Chapter 15
Relationships Between Climate Parameters and the Density of *Phlebotomus papatasi*, the Main Vector of Zoonotic Cutaneous Leishmaniasis

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ABSTRACT

This chapter presents an analysis of the seasonal activity of the Phlebotomus papatasi (leishmaniasis vector) through a correlation between its monthly activity and the monthly meteorological parameters. Three sites from three leishmaniasis endemic countries were used Morocco, Iran, and Greece. The high density of P. papatasi was observed in May in Greece, in July in Morocco and September in Iran. Before May and after September, an important decrease of P. papatasi activity was observed with a decline of maximum and minimum temperatures and an increase of precipitations. Secondly, strong associations between P. papatasi density and minimum and maximum temperatures were explored, third, no significant association have been detected between P. papatasi abundance and precipitations in the three sites. There is an average correlation between relative humidity and P. papatasi density for Isfahan and Creater Athens. Basically, P. papatasi is sensitive to low temperatures and high relative humidity, which makes these two variables better indicators for the possible emergence of cutaneous leishmaniasis.

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INTRODUCTION

Previous studies have investigated partially or mainly on the distribution on *Phlebotomus papatasi* because of its gravity as a vector of leishmaniasis (Cross et al., 1996; Yaghoobi-Ershadi et al., 2010;Soltani et al., 2015). During last five decades, this species was considered as the vector responsible for *L. major* in Mediterranean region mainly with arid climatic conditions (Bally-choumara et al., 1971; Rioux et al., 1984) and in Iran (Yaghoobi-Ershadi et al., 1995; Oshaghi et al., 2010; and Rassi et al., 2011),

According to the available literature, *P. papatasi* is the most abundant species in several countries, in Morocco (Zouirech et al., 2013), in Saudi Arabia (Mustafa et al. 1994; Doha & Samy, 2010), Libya (Dokhan et al., 2016), Iran (Abedi-Astaneh et al., 2015), Egypt (Ali et al., 2016), Tunisia (Chelbi et al., 2007), and in Turkey (Belen et al., 2011).

This species like others insects are climatic sensitive. Variation in climatic variables such as temperature, precipitation and humidity can impact on species distribution and abundance of leishmaniasis vectors (Maltezou, 2008). Topographically, the *P. papatasi* is localized in a large interval of altitude, between 814–1749m (Abedi-Astaneh et al., 2015) and 8–1756m (Yaghoobi-Ershadi, 2012). However, Doha & Samy (2010) recorded a distribution of the same species between 0-200 m and 800-1200 m. It is reported that currently, the leishmaniasis has a large geographical repartition compared to before (Dawit et al., 2013), and favored especially by human and environmental factors (Karmaoui, 2018; Karmaoui & Zerouali, 2018). Abedi-Astaneh et al., (2015) confirmed the high impact of human activities on leishmaniasis repartition.

Concerning the climatic factors, the impact of the mean temperature and relative humidity have been explored by Cross et al., (1996), Tarallo et al., (2010), and Reza & Mansour (2006), the maximum and minimum temperature were studied by Abedi-Astaneh et al., (2015) &Toprak et al., (2007), and the impact of the precipitation by Abdel-Dayem et al., (2012) &Abedi-Astaneh et al., (2015). Always in relation to the environmental factors, *P. papatasi* is frequent in the arid climate(Zhioua et al 2007) and attracted by the light (Volf et al., 2002). Additionally, the activity of *P. papatasi* in summer period was recorded by several authors, Alten et al., (2016) identified its activity in countries from south of Europe (Spain, France, Italy, Greece, and Cyprus), Boussaa et al., (2005), Veysi et al., (2012), and Sari et al., (2015) explored the abundance of *P. papatasi* respectively, in Kars province (Northeastern of Turkey),in Esfahan County(Iran), and in Marrakech city (Morocco). This seasonal activity can be used to explore the leishmaniasis risk (time and space).In this paper, the followings questions were investigated:

1. Is the insect behaves the same way in different areas and in different climatic parameters?
2. What is the common development period of the three sites?
3. Which variables have the greatest correlation with *P. papatasi* activity, and which will be used as relevant indicators of Leishmaniasis disease?

In order to address these issues, a statistic correlations between monthly *P. papatasi* density and monthly precipitation, temperature (maximum and minimum), relative humidity and wind speed were done between three sites from the three selected countries among the affected by leishmaniasis. The three selected sites are presents relatively in different climatic and geographical conditions. A comparison of climatic parameters was done in order to give a global vision of the vector behavior.