Rangel *et al.* 1990; Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Miguel Pereira, Paracambi (Santos 1998), Paraty (Aguiar *et al.* 1993; Carvalho *et al.* 1995, 2000), Petrópolis (Souza *et al.* 2002, 2005a, 2005b), Rio de Janeiro (Lima *et al.* 1981; Rangel *et al.* 1986; Oliveira *et al.* 1995; Souza *et al.* 2000, 2003b; Cabrera *et al.* 2003), São Fidélis, Saquarema (Brazil *et al.* 2011), Seropédica (Cardoso *et al.* 2009), Silva Jardim (Souza *et al.* 2001), Três Rios, Valença, Volta Redonda.

L. (*N.*) *intermedia* (Lutz & Neiva, 1912): Angra dos Reis (Martins *et al.* 1978; Araújo Filho *et al.* 1981; Rendeiro 2007; Souza *et al.* 2009; Carvalho *et al.* 2013), Araruama (Martins *et al.* 1978), Bom Jardim (Souza *et al.* 2003a), Bom Jesus do Itabapoana (Rezende *et al.* 2009), Cambuci, Cantagalo, Carmo (Alves 2007), Casimiro de Abreu (Souza *et al.* 2001), Duas Barras, Itaboraí (Martins *et al.* 1978), Itaguaí (Aguiar *et al.* 1987, 1996), Itaperuna (Martins *et al.* 1978), Itaperuna, Itatiaia, Macaé (Martins *et al.* 1978), Magé (Nery-Guimarães & Bustamante 1954; Nery-Guimarães 1955; Martins *et al.* 1978), Mangaratiba (Martins *et al.* 1978; Novo *et al.* 2013), Mesquita (Rangel *et al.* 1990; Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002, 2005; Afonso *et al.* 2005), Miguel Pereira, Niterói (Brazil *et al.* 1989, 1991; Rodrigues *et al.* 2013), Nova Iguaçu (Martins *et al.* 1978; Santana 2003), Paracambi (Santos 1998), Paraty (Aguiar *et al.* 1993; Carvalho *et al.* 1995, 2000; Costa *et al.* 2004; Moutinho *et al.* 2010), Petrópolis (Barretto & Zago Filho 1956; Martins *et al.* 1962a, 1978; Souza *et al.* 2002, 2005a, 2005b), Porto Real, Resende (Martins *et al.* 1978), Rio Bonito (Martins *et al.* 1978; Brazil *et al.* 1989), Rio de Janeiro (Lutz & Neiva 1912; Aragão 1927; Costa Lima 1932; Fundação Oswaldo Cruz 1974; Martins *et al.* 1978; Lima *et al.* 1981, 1988; Souza *et al.* 1981, 2000, 2003b; Rangel *et al.* 1984, 1986; Oliveira-Neto *et al.* 1988; Oliveira *et al.* 1995; Cabrera *et al.* 2003; Pita-Pereira *et al.* 2005; Gouveia *et al.* 2012), Santa Maria Madalena, São Fidélis, Saquarema (Brazil *et al.* 2011), Seropédica (Cardoso *et al.* 2009), Silva Jardim (Souza *et al.* 2001), Trajano de Moraes, Três Rios, Valença (Martins *et al.* 1978), Vassouras (Martins *et al.* 1978), Volta Redonda.

Subgenus *L. (Psychodopygus)* Mangabeira, 1941 (10 spp.):

L. (*P.*) *geniculata* (Mangabeira, 1941): Paraty (Aguiar *et al.* 1993).

L. (*P.*) *matosi* (Barretto & Zago Filho, 1956): Itatiaia (Afonso *et al.* 2007), Petrópolis** (Barretto & Zago Filho 1956; Martins *et al.* 1978), Resende (Martins *et al.* 1978), Vassouras (Martins *et al.* 1978).

L. (*P.*) *arthuri* (Fonseca, 1936): Paraty (Aguiar *et al.* 1993), Petrópolis (Barretto & Zago Filho 1956; Martins *et al.* 1978).

