



Original Research Article

## Sand flies of Morocco: Biodiversity of the *Phlebotomienne* fauna of Had Kourt Region (Province of Sidi Kacem, Morocco)

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### ABSTRACT

Over a year of exploration, among April 2009 and June 2010, we covered a range of 166.96 m<sup>2</sup> as a field of our research. We came to discover about 2677 sticky traps in six stations were located in the area of Had-Kourt. We have collected 3283 individuals divided into two genera: four subgenera and six species. *Phlebotomus Sergenti* is the most abundant type (37.95 %) followed by *Phlebotomus longicuspis* (30.40%), *Sergentomyia minuta* ( 20.01% ), *Phlebotomus papatasi* (9.60 %), *Phlebotomus perniciosus* (0.97 %) and, finally, *Phlebotomus Arisai* (only 0.12%) of the caught insects.

**Keyword:** Sandflies; biodiversity ; Had Kourt; Morocco

### INTRODUCTION

Phlebotomine sand flies are Nematoceros Dipterans of Psychodidae family and Phlebotominae subfamily [1]. The medical importance of these insects that those insects are vectors of certain various human and animal diseases. They can transmit fever in three days, or sand fly fever in the Eastern Mediterranean Basin, Peruvian wart in South America and cutaneous and visceral

leishmaniasis of men and dog in old and new continents.

In Morocco, the list consists of 22 species of sand flies, distributed in 13 species of the genus *Phlebotomus* and 09 species of *Sergentomyia* [2]. Only species of the genus *Phlebotomus* cause the transmission of leishmaniasis that is considered to be the problem of public health in Morocco.

The objective of this study is to recognize and to investigate on taxonomic components: The spatial distribution of different populations, their relative abundance and their sex rate.

## STUDY AREA

This research was done in the area of Had-Kourt, the capital of Tilal Elgharb in the north-eastern part of Gharb Chrada Bni Hssen region. It is one of the 5 circles constituents in the province of Sidi Kacem (Fig. 1) that is a part of the endemic focus of cutaneous leishmaniasis northwest of Morocco. We have chosen six stations out of six different sectors for the sake of this study. These stations as the following:

**El Khachla:** It is a well-organized urban located in the center of Had-Kourt.

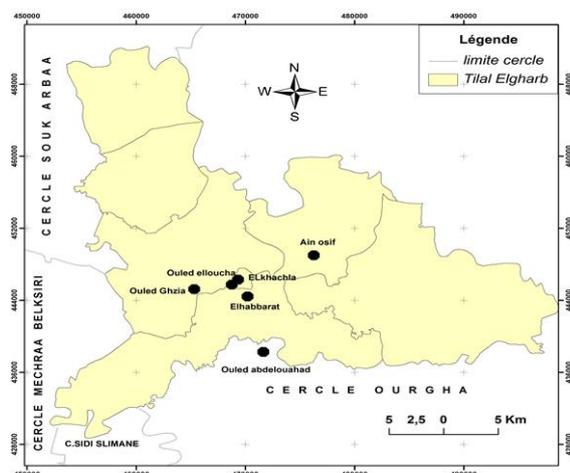
**Oueled Elloucha:** It is an unorganized slum consists of rural houses. It is located in the western outskirts of Had Kourt.

**El Habbarat:** an outskirts located in the south of the city. Most of its inhabitants are farmers.

**Ouled Abdelouahad:** It is a rural area far about 6 km south of the Had-kourt.

**Ouled Ghzzia:** it is a rural area located 3.5 km west of the Had-kourt, specifically on the east coast of Rdat River.

**Ain Ousif:** It is a water source located on the south-east of Kourt mountain.



**Fig. 1: The Location of the surveyed stations**

## MATERIELS AND METHODS

### Technique

We used in this study a single capture technique like adhesives traps, particularly best suited to the inventory of Phlebotomine resting sites in the extended region. These adhesive traps are made of matt white paper -format 15 x 20cm- largely soaked purified castor oil. They are placed at the entrance of sand flies lodgings in the evening around 6pm, and picked up until the next morning around 7am. They allowed us to study the spatial distribution and compare stocking densities in different habitats [3].

