

The dispersion of *Lutzomyia longipalpis* in urban areas

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Visceral leishmaniasis (VL) is the most severe form of leishmaniasis that has worldwide distribution. Today, there is no doubt that the parasite *Leishmania (Leishmania) infantum* was introduced to the New World in the XVI century by infected domestic dogs (*Canis familiaris*) that came as companions of the *conquistadores* from Portugal and the Mediterranean region¹. After this first contact, the disease spread rapidly through South and Central America in less than 500 years due to constant waves of European immigration to the New World and the presence of a permissive vector, *Lutzomyia longipalpis*. When the first Europeans arrived, the sandfly already had a large potential distribution throughout the continent. The eclectic feeding behavior of *Lu. longipalpis* meant that these flies had no difficulty in finding the newly introduced dog as an easy source for blood, becoming a new vector for imported *Leishmania*.

After Penna and Chagas's classic works^{2,3}, several human cases of VL were diagnosed in different regions of America, with Brazil having the greatest endemic presence of the disease with active transmission distinct from the original Mediterranean cycle. By the 1950s, Brazil had a clear picture of the VL endemic zones, which were mainly restricted to the northeast region and some specific areas in the States of Pará and Minas Gerais. Sporadic cases were also observed in other regions of the country, where the epidemiological aspects of the disease were associated with rural areas and the presence of *Lu. longipalpis*⁴. This scenario began to change in less than 30 years: the disease began moving to some urban areas, becoming *urbanized* a few years later⁵.

Several aspects of the epidemiology of the disease may partially explain how it happens. Concordant with results from Werneck⁵, transmission scenarios in urban settings appear to be highly heterogeneous, each showing some degree of similarity to the rural epidemiological pattern. However, the vital link for the spread of the disease in these urban sites is active and passive dispersion of *Lu. longipalpis*.

Lutzomyia longipalpis is found from southern Mexico (20°N) to Argentina (27°S), with several indications that this sandfly might encompass a species complex⁶. Independent

of the number of cryptic species, *Lu. longipalpis s.l.* has been detected in diverse ecological conditions, which may reflect its success in dispersion and adaptation. Alternatively, *Lu. longipalpis* may not have originated from the Amazon or the Atlantic Forest morphoclimatic domains of South America but from the open vegetation of the Brazilian Cerrado, which was moister during the Pleistocene compared with today. If so, this may be important in understanding the abilities of this fly to explore new environments, even in man-made areas. This event could have occurred long before European colonization: *Lu. longipalpis* may have occupied the coastal areas of Brazil when the Tupi-Guarani people moved there from central areas around 400-700 AD, bringing with them corn and manioc cultivation. This itinerant type of slash-and-burn agriculture left several areas of secondary forest known as *capoeira*, giving several organisms, plants and animals the opportunity to occupy this new ecotope⁷.

Autochthonous transmission of VL has been reported in recent years in all regions of Brazil. After the first urban epidemic in the City of Teresina, several outbreaks have been reported in peripheral or urban areas, such as São Luiz, Montes Claros, Belo Horizonte, Araçatuba, Cuiabá, Campo Grande, Três Lagoas, Palmas and Brasília.

The City of Campo Grande in Mato Grosso do Sul is a good example of how *Lu. longipalpis* can invade an urban area and become a real public health problem. In 1999/2000, *Lu. longipalpis* was reported in Campo Grande before VL was diagnosed in the human population; a few years later (2003-2005), *Lu. longipalpis* had completely adapted, showing high density in all studied ecotopes in the urban areas of the city⁸.

Mark-release-recapture experiments in urban areas of the same city⁹ have shown that the maximal dispersion distance for adult sandflies is 243m. However, the same type of experiments conducted in the rural communities of Marajó, Pará showed a maximal dispersion distance of 700m¹⁰. These data suggest that sandflies exhibit little dispersion activity in urban areas, remaining at the same site due to the presence of shelter and food. Although dispersal by flight cannot be neglected, it does not seem to be the main mechanism of urban invasion; instead, man may be creating ideal conditions for the proliferation of sandflies and the establishment of an urban transmission cycle.

