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Leishmaniasis in Morocco: diseases and vectors

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ABSTRACT

Leishmaniasis, a highly neglected disease, currently presents a significant health problem throughout Africa. This review presents a summarized analysis of its epidemiology in Moroccan context, a Mediterranean location in which leishmaniasis is prevalent and where both cutaneous and visceral leishmaniasis have been reported.

This study aims to determine the current leishmaniasis epidemiological situation in Morocco and the distribution of its different forms throughout the country. During the past 20 years, this disease has emerged as a major public health threat in Morocco. So, we gave a particular attention to vectorial status of Moroccan sandflies (Diptera: Psychodidae, Phlebotominae) in view of its major role in diseases spreading.

It seems clear that the risk of spread of the disease is rising in Morocco. Ecological characteristic of proven and potential vectors, according to climate and environmental changes, should be regarded as good marker to anticipate leishmaniasis distribution in Morocco.

1. Introduction

In Morocco, leishmaniasis are endemic diseases posing a major threat to public health. In 2011, Moroccan Ministry of Health reported 4319 cases of cutaneous leishmaniasis (CL) and 107 cases of visceral leishmaniasis (VL)[1].

CL is caused by three clinically important *Leishmania* species [*Leishmania major* (*L. major*), *Leishmania tropica* (*L. tropica*), and *Leishmania infantum* (*L. infantum*)], a flagellate protozoa of the family Trypanosomidae, while, VL is caused by *L. infantum*. Recently, the mucocutaneous form was also reported in Morocco, but remains rare[2].

Leishmania infection is transmitted to human host as a result of a bite by an infected female sandfly (Diptera: Psychodidae, Phlebotominae) of the genus *Phlebotomus*.

In Morocco, the *Phlebotomus papatasi* (*P. papatasi*) and *Phlebotomus sergenti* (*P. sergenti*) are the most common vectors for the spread of *L. major* and *L. tropica*, respectively[3]. *Phlebotomus ariasi* (*P. ariasi*), *Phlebotomus perniciosus* (*P. perniciosus*), and potentially *Phlebotomus longicuspis* (*P. longicuspis*) are reported to be the vectors of *L. infantum* in Mediterranean countries[3]. Previous studies in Morocco showed that the distribution of sandflies was due, in great part, to the bioclimate[4].

In Morocco, both zoonotic and anthroponotic forms were reported. The main reservoirs are dogs for zoonotic VL (ZVL), rodents for zoonotic CL (ZCL) and human for anthroponotic CL (ACL).

2. Epidemiology

Due to its geographical position, Morocco possesses different ecological and climatic conditions, which are important factors in the repartition and epidemiology of endemic neglected diseases such as leishmaniasis. According to Moroccan Ministry of Health, CL caused by *L. major* is the most dominant form (Figure 1), with

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more than 24000 cases reported during the last decade^[1]. Epidemiological data show that *L. major* dominated in the 1990s, however starting in 2000, the apparition and growth of *L. tropica* and *L. infantum* is noticeable (Figure 1). Including *L. major* and *L. tropica*, the highest CL cases were noted between 2000 and 2010. While VL cases remains comparatively stable (Figure 1).

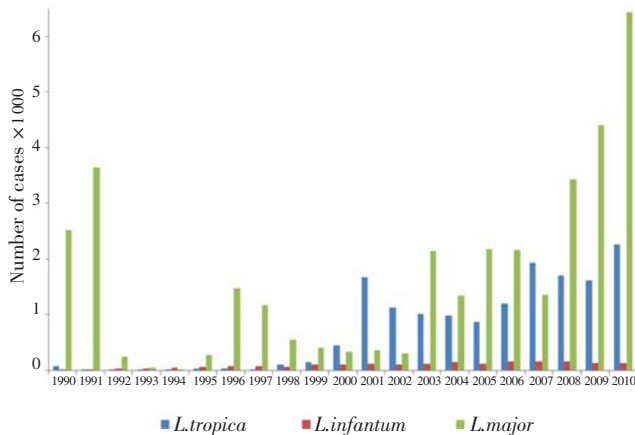


Figure 1. Evolution of cutaneous (*L. major*+*L. tropica*) and visceral (*L. infantum*) leishmaniasis cases between 1990–2010 in Morocco.

According to the same source, all ages are affected by the different forms of disease, with a high incidence for youth. Similar to the VL case^[5], young children are at high risk for both CL by *L. tropica*^[6,7] and CL by *L. major*^[8]. In the same way, leishmaniasis affects both genders almost equally with a slight increase in women^[7,8]. The large numbers of women and children infected, indicates that *Leishmania* transmission may have occurred in the peridomestic habitat^[6].