L. (*P.*) *lloydi* (Antunes, 1937): Bom Jardim (Souza *et al.* 2003a), Petrópolis (Barretto & Zago Filho 1956; Souza *et al.* 2002, 2005a; Martins *et al.* 1978).

L. (*P.*) *davisi* (Root, 1934): Angra dos Reis (Souza *et al.* 2009); Duque de Caxias (Martins *et al.* 1978), Itatiaia (Afonso *et al.* 2007), Magé (Martins *et al.* 1978; Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a, 1985b);

Nova Iguaçu (Martins *et al.* 1978), Paraty (Carvalho *et al.* 1995, 2000), Valença, Vassouras (Martins *et al.* 1978).

L. (*P.*) *hirsuta hirsuta* (Mangabeira, 1942): Casimiro de Abreu (Souza *et al.* 2001), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a, 1985b, 1985c, 1986; Aguiar & Vilela 1987), Nova Iguaçu (Martins *et al.* 1978), Paracambi (Santos 1998), Petrópolis (Martins *et al.* 1962a, 1978), Rio de Janeiro (Souza *et al.* 2003b; Gouveia *et al.* 2012), Silva Jardim (Souza *et al.* 2001), Valença.

L. (*P.*) *paraensis* (Costa Lima, 1941)***: Bom Jardim (Souza *et al.* 2003a).

L. (*P.*) *ayrozai* (Barretto & Coutinho, 1940): Angra dos Reis (Souza *et al.* 2009; Rendeiro 2007; Carvalho *et al.* 2013), Carmo (Alves 2007), Duque de Caxias (Martins *et al.* 1978), Itatiaia (Afonso *et al.* 2007), Magé (Martins *et al.* 1978; Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a, 1985b, 1985c, 1986; Aguiar & Vilela 1987), Mesquita (Meneses *et al.* 2002), Nova Iguaçu (Martins *et al.* 1978), Paraty (Aguiar *et al.* 1993), Petrópolis (Barretto & Zago Filho 1956; Martins *et al.* 1962a, 1978), Resende (Martins *et al.* 1978), Silva Jardim (Souza *et al.* 2001), Valença, Vassouras (Martins *et al.* 1978).

L. (*P.*) *carrerai carrerai* (Barretto, 1946): Itatiaia (Barretto 1955), Resende (Martins *et al.* 1978).

L. (*P.*) *fairchildi* Barretto, 1966: Itatiaia** (Barretto 1966, Martins *et al.* 1978).

Subgenus *L. (Micropygomyia)* Barretto, 1962 (3 spp.):

L. (*M.*) *minasensis* (Mangabeira, 1942)*: Petrópolis (Souza *et al.* 2002, 2005a).

L. (*M.*) *schreiberi* Martins, Falcão & Silva, 1975: Angra dos Reis (Araújo Filho *et al.* 1981; Souza *et al.* 2009; Carvalho *et al.* 2013), Duque de Caxias (Martins *et al.* 1978), Itaboraí (Martins *et al.* 1978), Itaguaí (Aguiar *et al.* 1987, 1996), Itaperuna (Martins *et al.* 1978), Macaé (Martins *et al.* 1978), Magé (Martins *et al.* 1978), Mangaratiba (Martins *et al.* 1978), Mangaratiba (Martins *et al.* 1978; Novo *et al.* 2013), Maricá (Rodrigues *et al.* 2013), Mesquita (Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Niterói (Brazil *et al.* 1989), Niterói (Martins *et al.* 1978; Rodrigues *et al.* 2013), Nova Iguaçu (Martins *et al.* 1978), Paraty (Aguiar *et al.* 1993; Carvalho *et al.* 1995, 2000; Moutinho *et al.* 2010), Petrópolis (Martins *et al.* 1962a, cited as *L. micropygus*; Martins *et al.* 1978), Rio Bonito (Martins *et al.* 1978; Brazil *et al.* 1989), Rio de Janeiro (Martins *et al.* 1978; Rangel *et al.* 1986; Lima *et al.* 1988; Oliveira *et al.* 1995; Souza *et al.* 2000, 2003b Cabrera *et al.* 2003; Gouveia *et al.* 2012), São Pedro da Aldeia (Martins *et al.* 1978), Teresópolis (Martins *et al.* 1978).

