Vectorial Role of Phlebotomine Sandflies

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Abstract

The mating of sand flies is done at the beginning of the adult stage, it occurs after the blood meal, necessary for the maturation of the eggs. There are about 100 eggs per female. Egg incubation time ranges from 5 to 10 days in humid, relatively constant temperature environments and is close to organic matter required for larval nutrition such as burrows, upper soil layers furniture, cracks in the walls [1]. The hatching gives birth to a larva that passes through four larval stages separated by three moults; the fourth gives birth to a nymph. Pupation is done in a less humid place and the nymph gives the adult 7-10 days later. The duration of development cycle is 35 to 60 days depending on the climatic conditions [2]. The drop in temperature during the bad season, coupled with an increase in humidity, causes diapause in the fourth larval stage [3].

The life span of males ranges from 2 weeks to 2 months, depending on external factors, particularly temperature and humidity [2]. Some species are clearly endophagic, others are exophilic. Sandflies of both sexes feed on plant juices, but only the female is hematophagous. Hematophagy is telmophagic type and the blood meal is necessary for the development of eggs and the gonotrophic cycle of the female.

Adults start to come out at night if the temperature is high enough (above 19 to 20°C), if there is no wind and the humidity is high. During the day, they hide in dark, sheltered places. In tropical regions, they are active all year, while in temperate regions, their activity is seasonal. Their appearance, their density, their period of activity and their disappearance vary according to the latitude, the altitude, the season and the species [4]. In Tunisia, the period of activity of sandflies is closely related to the transmission of leishmaniasis. It is spread from May to October [5]. The peak activity period appears to be in August [6].

The flight of the sandfly is perfectly silent; it is made by small leaps but can also cover quite large distances. Studies in different countries have shown that flying distance varies with species and bioclimatic factors [7-10].

Transmission of Disease Agents by Phlebotomine Sand Flies

Exposure to repeated bites of sandflies can induce allergic reactions. Many people suffer from the toxic effect of their saliva. The sting is telmophagous and painful, but the intensity of the host’s reactions varies according to the species of sandflies involved (pain, appearance of a papule or a haemorrhagic stain).

Sandflies are also known by their carrier roles of many agents of various human, animal and even plant diseases. In 1969, Macfarlane and his collaborators showed that males of Phlebotomus langeroni can play the role of mechanical vector of Brevipalpus phoenicis (mite of the family Tenuipalpidae). Indeed, these authors collected on this vector five copies of this parasite. The latter is parasitic plants like Citrus, Thea, Coffea. It attacks these plants by essentially causing browning or necrotic areas on the leaves, fruits, stems, twigs and bud tissues of the infected host.

Two genera, Phlebotomus in the Old World and Lutzomyia in the New World, are of medical interest: they transmit leishmaniasis, bartonellosis and several arboviruses [4,11-13]. Recently, the detection of Toscana virus RNA in Sergentomyia minuta and Leishmania major in Sergentomyia species, a species of sandflies considered as herpetophile, made it possible to incriminate the vector role of species of the genus Sergentomyia [14-16]. In this context, it is important to note that there is a specific association between insect vector species and parasites although permissive sandflies were recently reported [17]. Phlebotomus sergenti is known to transmit Leishmania tropica. However, several studies showed that this parasite can be transmitted by Phlebotomus arabicus in some areas of the world [18].

Since the beginning of the last century, leishmaniasis has been the subject of numerous clinical and epidemiological studies [19-22]. The suffering due to leishmaniasis is threatening 350 million people in 88 countries. In its most serious form, this disease is fatal. Leishmaniasis is a parasitic disease with a wide variety of clinical manifestations.
Bartonello, a disease restricted to the high valleys of Latin America, has also been well studied [23-25]. The cause of this disease, also known as "Oroya fever", is a bacterium, called *Bartonella bacilliformis*, transmitted by sandflies belonging to the genus *Lutzomyia*. As for arboviruses due to sandflies, they remain insufficiently known. The transmitted viruses are divided into three genera belonging to different families: Phlebovirus, Vesiculovirus distributed in the old world and the new world and Orbivirus which affects only the new world. In the Mediterranean region, only phleboviruses are involved in medicine. They define what is commonly known as the "sand fly fever", "papatasi fever" or "three-day fever" group [26,27].

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