The passive dispersal of sandflies is poorly understood. However, soil transference commonly occurs during urban formation and city development, such as when new condominiums need to build large gardens to provide green areas within the concrete jungle. Transporting soil to the city from rural areas

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FIGURE 1 - Aerial view of the Caju Cemetery in the urban area of Rio de Janeiro City. Image was taken from Google Earth. Source: <http://earth.google.br>

to build city squares and gardens in urban environments can present a real problem through the introduction of uncommon organisms, such as sandflies, that use soil as a breeding site. This new aspect to urban development can be noted in medium to large cities in Brazil, such as Teresina, Belo Horizonte and Campo Grande, which have had both tangible urban growth in the last 30 years and persistent VL.

More recently, a new epidemiological situation that was observed in Rio de Janeiro provides an example of a discrepancy for this new transmission phenomenon of urban VL. The presence of both naturally infected dogs and the vector *Lu. longipalpis* in the Caju Cemetery was a dangerous situation. Caju is one of the biggest cemeteries in Brazil, located in the central area of Rio de Janeiro, and is surrounded by totally urbanized zones (**Figure 1**). Epidemiologically, *Lu. longipalpis* would not likely be present in this area; however, their presence appears to be triggered by the transfer of soil used in flower pots that originates from natural and prevalent areas of *Lu. longipalpis* outside Rio de Janeiro. This real threat could happen in any large city in Brazil. Further studies are necessary to determine the importance of both active and passive dispersal of sandflies to urban areas and their impact on the epidemiology of VL.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

1. Kuhls K, Alam MZ, Cupolillo E, Ferreira GEM, Mauricio IL, Oddone R, et al. Comparative Microsatellite Typing of New World *Leishmania infantum* Reveals Low Heterogeneity among Populations and Its Recent Old World Origin. *PLoS Negl Trop Dis* 2011; 5:e1155.
2. Penna HA. Leishmaniose visceral no Brasil. *Brasil Med* 1934; 48: 949-950.
3. Chagas E, Cunha AM, Castro GO, Ferreira LC, Romãña C. Leishmaniose visceral americana. (Nova entidade mórbida do homem na América do Sul)-Relatório dos trabalhos realizados pela Comissão Encarregada do Estudo da Leishmaniose Visceral Americana em 1936. *Mem Inst Oswaldo Cruz* 1937; 32:321-385.
4. Deane LM. Leishmaniose Visceral no Brasil. Rio de Janeiro: Serviço Nacional de Educação Sanitária; 1956.
5. Werneck GL. Forum: Geographic spread and urbanization of visceral leishmaniasis in Brazil. *Introduction Cad Saúde Pública* 2008; 24: 2937-2940
6. Araki AS, Vigoder FM, Bauzer LG, Ferreira GE, Souza NA, Araujo IB, et al. Molecular and behavioral differentiation among Brazilian populations of *Lutzomyia longipalpis* (Diptera: Psychodidae: Phlebotominae). *PLoS Negl Trop Dis* 2009; 3: e365.
7. Por FD, Impreatriz-Fonseca VL, Lencioni Neto F. *Biomes of Brazil*. Sofia: Pensoft Publisher; 2005.
8. Oliveira AG, Galati EAB, Oliveira O, Oliveira GR, Espindola IAC, Dorval MEC, et al. Abundance of *Lutzomyia longipalpis* (Diptera: Psychodidae: Phlebotominae) and urban transmission of visceral leishmaniasis in Campo Grande, State of Mato Grosso do Sul, Brazil. *Mem Inst Oswaldo Cruz* 2006; 101:869-874.
9. Oliveira EF, Silva EA, Casaril AE, Fernandes CE, Paranhos Filho AC, Gamarra RM, et al. Behavioral aspects of *Lutzomyia longipalpis* (Diptera: Psychodidae) in urban area endemic for visceral leishmaniasis. *J Med Entomol* 2013; 50:277-284.
10. Dye C, Davies CR, Lainson R. Communication among phlebotomine sandflies: a field study of domesticated *Lutzomyia longipalpis* populations in Amazonian Brazil. *Animal Behaviour* 1991; 42:183-192.