L. (*M.*) *micropyga* (Mangabeira, 1942)***: Rio de Janeiro (Fundação Oswaldo Cruz 1974; Souza *et al.* 1981).

Species Group *Oswaldoi* Theodor, 1965 (6 spp.):

L. borgmeieri Martins, Falcão & Silva, 1972: Itaboraí (J. D. Andrade Filho, personal communication).

L. quinquefer (Dyar, 1929): Angra dos Reis (Souza *et al.* 2009), Armação dos Búzios, Bom Jardim (Souza *et al.* 2003a), Bom Jesus do Itabapoana (Rezende *et al.* 2009), Cantagalo, Carmo (Alves 2007), Itaguaí (Aguiar *et al.* 1996), Itaperuna (Martins *et al.* 1978), Mangaratiba (Novo *et al.* 2013), Mesquita (Rangel *et al.* 1990; Oliveira-Neto *et al.* 2000; Meneses *et al.* 2002), Paraty (Aguiar *et al.* 1993), Petrópolis (Martins *et al.* 1978; Souza *et al.* 2002, 2005a), Rio de Janeiro (Cabrera *et al.* 2003; Souza *et al.* 2003b; Gouveia *et al.* 2012), Santa Maria Madalena, São Fidélis, Trajano de Moraes, Três Rios.

L. longipennis (Barretto, 1946)*: Bom Jardim (Souza *et al.* 2003a).

L. peresi (Mangabeira, 1942): Itatiaia (Afonso *et al.* 2007), Rio de Janeiro (Oliveira *et al.* 1995).

L. capixaba Dias, Falcão, Silva & Martins, 1987*: Mangaratiba (Novo *et al.* 2013).

L. oswaldoi (Mangabeira, 1942)*: Angra dos Reis (Souza *et al.* 2009), Bom Jardim (Souza *et al.* 2003a), Cambuci, Paraty (Carvalho *et al.* 1995, 2000), Rio de Janeiro (Souza *et al.* 2000, 2003b), Seropédica (Cardoso *et al.* 2009).

Ungrouped *Lutzomyia* Species (2 spp.):

L. monticola (Costa Lima, 1932): Angra dos Reis (Rendeiro 2007), Bom Jardim (Souza *et al.* 2003a), Casimiro de Abreu (Souza *et al.* 2001), Itaguaí (Aguiar *et al.* 1987, 1996), Itatiaia (Afonso *et al.* 2007), Magé (Aguiar & Soucasaux 1984; Aguiar *et al.* 1985a, 1985b, 1985c, 1986; Aguiar & Vilela 1987), Paracambi (Santos 1998), Paraty (Aguiar *et al.* 1993), Petrópolis (Barretto & Zago Filho 1956; Martins *et al.* 1978; Souza *et al.* 2002, 2005a), Resende (Martins *et al.* 1978), Rio de Janeiro (Rangel *et al.* 1986), Silva Jardim (Souza *et al.* 2001), Vassouras (Martins *et al.* 1978).

L. misionensis (Castro, 1959)*: Casimiro de Abreu (Souza *et al.* 2001), Itatiaia (Afonso *et al.* 2007).

Five species were considered potential leishmaniases vectors in the state: *L.* (*N.*) *intermedia*, *L. migonei*, *L.* (*N.*) *whitmani, L.* (*N.*) *flaviscutellata* and *L.* (*L.*) *longipalpis*. Distribution maps of these species and leishmaniases human cases by municipality are presented separately for ACL (Fig. 1) and AVL (Fig. 2).

