ENTOMOLOGICAL STUDIES OF *PHLEBOTOMUS PAPATASI* AND *P. SERGENTI* (DIPTERA: PSYCHODIDAE) AS VECTORS OF CUTANEOUS LEISHMANIASIS IN SHIRAZ, IRAN

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Abstract. Leishmaniasis is considered endemic in 82 countries, including Iran. In order to control the vectors of leishmaniasis, entomological studies, such as fauna, seasonal abundance, nocturnal activity, sex ratio, resting site, etc, are necessary. In this investigation, the species composition of sandflies, and the seasonality and nocturnal activity, sex ratio, and resting site, of *Phlebotomus papatasi* and *P. sergenti*, for implementation of future control measures, were surveyed in northeast Shiraz City, southern Iran. Two thousand, five hundred (2,500) adult sandflies were collected from internal and external fixed places by sticky trap. SPSS version 1.3 software was used to analyze the data. Meteorological data were obtained from the meteorological organization in Shiraz. In this investigation, a total of 4 species were recorded: *P. papatasi*, *P. sergenti*, *Sergentomyia sintoni*, and *Ser. dentata*. Peak abundance of both *P. papatasi* and *P. sergenti* occurred in September, and declined by December. Between sunset and sunrise, the maximum and minimum abundance were found to be at 20 00 hour, and 05 00 or 06 00 hour, respectively. The sex ratio (F/M) of the *P. papatasi* varied from a high ratio of 10.9: 1 in October, to a low ratio of 1.2: 1 in June. The abundance of sandflies in the external regions was significantly more ($p<0.05$) than the internal regions in all months except May and June. Using the results of this investigation, health workers in this area can better manage the control and prevention of cutaneous leishmaniasis.

INTRODUCTION

Phlebotomine sandflies are known vectors of several pathogens of public health importance, including protozoa of the genus *Leishmania* and several arboviruses (Javadian *et al*, 1991). Leishmaniasis is a vector-borne zoonotic disease occurring in three distinct manifestations: cutaneous, muco-cutaneous, and visceral. It is endemic in approximately 90 countries in tropical and subtropical regions of the world (Desjeux, 1996). Transmission can occur in different areas, such as rain forests and desert, rural and peri-urban habitats and sylvatic and domestic areas in Asia, Africa, Europe and South America (Magill *et al,* 1993; Herwaldt, 1999).

Leishmaniasis is still a great health problem in Iran, with > 30,000 new cases every year (Motazedian *et al*, 2002). Both forms of cutaneous leishmaniasis (CL) are present, and *Phlebotomus papatasi* and *P. sergenti* are the main vectors of the disease in Iran (Yaghoobi-Ershadi *et al,* 2001). Entomological studies are necessary to control the vectors of leishmaniasis. The objectives of this investigation were to describe the seasonal abundance, nocturnal activity, resting sites, sex ratio of *P. papatasi* and *P. sergenti*, and the species composition of sandflies in the study area.

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MATERIALS AND METHODS

This investigation was carried out in northeast Shiraz City, Fars Province, in southern Iran, in January-December 2004. Sticky traps and an aspirator were used to collect sandflies at selected indoor and outdoor sites, selected on the basis of previous investigations of the biology of sandflies, including cracks in walls, caves, on riverbanks, and in private homes. The sticky traps were laid out from sunset to sunrise on three nights per month. In January, April, November, and December, when the numbers of adults were < 1, sticky traps were laid only 1 night per month. Meteorological data were obtained from Shiraz weather station for several months.

Air temperature and relative humidity were recorded hourly from 18 00-06 00 hour, to report nocturnal activity. Sticky traps were also laid out in three outdoor and indoor fixed places from 18 00-06 00 hour once-hourly for the nocturnal activity of sandflies in the peak month of activity. The sticky traps were transported to the laboratory and specimens were separated for identification using the pictorial key of Nadim and Javadian (1976). Data were analyzed by SPSS ver. 10 computer software.

RESULTS

A total of 4,325 adult sandflies were collected from January to December. Four species of two genera (*Phlebotomus* and *Sergentomyia*) were identified. *P. sergenti* (54%) was the most abundant species, followed *by P. papatasi* (24%), *Ser. sintoni* (14%), and *Ser. dentata* (8%).

Seasonal abundance

A total of 2,325 adult sandflies, comprising *P. papatasi* (780) and *P. sergenti* (1545) were collected from January to December in one year. According to Fig 1, sandflies were not active in January-April, and December, and they were recorded in May for the first time. September was the month of peak activity. The population of both species, *P. papatasi* and *P. sergenti,* increased to a maximum during September and then decreased to a minimum during November. The number of adult *P. sergenti* per month was significantly greater than *P. papatasi* ($p< 0.01$). In May, the month when activity began, the mean temperature was 18.5°C and the relative humidity 26.5%. In September, the peak-activity month, the mean temperature was 28.5 °C and the relative humidity was 32.5% (Fig 1).

