Short Report: First Report of Lutzomyia (Nyssomyia) neivai (Diptera: Psychodidae: Phlebotominae) Naturally Infected by Leishmania (Viannia) braziliensis in a Periurban Area of South Brazil Using a Multiplex Polymerase Chain Reaction Assay

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Abstract. To identify Lutzomyia (Nyssomyia) neivai naturally infected by Leishmania a multiplex polymerase chain reaction (PCR) was used for the analysis of 450 specimens (270 females, 180 males) collected in an endemic periurban area of cutaneous leishmaniasis, Porto Alegre, Brazil. Insects were grouped into pools of 10 and positive results were achieved in 3/27 Lu. (N.) neivai female pools. Infection by L. (Viannia) braziliensis was confirmed after hybridizing PCR products with a subgenus-specific biotinylated probe. Considering the detection of three positive pools with at least one infected insect in each, an infection rate of 1.1% was estimated. Our results associated with epidemiologic data suggest a potential ability of Lu. (N.) neivai in transmitting L. braziliensis in Porto Alegre, where the first notifications of autochthonous cutaneous leishmaniasis in humans occurred in 2002, with an increase in the number of cases in recent years possibly as a consequence of deforestation and agricultural activities in the area.

In Brazil, from 2003 to 2007 the Ministry of Health recorded 181,117 human cases of American cutaneous leishmaniasis (ACL) (Alves W, unpublished data). It has been reported that an increase of ACL incidence in all Brazilian states with dissemination of the disease to the periurban areas of some state capitals, such as Manaus, Rio de Janeiro, and Belo Horizonte, thus constituting a serious health problem.1,2

There are few studies directed to the sand fly fauna in Rio Grande do Sul State,3,4 mainly because of the inexistence of reports on autochthonous ACL cases in the last decades. More recently, in accordance with the Secretariat of Health of Rio Grande do Sul, the epidemiologic situation has changed. From 2002 to 2008, 20 confirmed autochthonous human cases resulting from Leishmania (Viannia) braziliensis were reported in the periphery of the city of Porto Alegre, in areas of residual vegetation close to creeks. The region presents rural zone characteristics, such as animal husbandry and agricultural activities in the proximity to residences. In previous entomologic studies, Lutzomyia (Nyssomyia) neivai (Pinto) was the most frequent species found in the area and was considered a potential ACL vector.5

In the present study, a multiplex polymerase chain reaction (PCR) assay associated to non-isotopic hybridization was used to evaluate the occurrence of Lu. (N.) neivai naturally infected by Leishmania parasites in an urban area of tourism activity located in Porto Alegre, where human ACL cases were recently described. Sand flies were collected monthly from October 2006 to May 2007 with Centers for Disease Control and Prevention (CDC) light traps in 10 monitoring stations in the proximity to residences. In previous entomologic studies, Lu. (N.) neivai was sent to the laboratory for PCR examination after taxonomic identification according to Young and Duncan4 for genus and subgenus, and Marcondes2 and Andrade-Filho and others8 for the species level taking into account the morphologic characteristics of males and females. The insects were grouped into pools of 10 specimens and submitted to molecular analysis for Leishmania infection. The multiplex PCR9,10 was designed to simultaneously amplify the cacophony gene IVS6 region in sand flies of the neotropical genus Lutzomyia (as an internal control for the polymerase enzyme activity), and the conserved kinetoplast DNA minicircle region from Leishmania spp. The amplified products were further submitted to dot blot hybridization using a L. (Viannia)-specific biotinylated probe.9

The PCR assay showed positive results in 3 out of 27 female pools analyzed, and hybridization confirmed the infection with parasites from the subgenus Viannia (Figure 1). Considering the occurrence of at least one infected insect in each pool of 10 phlebotomines, we found that the minimal infection rate for Lu. (N.) neivai was 1.11%. The PCR approach was highly sensitive and able to reveal on agarose gel, a 120 bp fragment from Leishmania kDNA minicircles in all three positive sand fly pools before the hybridization step. All samples analyzed yielded a 220 bp amplified product corresponding to a constitutive gene (cacophony) from Lutzomyia spp., thus confirming the integrity of the insect DNA preparations and the absence of eventual PCR inhibitors (Figure 1).

In Brazil, ACL resulting from L. (V.) braziliensis has been reported in all states and involves a diversity of sand fly species, such as Lu. (Psychodopygus) wellcomei (Fraiha, Shaw, & Lainson, 1971); Lu. (P.) complexa (Mangabeira, 1941); Lu. (N.) whitmani (Antunes & Coutinho, 1939); Lu. Migonei (França, 1920), and Lu. (N.) intermedia (Lutz & Neiva, 1912), based on evidences regarding their anthropophily, natural infection by Leishmania parasites, and spatial distribution in accordance with human cases transmission sites.11

Marcondes and others12 discussed the epidemiologic role of Lu. (N.) neivai in the transmission of L. (V.) braziliensis in
Figure 1. Multiplex polymerase chain reaction (PCR) followed by hybridization for the diagnosis of Leishmania (Viannia) braziliensis infection in Lutzomyia neivai collected in Porto Alegre, Rio Grande do Sul State, Brazil. The phlebotomines were grouped into pools of 10 female specimens and PCR was performed with total DNA extracted from these pools. A. Ethidium bromide-stained 2% agarose gel revealing the 220 bp product from cacophony gene amplification (Lutzomyia genus) and the 120 bp fragment corresponding to the conserved kinetoplast minicircle region from Leishmania spp. M, molecular weight marker (100 bp DNA ladder). Lane 1, amplification reaction without added DNA (PCR negative control); lanes 2–5, negative controls for the DNA extraction step (male insect pools); lanes 16–19, female sand fly pools (lanes 15–17, Lu. neivai positive pools); lanes 20 and 21, PCR positive controls (DNA extracted from a mixture of male insect pool containing L. (V.) braziliensis promastigotes). B. Dot hybridization using a biotinylated probe specific for parasites from the Viannia subgenus.

Disclosure: Daniela Pita-Pereira is a fellow PhD student from FIOCRUZ/CAPES, Carlos R. Alves, Constança Britto, and Elizabeth F. Rangel are fellows of the CNPq Institution, and Adriana Zwetsch is a fellow of the FAPERJ Institution.


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5. Nogueira AS, 2003. Identification of naturally infected N. intermedia (Azvedo A and others, unpublished data). Epidemiologic data from the Secretariat of Health of Porto Alegre suggested Lu. (N.) neivai as the main vector of ACL, as suggested by the occurrence of natural ACL cases, revealed the predominance of Lu. (N.) neivai (94.9%) without the identification of Lu. (N.) intermedia (Azvedo A and others, unpublished data). Epidemiologic data from the Secretariat of Health of Porto Alegre suggested Lu. (N.) neivai as the main vector of ACL, because of its anthropophagic characteristic and spatial and seasonal abundance in anthropic environments. This information associated with the evidence of natural infection by Leishmania indicate the importance of Lu. (N.) neivai in the epidemiologic cycle of ACL in Porto Alegre, and suggests this species as another L. (V.) braziliensis vector in the southeast and south regions of Brazil.

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