There is evidence that changes in climate contribute to some extent to the incidence and expansion of the range of the CL^[9,10], but the absence of leishmaniasis epidemiological information collection system pre-1993 did not allow to accurately describe the epidemiological situation in Morocco^[11] or to establish correlations between dynamics of the disease and global changes.

Since 1993, various studies of leishmaniasis foci together with the national incidence statistics confirmed the change in geographical distribution of leishmaniasis in Morocco, marked by the disappearance of the traditional North–South

dichotomy between visceral and cutaneous leishmaniasis, respectively (Figure 2). An overlap of foci, including *L. infantum* and *L. tropica* began then to emerge.

Currently, VL due to *L. infantum* is distributed mainly in Northern Morocco Rif and pre-Rif region (Figure 2A), geographically separated from other areas by mountains which constitute a natural barrier^[12]. The ACL *L. tropica* has the widest geographic distribution with large foci in the Central and Western Morocco (Figure 2B), while, the ZCL *L. major* is dispersed in the south and south-east of the Atlas Mountain (Figure 2C) where the disease is located in the steppe fringes of the Sahara desert^[10].

However, for the extreme south, there are no available epidemiological data. Rioux *et al.* have led an entomological survey carried out in the littoral zone of the Western Saharan region of Morocco, namely in Tan-Tan, Tarfaya, Layoun, Boujdour and Dakhla^[13]. The authors noted the scarcity of vector species and absence of leishmaniasis cases. It's necessary to update these entomological data and assess the current status of human leishmaniasis in the entire extreme Southern Morocco.

3. ZCL

In the pre-Saharan area, ZCL has been identified since 1914^[11], in the palm grove of Oued Tata where a major CL epidemic manifested during the late 1970s. Currently, foci of ZCL are basically linked to palm groves, rural and periurban areas with degraded environmental and socio-economic conditions like poor housing and hygiene^[8]. It is widespread from the Atlantic coast, south of the Anti-Atlas mountains to the north-east, crossing Saharan areas south of the Anti-Atlas and High Atlas mountains, and east of the Middle Atlas mountains^[14]. Caused by *L. major*, this form is transmitted by the *P. papatasi*, with *Meriones shawi grandis* as the main reservoir host^[10]. All strains isolated from the host, human and vector are identical and are identified biochemically as being due to *L. major* MON-25^[15]. The same results were found on skin smears in 2007, in the provinces of Ouarzazate and Errachidia^[16].

P. papatasi was reported in Morocco as early as 1916^[17]. This species is very common and has a significant ecological plasticity. It can be found in various biotopes, including

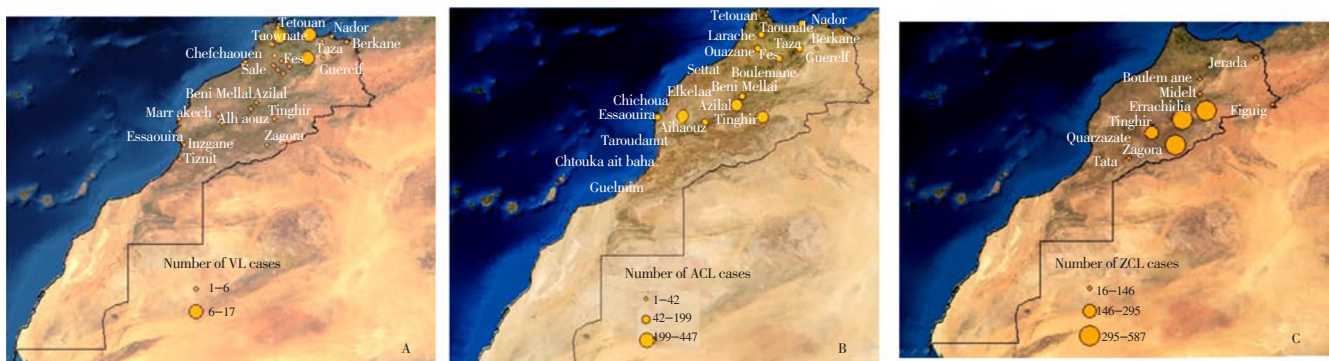


Figure 2. Geographical distribution of VL due to *L. infantum* (A), ACL cases due to *L. tropica* (B) and ZCL cases due to *L. major* (C) in Morocco (cases recorded in 2011).

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