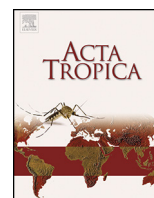




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Entomological investigation following the resurgence of human visceral leishmaniasis in southern Algeria

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ABSTRACT

Visceral and cutaneous leishmaniasis are the main endemic vector born diseases in Algeria. In the Hoggar region (extreme south of the country) human visceral leishmaniasis (HVL) is known to be sporadic but during the last decade the number of cases has increased significantly. In 2010, a peak of HVL cases was registered mostly among children. Therefore an entomological survey and a retrospective study on HVL cases were carried out in order to explore the transmission of the disease. Among the sand fly caught *Phlebotomus bergeroti* was the most frequent species (68%) followed by *Sergentomyia schwetzi* (22%). In this work we describe the presence of *Phlebotomus (Paraphlebotomus) kazeruni* for the first time in the Hoggar region.

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1. Introduction

Human visceral leishmaniasis (HVL) is a protozoal disease caused by a flagellate belonging to *Leishmania* genus. The worldwide annual incidence of leishmaniasis is believed to be 0.7–1.2 million new cases of cutaneous leishmaniasis (CL) and 200,000–400,000 new cases of HVL (Alvar et al., 2012). In the northern part of Algeria, where more than 50% of all leishmaniasis cases of the country are recorded, HVL is a major public health. However, other foci have been reported from southern Algeria, especially in the Hoggar, where leishmaniasis is known since 1950's mainly among children (Doury, 1957, 1956). During the period 1975–1990 only three HVL cases were recorded in this region (Harrat et al., 1992).

To our knowledge, a few studies on HVL epidemiology have been carried out in Tamanrasset despite the identification of several species of sand flies some of which are proven or suspected to transmit old world leishmaniasis: *Phlebotomus (Phlebotomus) bergeroti* (Parrot, 1934), *Phlebotomus (Larroussius) perniciosus* (Newstead, 1911), *Phlebotomus (Larroussius) longicuspis* (Nitzulescu, 1930), *Phlebotomus (Paraphlebotomus) sergenti* (Parrot 1917), *Phlebotomus (Paraphlebotomus) alexandri* (Sinton 1928),

Sergentomyia (Sintonius) christophersi (Sinton, 1927), *Sergentomyia (Sergentomyia) fallax* (Parrot, 1921), *Sergentomyia (Sergentomyia) antennata* (Newstead, 1912), *Sergentomyia (Sergentomyia) schwetzi* (Adler, Theodor et Parrot, 1929), *Sergentomyia (Sintonius) clydei* (Sinton, 1928), *Phlebotomus hirtus* (Parrot, Bouquet de Jolinière, 1945) and *Phlebotomus (Parrotomyia) eremitis* (Parrot, Bouquet de Jolinière, 1945) (Belazzoug and Mahzoul, 1986).

Here, we report a retrospective study on HVL cases together with an inventory of sand flies which have been established in the leishmaniasis foci of Hoggar.

2. Materials and methods

2.1. Study area

Hoggar is a highland region in central Sahara (southern Algeria). Tamanrasset is the main city located about 1.500 km south of Algiers with a population of 209.324 inhabitants according to the last census of 2009. The region is largely a rocky desert with an average altitude of more than 1000 m above the sea and an area of 557.906 km². Due to its prehistoric settlement and biodiversity, the Hoggar is a protected region included within the national parks of the country. The climate is very hot during summer and cold in winter when the temperature usually falls below 0 °C. Rainfall is sporadic and rare; however the climate is less extreme than in most other areas of the Sahara. Touaregs are the inhabitants of this region (Fig. 1).