DISCUSSION

Published lists of sand fly species from Brazil commonly demonstrate species distribution by state, such as studies by Aguiar & Medeiros (2003), the online database of CIPA Group (1999) and the taxonomic key of Galati (2003). Species distributions from each state are commonly published separately, like those from Minas Gerais (Andrade & Dantas-Torres 2010), São Paulo (Shimabukuro *et al.* 2010), Pernambuco (Dantas-Torres *et al.* 2010), Mato Grosso (Missawa & Maciel 2007) and Rio Grande do Norte (Ximenes *et al.* 2000). The present work is the first to summarize the distribution of sand fly species from Rio de Janeiro State.

Several epidemiological studies and entomologic surveys confirmed *L.* (*N.*) *intermedia* as the predominant species in peridomestic environment in many municipalities of Rio de Janeiro State, such as Angra dos Reis (Souza *et al.* 2009; Carvalho *et al.* 2013), Bom Jardim (Souza *et al.* 2003a), Bom Jesus do Itabapoana (Rezende *et al.* 2009), Carmo (Alves 2007), Casimiro de Abreu (Souza *et al.* 2001), Magé (Nery-Guimarães 1955), Mangaratiba (Novo *et al.* 2013), Niterói (Brazil *et al.* 1989), Paraty (Aguiar *et al.* 1993; Carvalho *et al.* 1995, 2000; Costa *et al.* 2004; Moutinho *et al.* 2010), Rio Bonito (Brazil *et al.* 1989), Rio de Janeiro (Lima *et al.* 1981; Souza *et al.* 2000; Gouveia *et al.* 2012), Saquarema (Brazil *et al.* 2011) and Seropédica (Cardoso *et al.* 2009). In addition to these cited references, the findings of naturally infected females of *L.* (*N.*) *intermedia* by *Leishmania* (*V.*) *braziliensis* (Rangel *et al.* 1984; Pita-Pereira *et al.* 2005; Rocha *et al.* 2010) and experimental infection by the same parasite (Rangel *et al.* 1992) reinforce the hypothesis that this sand fly species is the main ACL vector of Rio de Janeiro State.

Lutzomyia migonei is considered secondary vector of *Leishmania* (*V.*) *braziliensis* in Rio de Janeiro State. This was first suggested by Araújo Filho *et al.* (1981), who noticed it as the second most abundant species inside houses where ACL human cases had been recorded in Ilha Grande (Angra