### Treatment

All the collected samples were preserved in alcohol (70%) until the microscopic mounting. They have been clarified by 10% potash for 4 hours and Marc-André liquid for 2 hours. Then they were mounted between slide and cover slip in the Marc Andre liquid. The head is placed on its underside, its dorsal face in the upper position (for the Phlebotomus genus) to have an easy observation of pharyngeal armatures. Male genitalia and the distal portion of female abdomen are deposited on their side faces to observe the different elements necessary for this specific diagnosis [6].

## RESULTS

### Global inventory

Between April 2009 and June 2010, we covered 166.96 m<sup>2</sup> trapping, 2677 traps in six stations (El Khechna, Elloucha, Ouled El Habbarat, Ouled Abdelouahad, ouled Ghzia and Ain Ozif). The results of this entomological investigation are reported in Table1.

As indicated in Table 1, we collected 3283 individuals divided into two types, four subgenus of sand flies and six species. *Phlebotomus sergenti* is the most abundant species (37.95%), followed by *Phlebotomus longicuspis* (30.40%), *Sergentomyia minuta*

(20.01%), *Phlebotomus papatasi* (9.60%), *Phlebotomus perniciosus* (0.97%) and, finally, *Phlebotomus Arisai* only 0.12%.

#### Stational distribution and abundance Frequency

The results of the relative abundance of different species of sand flies captured in the six stations of Had Kourt region are indicated in table 2.

The results provided in table 2 reveal that two of the most abundant species in our harvest (*Phlebotomus sergenti* and *longicuspis*) are present in all studied areas with proportions and vary between 0.09% and 13.07% according to the area of *Sergentomyia minuta* with a rate of 20% and *Phlebotomus papatasi* with 9.59% were observed in five between the six stations involved in our study.

**Table 1: Number and relative abundance of captured sand flies**

Genus	Sub genus	Species	Effective	Relative abundance (%)
Phlebotomus	Paraphlebotomus	P.sergenti	1246	37,95
		Larroussius	P.longicuspis	998
	Phlebotomus	P.perniciosus	63	1,92
		p ariasi	4	0,12
Sergentomyia	Sergentomyia	P.papatasi	315	9,60
		S.minuta	657	20,01
	totale		3283	100

**Table 2: Frequency abundance relative of the caught species**

Stations	Relative abundance (%)						Total
	P longicuspis	P sergenti	S minuta	P papatasi	P perniciosus	P ariasi	
O. Elloucha	13,07	9,23	6	4,23	0,98	0	33,51
El habbarat	8,96	10,57	4,69	0,94	0,34	0,12	25,62
O. Abdelwahad	5,76	9,66	3,96	2,74	0,46	0	22,58
Ain Ouzzif	2,01	5,42	3,1	1,25	0,15	0	11,93
O. Ghzia	0,37	2,98	2,25	0	0	0	5,6
Al khachla	0,24	0,09	0	0,43	0	0	0,76
Total	30,41	37,95	20	9,59	1,93	0,12	100

O : Ouled, P : phlebotomus, S : sergentomyia

*Phlebotomus perniciosus* (1.93%) was found in three stations and *Phlebotomus ariasi* species abundant (0.12%) were observed only in the locality of El Habbarat.

#### Stational distribution and sex rate of the species

The results of the sex rate of sand flies species in six stations are identified in Fig. 2.

The samples collected by oiled paper, a predominance of males to females by contribution was observed in five species (*Phlebotomus sergenti*, *longicuspis*, *papatasi*, *perniciosus* and *Sergentomyia minuta*). However, the total female dominance over males was observed in *Phlebotomus Arisai*. Male dominance was recorded in all surveyed localities.