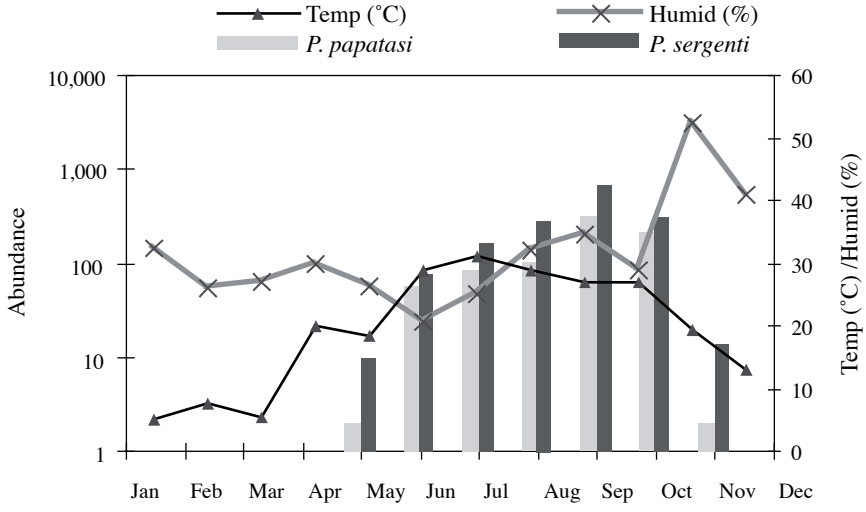

Fig 1- Monthly means of adult *P. papatasi* and *P. sergenti* captured per sticky trap in Shiraz, Iran, Jan-Dec 2004.

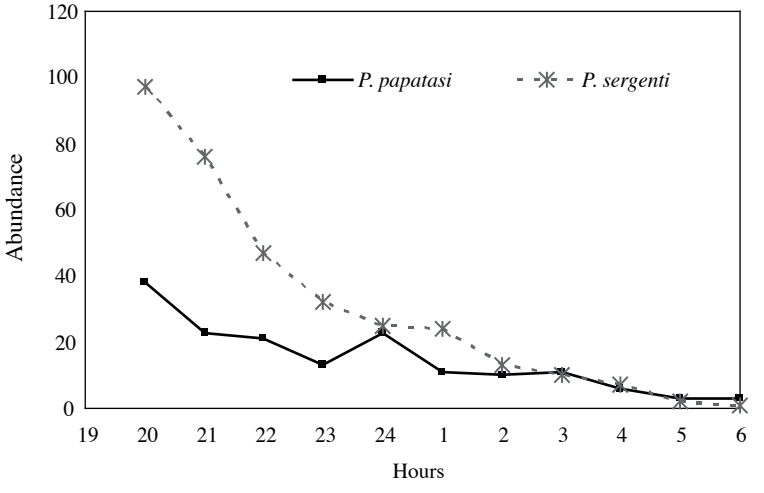

Fig 2- Nocturnal activity of adult *P. sergenti* and *P. papatasi* from 20 00 -06 00 hour in August 2004, in northeast Shiraz, Iran.

Nocturnal activity

The peak activity of adult *P. papatasi* and *P. sergenti* was at 20 00 hour and the minimum for both was 06 00 hour during the period 18 00-06 00 hour in September, the month of peak activity (Fig 2).

Sex ratio

Significantly more adult male than female of both *P. papatasi* and *P. sergenti* sandflies were collected in sticky traps each month. The sex ratio (female:male) of the adult *P. papatasi* varied each month, from a high of 10.9:1 in October, to a low of 1.2:1 in June. For *P. sergenti*, it varied from a high of 4:1 in May, to a low of 1.2:1 in October. The overall percentage of male *P. papatasi* was 85% and *P. sergenti* 70%.

Resting site

The monthly abundance of *P. sergenti* outdoors was higher than indoors in all months, while the monthly abundance of *P. papatasi* outdoors was almost equal to indoors. The nocturnal activity of both *P. papatasi* and *P. sergenti* outdoors was greater than indoors, especially from 19 00-23 00 hour.

DISCUSSION

Phlebotomine sandflies, the vectors of leishmaniasis, have received considerable attention in recent years due to the resurgence of leishmaniasis in some endemic areas of Iran. Extensive studies have been conducted on the ecology of sandflies in different parts of country in recent years. No sandflies were observed in winter, and adult specimens were not collected when the temperature was < 18.5°C. The peak nocturnal activity of *P. papatasi* and *P. sergenti* was at 20 00 hour, and it slowly decreased to a minimum at 06 00 hour. The nocturnal, monthly, and yearly activities of both *P. papatasi* and *P. sergenti* outdoors was greater than indoors. The findings in this region of Iran agreed with those of Javadian *et al* (1991) in Meshkinshahr, in northwest Iran, and also Varamin, south of Tehran. The seasonal activity of *P. papatasi* and *P. sergenti* was observed in northeast Shiraz during the summer. These results were used to prevent and control vectors of cutaneous leishmaniasis in Shiraz, Fars Province, Iran, by healthcare workers in the Center for Disease Control (CDC).

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