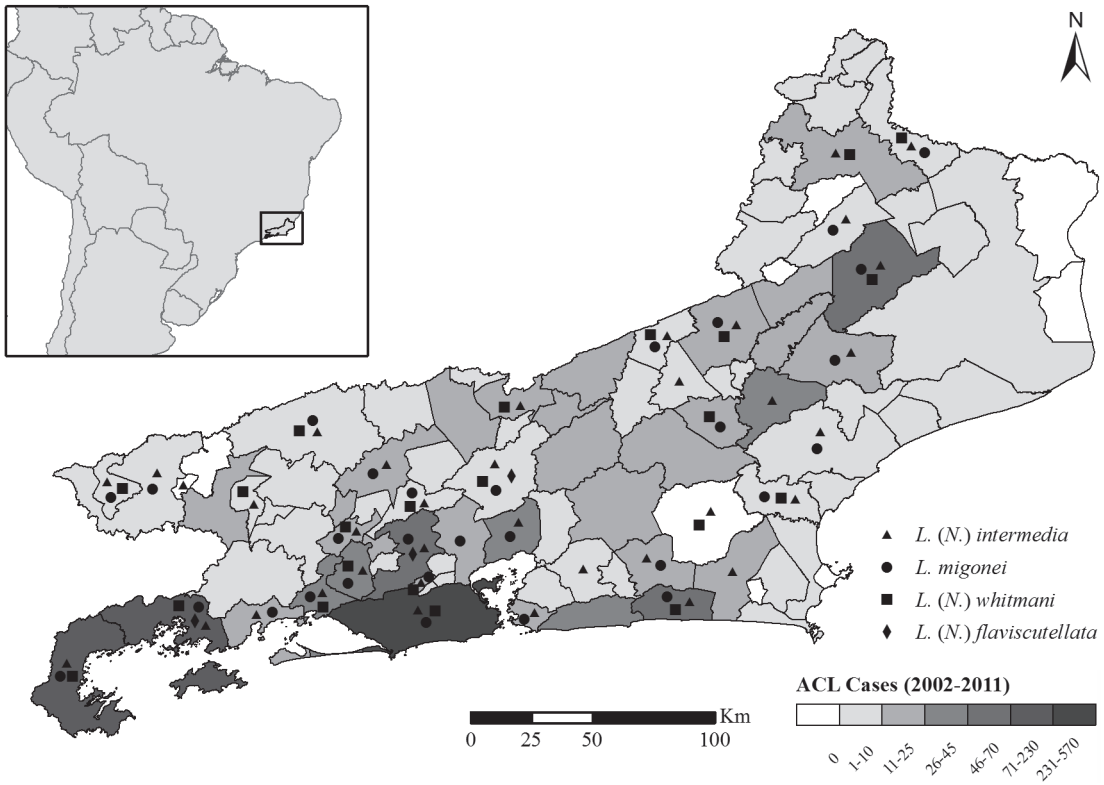

Fig. 1. Distribution of *Lutzomyia* (*Nyssomyia*) *intermedia*, *L. migonei*, *L.* (*N.*) *whitmani*, *L.* (*N.*) *flaviscutellata* and American Cutaneous Leishmaniasis (ACL) autochthonous human cases from Rio de Janeiro State, by municipality.

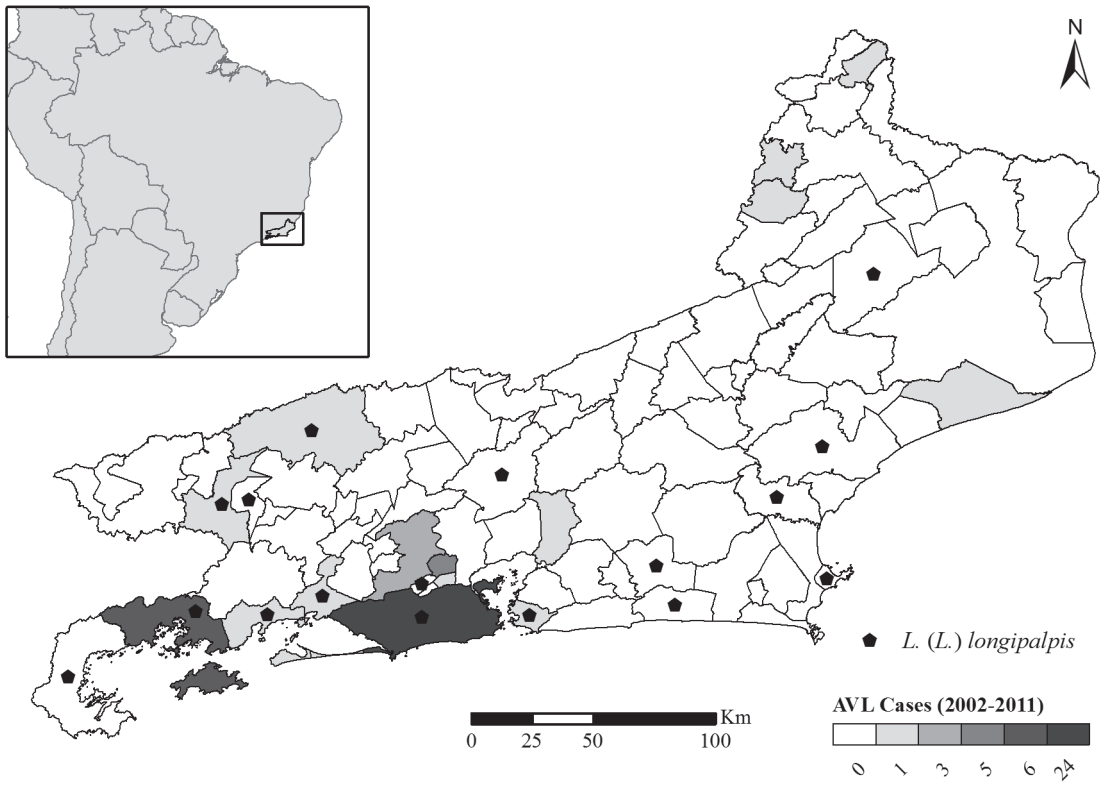

Fig. 2. Distribution of *Lutzomyia* (*Lutzomyia*) *longipalpis* and American Visceral Leishmaniasis (AVL) autochthonous human cases from Rio de Janeiro State, by municipality.