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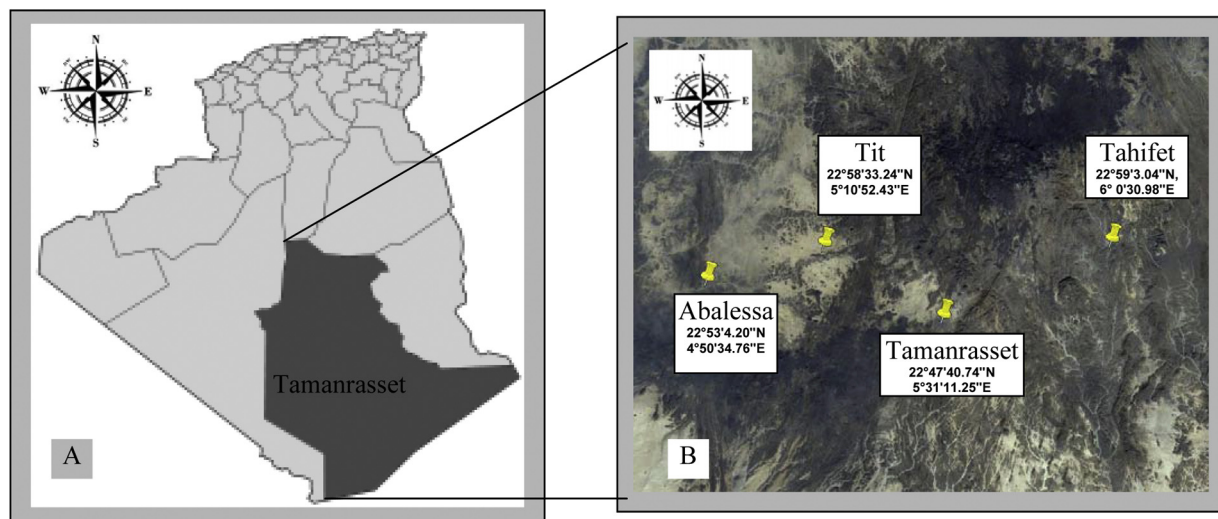


Fig. 1. (A) Map of Algeria. (B) Sites of entomological surveys.

2.2. Patients

Epidemiological data including age, sex, location of patients and the treatment outcome were kindly provided by the Health Services of Tamanrasset.

2.3. Sand flies

45 night/traps were performed from May to November 2010. CDC miniature light traps were placed in animals shelters, inside and outside houses at the sunset and removed early in the morning from the different sites namely Abalessa, and Tamanrasset including Tit and Tahifet. These villages were selected based their record of leishmaniasis during the precedent years. Sand flies collected were stored in 70% alcohol and sent to the Pasteur Institute of Algeria for identification and analysis. The head and genitalia of each female were separated from the body for identification using the keys of Abonnenc (1972) and Dedet et al. (1984). The remaining body was used for PCR analyses.

2.4. Parasite detection

DNA from each batch containing females of the same species was extracted by the Qiagen kit according to the manufacturer instruction. *Leishmania* sp. detection was carried out by ITS1 PCR (Internal Transcribed Spacer) according to protocol of Schönian et al. (2003).

Table 1
Distribution of human visceral leishmaniasis cases in the Hoggar (1997–2011).

Years	Tamanrasset (n = 95.400)	Abalessa (n = 10.622)	Tazrouk (n = 10.568)	Total
1997	1	–	–	1
1998	4	–	6	10
1999	1	–	1 (1*)	2
2000	1	2 (1*)	–	1
2001	2	–	–	4
2002	1	–	–	1
2006	2 (1*)	1	1	1
2007	4 (1*)	–	–	1
2008	6 (3*)	–	–	2
2009	1	1	–	4
2010	24	–	4 (1*)	11
2011	5	4	4 (1*)	5
Total case		1	16	43
Total death			3	9

3. Results

3.1. HVL cases

During the period 1997–2011, 43 HVL cases were notified with an annual fluctuation of 01 to 11 cases (Table 1). The distribution of cases shows two major peaks; 10 cases in 1998 and 11 cases in 2010; most of them were recorded in the localities of Tamanrasset (50%) and Tazrouk (30%). The disease touched mostly children (42/43) and 50% of them were recorded in infants under 5 years. Males represented 65% of all cases with a sex ratio of 1.93 (Fig. 2), Deaths represent more than 20% (09/43) of all cases mainly recorded among infants between 5 months and 7 years.

3.2. Sand flies identification

A total of 180 sand flies belonging to the genera *Phlebotomus* and *Sergentomyia* were collected from the selected sites. *Phlebotomus bergeroti* was the most abundant species (68%) followed by *S. schwetzi* (22%). They were collected mainly indoor (Table 2).

Leishmania DNA detection was negative in 65 females of *P. bergeroti*, *Paraphlebotomus alexandri* and *P. kazeruni* species.

4. Discussion

Human visceral leishmaniasis (HVL) is a neglected vector born disease which affects mostly the poorest countries worldwide, This

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