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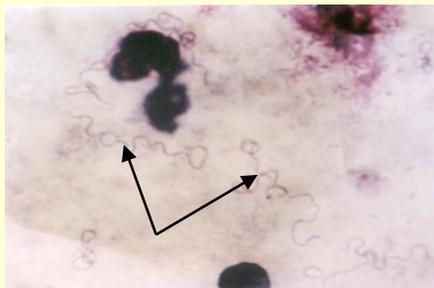
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Background

Tick-borne relapsing fever (TBRF) due to *Borrelia crociduræ*, a poorly known disease with symptoms similar to malaria, is a major cause of morbidity in most rural areas of Senegal where the distribution of the disease, previously limited to the Sahel, spread to Sudan savannah areas during the 1970s in relation to the persistence of the sub-Saharan drought. Here we report studies conducted from 2002 to 2011 in 11 West African countries to investigate the current distribution of the vector tick *Ornithodoros sonrai*, the occurrence of *B. crociduræ* infections in the vector and in small mammals, and their relationship with climatic and other environmental factors.



The Pathogen

The spirochaete *Borrelia crociduræ*



The vector

The Argasid tick *Ornithodoros sonrai*



The Vertebrate Reservoir

Small wild rodents and insectivores

Geographical distribution of the tick vector and recent extension of tick-borne borreliosis

The distribution of *O. sonrai* is poorly known, but a relationship to rainfall was already reported in Senegal (Trape *et al.*, 1996). The presence of this tick is known in sahelo-soudanian areas of West Africa and also reported in Egypt, saharian regions from south Morocco. After Morel (1965), the most of the localities where this tick was collected are situated in the regions where the mean rainfall is below 500 mm. It was never collected in places where the annual rainfall exceed 750 mm.

In West Africa, including Senegal, we note that the isohyets shifted to the south for at least one degree of latitude since 1970 due to the persistence of the sub-Saharan drought (Figure1). The geographical extension of *Ornithodoros sonrai* tick distribution corresponds closely to the southern shift of the isohyet 750 mm since 1970 (Figure 1).

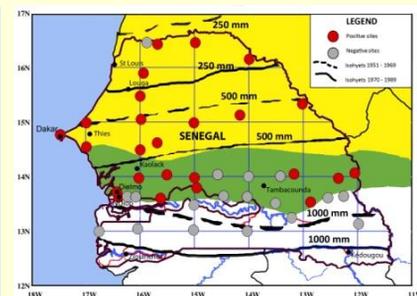


Figure1: The previous (before 1970, yellow) and present (green) distribution of *Ornithodoros sonrai* in Senegal.

Materials and Methods

From 2002 to 2011, we investigated the occurrence of *O. sonrai* in rodent burrows in 181 study sites in Mauritania, Senegal, Guinea Bissau, Guinea, Liberia, Mali, Burkina Faso, Niger, Benin and Togo. Ticks collected in each site and associated *Borrelia* were genetically characterized by sequencing. We collected small mammals in Mauritania, Senegal, Mali, Niger and Benin. They were tested for *Borrelia* infections by thick blood film and/or blood or brain inoculation to white mice.

Findings

Of 7,791 burrows of small rodents and insectivores examined, 905 (11.6%) were found colonized by *Ornithodoros* ticks morphologically and genetically attributable to *O. sonrai*. Only sites in Senegal, Mali, the Gambia and Mauritania were found positive for this vector (Figure 2). *B. crociduræ* infections were demonstrated in 245/1121 (21.8%) of ticks tested by nested PCR (Figure 3) and 44/727 (6%) of rodents and insectivores. All infected mammals were collected in areas where we found the vector. The southern distribution limits of *O. sonrai* and *B. crociduræ* were 13°32'N in Senegal, 13°35'N in The Gambia, and 13°58'N in western Mali, i.e. corresponding approximately to the 750 mm isohyet (Figure 2). In central and northern Mali, the vector was only found along the Niger River and its eastern limit was 00°34'E. In Mauritania, the vector reached the Moroccan border.

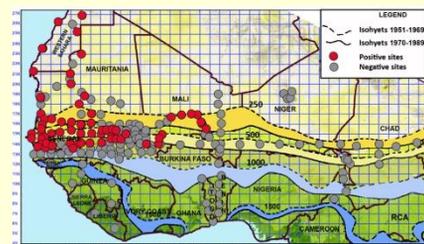


Figure. 2: Geographical distribution of *O. sonrai* ticks related to the isohyets shift in the West Africa (250 mm, 500 mm, 1000 mm, 1500 mm) in 1951-1969 and 1970-1989 (L'HOTE & MAHE, 1996)

Discussion

Although climatic factors are clearly associated with the distribution and the recent spread of TBRF in the westernmost part of West Africa, the vector appears absent from climatically suitable areas of Burkina Faso and Niger. It is only in central and eastern Mali that the distribution of the vectors was associated with the principal riverbed of Niger River and its main inflows.

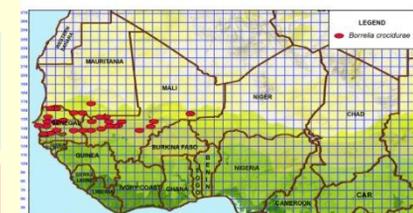


Figure 3: Spatial distribution of *Borrelia crociduræ* in the West Africa

References : Trape *et al.* Tick-borne borreliosis in West Africa. *Lancet* 1991, 337:473-475; Trape *et al.* The spread of tick-borne borreliosis in West Africa and its relation to Subsaharian drought. *Am J Trop Med Hyg* 1996, 54:289-296; Godeluck B *et al.* A longitudinal survey of *Borrelia crociduræ* prevalence in rodents and insectivores in Senegal. *Am J Trop Med Hyg* 1994, 50:165-168; Diatta G *et al.* A comparative study of three methods of detection of *Borrelia crociduræ* in wild rodents in Senegal. *Trans Roy Soc Trop Med Hyg* 1994, 88:423-424; Vial *et al.* Incidence of tick-borne relapsing fever in West Africa: a longitudinal study. *Lancet* 2006, 368:37-43