dos Reis). In Jacarepaguá (Rio de Janeiro), *L. migonei* showed high abundance and preference to feed on dogs, suggesting it would be maintaining the canine ACL cycle in the area (Rangel *et al.* 1986). In Itaguaí, Aguiar *et al.* (1996) compared the sand fly fauna of different altitude levels (100 and 300 m) and noticed that *L. migonei* had higher abundances than *L.* (*N.*) *intermedia* at 300 m, suggesting a possible involvement in ACL transmission. *Lutzomyia migonei* is commonly found in high abundances next to *L.* (*N.*) *intermedia*, as it was also shown in Rio de Janeiro (Lima *et al.* 1981; Gouveia *et al.* 2012), Mesquita (Rangel *et al.* 1990; Meneses *et al.* 2002) and Paraty (Aguiar *et al.* 1993; Carvalho *et al.* 1995, 2000; Moutinho *et al.* 2010). In the state, this species was also captured naturally infected by *Leishmania* (*V.*) *braziliensis* (Pita-Pereira *et al.* 2005).

Besides *L.* (*N.*) *intermedia* and *L. migonei*, other sand fly species found in Rio de Janeiro State show evidences of participation on ACL transmission cycles, such as *L.* (*N.*) *whitmani* (Forattini 1953; Souza *et al.* 2002; Costa *et al.* 2007), *L.* (*P.*) *fischeri* (Coutinho & Barreto 1941; Lainson 1983; Souza *et al.* 2002) and *L.* (*P.*) *pessoai* (Forattini 1954; Silva & Grunewald 1999), all of them with observed anthropophily and adaptability to domestic environments (Rangel & Lainson 2009). From these cited species, the ones that were already found naturally infected by *Leishmania* (*V.*) *braziliensis* in southeastern and southern Brazil are only *L.* (*N.*) *whitmani* and *L.* (*P.*) *fischeri* (Pita-Pereira *et al.* 2005, 2011; Rocha *et al.* 2010).

Although *L.* (*N.*) *whitmani* has been suggested as the most important vector of ACL in Brazil, being widespread in the country (Costa *et al.* 2007; Rangel & Lainson 2009), it is not very abundant in Rio de Janeiro State. Its role in the state's ACL transmission was further discussed by Souza *et al.* (2002, 2005a, 2005b) during studies in Petrópolis. The authors suggested that the two most frequent species, *L.* (*N.*) *intermedia* and *L.* (*N.*) *whitmani*, would be sharing ACL transmission throughout several months of the year, since both showed high anthropophily. In addition, *L.* (*N.*) *intermedia* was more predominant during the hotter months (December, January and February), while *L.* (*N.*) *whitmani* was more frequent during colder months (June, July and August). The authors also noticed that *L.* (*N.*) *whitmani* was more frequent in captures inside the forest and near banana plantations, while *L.* (*N.*) *intermedia* predominated in peridomestic environments.

