



Phlebotomine sandflies (Diptera, Phlebotomidae) of Lanzarote Island (Canary Islands, Spain): Ecological survey and evaluation of the risk of *Leishmania* transmission



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ABSTRACT

Phlebotomine sandflies are natural vectors of *Leishmania* spp. and their expansion throughout has been evidenced in the last few years due to the global warming and changes in human behavior, worsening leishmaniasis problem. However, phlebotomine sandflies have been captured in small numbers on the Canary Islands, particularly on the island of Lanzarote, where only one limited survey was carried out almost thirty years ago. The proximity of this island to Morocco, in addition to the high number of tourists, sometimes accompanied by their dogs, from leishmaniasis endemic regions, highlights the importance of studying the sandfly fauna on this island in order to determine the transmission risk of leishmaniasis.

Thirty-eight sampling sites spread across the island were studied, and ecological features were gathered to identify the ecological traits associated to the presence of sandflies. Only 85 sandfly specimens were captured (1.18/m²) with the following species distribution: *Sergentomyia minuta* (0.15 specimens/m²), which was reported for the first time on this island, and *S. fallax* (1.03/m²). Sandfly captured were achieved in only 7 out of 38 stations. No specimen of the *Phlebotomus* genus was captured and given that none of the species captured has been demonstrated vectors of human pathogenic *Leishmania* and considering that they were captured in low frequency and density, it can be concluded that the current leishmaniasis transmission risk is null.

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1. Introduction

Leishmaniasis are protozoal diseases caused by different species of genus *Leishmania* and transmitted by sandflies (Diptera, Phlebotomidae). In recent years, a net expansion of this disease has been reported in Europe (Bart et al., 2013; Harms et al., 2003) and North Africa (Kahime et al., 2014), due to human activity (travel, immigration, emigration, urbanization, etc.), or global warming (Fischer et al., 2011). Sandfly vectors have been recently captured in countries or areas where they were unknown, such as Belgium

(Depaquit et al., 2005), Germany (Naucke et al., 2008), Italy (Maroli et al., 2008; Morosetti et al., 2009), Andorra (Ballart et al., 2012), France –Jura region (Kasbari et al., 2012), Austria (Poeppel et al., 2013), Hungary (Bede-Fazekas and Trájer, 2015), and the number of infection cases in people from Central Europe or their pets when visiting endemic countries is increasing. Twenty thousand dogs with canine leishmaniasis are estimated only in Germany (Aspöck et al., 2008). These findings highlighted the relevance of leishmaniasis epidemiology to assess the risk of transmission (Alten et al., 2015; Aspöck et al., 2008; Medlock et al., 2014; Ready, 2013).

Similar take place in Spain (Amela et al., 2012); an expansion of the vector and the disease has been demonstrated in northern Spain (Miró et al., 2012; Ballart et al., 2014), the island of Menorca (Alcover et al., 2013) and in a recent epidemic outbreak in Madrid, where a tenfold increase in human cases was reported (Arce et al., 2013). However, few leishmaniasis cases have been diagnosed in the Canary Islands, all of them in people or dogs coming from peninsular Spain and other Mediterranean regions;