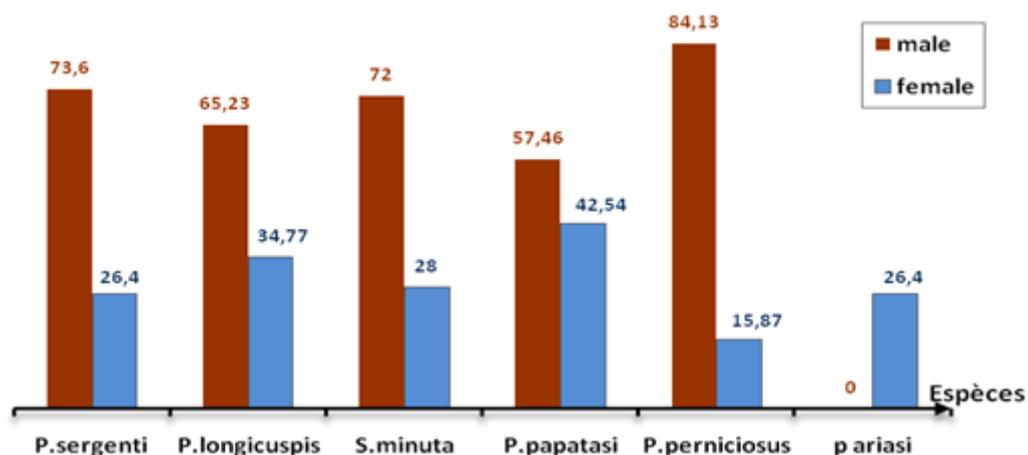


Fig. 2: Frequency abundance relative of the caught species

## DISCUSSION

Through this process, we have brought together a number of very useful data on biodiversity and spatial distribution of sand flies in Had-Kourt city and its environs. The oiled paper method of capturing being used in the research enables knowing the important work of the Russians epidemiologists VLAZOV (1932), and PETRISCHEVA (1935) [3]. It is a non-selective method that has been widely used in this kind of investigation in various countries of the Mediterranean region [4, 5].

For 12 months, we were able to capture 3283 individuals. The sand flies belong to the six species and two genera. The genus *Phlebotomus* species is involved in the transmission of leishmaniasis to humans in Africa [6]. More than 47.44% of this genus is represented by *Phlebotomus sergenti* species known as a vector of LC in Maghreb [7] and Morocco [8]. The second species of the genus *Phlebotomus* is *Phlebotomus longicuspis* with a proportion of 38%. It is involved in the transmission of *L. infantum* [9].

The other species of this genus are less represented with respectively 12% for *Phlebotomus papatasi* vector of cutaneous

leishmaniasis caused by *Leishmania major* [10], 2.4% *Phlebotomus perniciosus* and 0.15% for *Phlebotomus ariasi*. These last two species are reported as vectors of visceral leishmaniasis in the Mediterranean countries [11,12]. The genus *Sergentomyia* is representing 20.01% of the total of individuals collected. We captured a single species in the area of Had Kourt which is *Sergentomyia minuta* including epidemiological role remains unclear.

The study of the spatial distribution of different species of sand flies in the study area allowed us to discover that species richness that varies from one area to another. In fact, all species were identified in this study (six species) and were found in El habbarat area. Moreover, five species were collected in three other areas: Ouled Elloucha, O. Abdelwahad and Ain Ouzzif. The three species are representing the lowest species richness that were found in two areas of Ouled Ghzia and Al khachla.

The analysis of the relative frequency of abundance proves that *Phlebotomus longicuspis* and *sergenti* are present in all the territory of the study. These two species are ubiquitous in Morocco [13, 14]. *Sergentomyia minuta* and *Phlebotomus papatasi* were captured in five areas: *Phlebotomus perniciosus*

was found in three of the six explored area and, finally, *Phlebotomus ariasi* was collected only in the area of El habbarat.

Regarding the sex rate, the results of our entomological survey demonstrate that there was a predominance of males representing 69.26% of the total. By contrast, females shape only 30.74% of captured species. The male predominance is observed in five species identified on six. However, the dominance of female over male is total in one species *Phlebotomus ariasi*. These results can be explained by the fact that males usually remain near to the resting places, while females search for blood or ovipositor places [11].

## CONCLUSION

During a year of exploration in Had Kourt region, we have identified six species of sand flies. Five among them are confirmed vectors of leishmaniasis. The spatial distribution of these species that the sex rate in favor of males is not uniform in this region, but it depends on the environmental conditions.

Eventually, this prospective study is still preliminary, yet other scientific studies concerning the sand flies should be encouraged to specify the biogeographical and ecological profile of these insect that are vectors of leishmaniasis in the active center of Had Kourt.

## CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

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