Lutzomyia (*Nyssomyia*) *flaviscutellata* is the main vector of *Leishmania* (*L.*) *amazonensis*, causative agent of Diffuse Cutaneous Leishmaniasis (DCL) (Lainson & Shaw 1968; Ward *et al.* 1977; Lainson *et al.* 1987; Rangel & Lainson 2009). In 2007, Rio de Janeiro State's first autochthonous DCL human case was detected in Paraty (Azeredo-Coutinho *et al.* 2007). Until today, there are no records of other human cases in the state, although in São Paulo State, dogs and rodents (*Akodon* sp.) were detected infected with *Leishmania* (*L.*) *amazonensis* (Tolezano *et al.* 1988, 2007). *Lutzomyia* (*N.*) *flaviscutellata* is widespread in Brazil, and frequently associated with primary and secondary forests of Amazon, Atlantic Forest and Cerrado biomes. It is strongly attracted to rodents, but not so much to humans (Shaw & Lainson 1968; Shaw *et al.* 1972; Rangel & Lainson 2009), explaining why captures with Disney traps (Disney 1966), using rodents as baits, are often more successful in capturing this species (Araújo Filho *et al.* 1981; Dorval *et al.* 2010). In Rio de Janeiro State, *L.* (*N.*) *flaviscutellata* was found only in Angra dos Reis (Araújo Filho *et al.* 1981; Carvalho *et al*. 2013), Nova Iguaçu (Martins *et al.* 1978) and Petrópolis (Martins *et al.* 1962a, 1978). Its real distribution and abundance is underestimated, probably because there is only one published study that used Disney traps to capture sand flies in the state (Araújo Filho *et al.* 1981). Even with its major occurrence on north and northeast Brazil, the species was also found in São Paulo State (Gomes & Galati 1989, Gomes 1994), in Atlantic Forest areas very similar to those in Rio de Janeiro State.

Lutzomyia (*Lutzomyia*) *longipalpis* is highly adaptable to man-modified environments, probably because it feeds on a wide variety of vertebrate hosts and is highly anthropophilic (Lainson & Rangel 2005; Afonso *et al.* 2012). The presence of this species in urban areas of Brazil is a determinant factor for AVL urbanization process (Rangel & Vilela 2008; Werneck 2008). In Rio de Janeiro State, this species have been recorded in low abundances on several studies, frequently in rural or periurban areas (Araújo Filho & Sherlock 1981; Araújo Filho *et al.* 1981; Rangel *et al.* 1986, 1990; Souza *et al.* 1981, 2001, 2002; Cabrera *et al.* 2003; Carvalho *et al*. 2013). Recently, *L.* (*L.*) *longipalpis* was detected in an urban area of Rio de Janeiro City (in the locality of Caju). This finding, coupled with the record of canine VL cases and one human AVL case, demonstrates the first AVL focus in an urban area of Rio de Janeiro City (Brazil 2013).

In some AVL areas of the state, *L.* (*L.*) *longipalpis* could not be found (Souza *et al.* 2000, 2009). In these areas, Souza *et al.* (2003b) hypothesized the possible epidemiologic importance of *L. migonei* in maintaining and expanding canine infection, based on its strong attraction to dogs. *Lutzomyia migonei* shows evidences of AVL transmission in Pernambuco State, where it was found naturally infected by *Leishmania* (*L.*) *infantum chagasi* in areas without records of *L.* (*L.*) *longipalpis* (Carvalho *et al.* 2010). Definitely more studies are necessary to test the hypothesis of this alternative AVL vector species in Rio de Janeiro State.

The records of *L.* (*P.*) *paraensis* and *L.* (*M.*) *micropyga* in Rio de Janeiro State should be interpreted with caution, since both are considered Amazonian species (Young & Duncan 1994).

The entomologic records from the Health Department of the State contributed with knowledge of the sand fly fauna from 22 municipalities. About 60% of these were not surveyed in scientific studies, such as São Fidélis. If this municipality had not been surveyed by the Health Department of the State, three sand fly species would not have been registered in Rio de Janeiro State: *Lutzomyia* (*L.*) *ischyracantha*, *L.* (*L.*) *alencari* and *L. walkeri*. This evidence reinforces the importance of collaboration between researchers and health department professionals, so that these data reach the scien-

tific literature. Leishmaniases control actions are mainly based on entomologic surveillance, so it is fundamental that endemic areas be constantly surveyed.

This list shows records of 65 sand fly species from 46 municipalities. Since this corresponds to only 50% of the 92 municipalities of Rio de Janeiro State, some other species could certainly be found in other areas with future studies.

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