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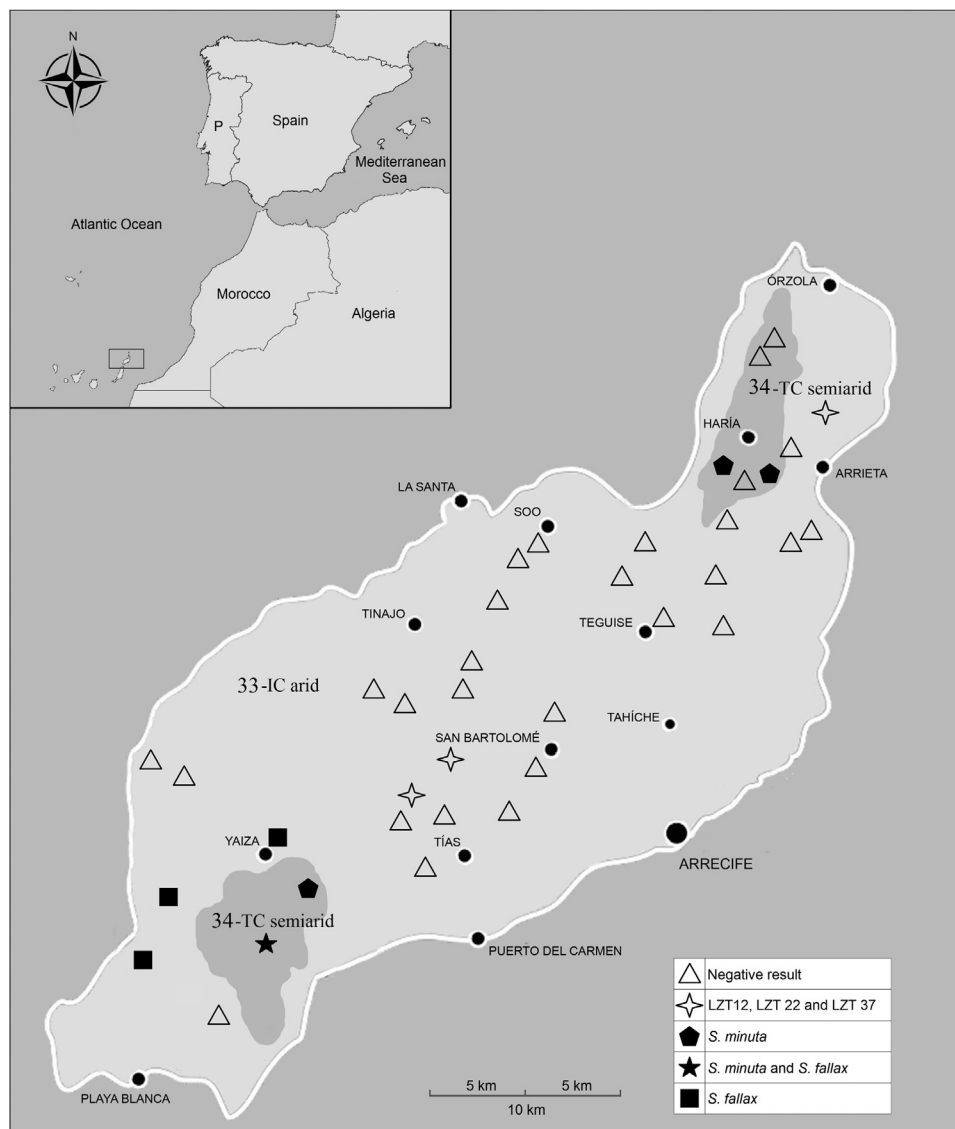


Fig. 1. Map of Lanzarote. The figure shows the geographical situation of the island and the sampling sites where sandfly species were captured. LZT12, LZT22 and LZT37 are sampling sites situated in fields where there was only lava. 33-IC arid indicates arid Infracanarian bioclimatic level. 34-TC semiarid indicates semiarid Thermocanarian bioclimatic level. P=Portugal.

moreover, studies on the sandflies of these islands are scarce. Sandflies were not captured until 1982, when *P. fortunatarum*, a new species subsequently included in a new subgenus (*Abonnenicus*), was found on the island of Gran Canaria (Ubeda Ontiveros et al., 1982; Morillas Márquez et al., 1984). Later studies performed on the other islands of the archipelago confirmed this endemism and reported the presence of *P. perniciosus* (Tenerife), *P. sergenti* (Tenerife), *P. ariasi* (Fuerteventura), *Sergentomyia minuta* (Tenerife, Gomera, Hierro, and La Palma), and *S. fallax* (Tenerife, Gomera, La Palma, Fuerteventura, and Lanzarote) (Morillas Márquez et al., 1984; Morillas-Márquez et al., 1995; Martínez Ortega et al., 1988; Leger et al., 1995). Regarding the island of Lanzarote, the northernmost and easternmost island of the Canary archipelago, only a survey was carried out almost 30 years ago (Lane and Alexander, 1988), in which *S. fallax* was the only species captured in two sampling sites. The proximity of this island to Morocco, in latitudes where leishmaniasis is endemic and phlebotomine sandflies are frequent (Rioux et al., 1997; Kahime et al., 2015), in addition to the high number of tourists, sometimes accompanied by their dogs, from leishmaniasis endemic regions, as well as African immigrants,

highlights the importance of studying the sandfly fauna on this island in order to determine the transmission risk of leishmaniasis (Rioux et al., 1990).

2. Material and methods

2.1. The island of Lanzarote

Lanzarote belongs to the Canary archipelago (Spain), and it is situated between 28°50'–29°30' latitude North and 13°25'–13°53' longitude West (Fig. 1), with an extension of 845.93 km² and 143.209 inhabitants.

Since the 1960s, the main economical activity is tourism, but some traditional agricultural activities remain (vineyards, potatoes, sweet potatoes etc.) in spite of the fact that a major part of terrain is covered by lava as a consequence of volcanic activity during 18th and 19th centuries. There are also other relevant activities such as livestock, fishing and a particular interest in hunting, specially lagomorph hunting with autochthonous hounds. Regarding the climate, this island is quite arid with a mean temperature of 20.1 °C

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