Available online at www.sciencedirect.com

Revista Mexicana de Biodiversidad

Revista Mexicana de Biodiversidad 86 (2015) 737–743

Instituto de Biología UNAM

www.ib.unam.mx/revista/

Ecology

Dimorphism and population size of the Mexican redrump tarantula, *Brachypelma vagans* (Araneae: Theraphosidae), in Southeast Mexico

Dimorfismos y tamaño de poblaciones de la tarántula de cadera roja Brachypelma vagans *(Araneae: Theraphosidae), en el sureste de México*

Yann Hénaut[a,*], Salima Machkour-M'Rabet[b], Holger Weissenberger[c], Roberto Rojo[a]

[a] *Laboratorio de Conducta Animal, El Colegio de la Frontera Sur., Av. Centenario Km. 5.5, 77014 Chetumal, Quintana Roo, Mexico*
[b] *Laboratorio de Ecología Molecular y Conservación, El Colegio de la Frontera Sur., Av. Centenario Km. 5.5, 77014 Chetumal, Quintana Roo, Mexico*
[c] *Laboratorio de Análisis de Información Geográfica y Estadística, Av. Centenario Km. 5.5, 77014 Chetumal, Quintana Roo, Mexico*

Received 10 July 2014; accepted 1 March 2015
Available online 31 August 2015

Abstract

As a general rule, spiders exhibit sexual dimorphism and their populations may differ in size according to season duration and resource availability. However, few studies have focused on dimorphism in tarantulas. Mexican redrump tarantulas, *Brachypelma vagans*, listed in CITES, have an exceptionally wide distribution. Surprisingly, there are no studies on the possible relationship between the abundance of tarantulas per population and the geographical areas where they are present, or on how the distribution pattern of this spider may affect individual morphological characteristics. Furthermore, there are no studies on sexual dimorphism within the genus *Brachypelma*. The aim of the study is to determine the existence of sexual and geographical dimorphism in populations of *B. vagans*. It was observed that the abundance of spiders per population may vary according to the geographical areas where they were recorded. In six localities in southern Mexico, we recorded morphological data on adult tarantulas. Sexual dimorphism was clearly observed at the site that presented numerous spiders characterized by much smaller females. Since the results of this study demonstrate differences in tarantula number of individuals per locality in southern Mexico, they make an important contribution to the conservation of this species.

Keywords: *Brachypelma*; Tarantulas; Density; Morphometry; Sexual dimorphism; Conservation

Resumen

El dimorfismo sexual es muy común en las arañas, pero también existen diferencias morfológicas entre poblaciones en función de las temporadas y la disponibilidad en los recursos. Pocos estudios han analizado el dimorfismo en tarántulas. La tarántula mexicana de cadera roja *Brachypelma vagans*, listada en el CITES, presenta una distribución amplia. Sin embargo, se conoce poco sobre sus poblaciones por áreas geográficas y sobre cómo el patrón de distribución de estos organismos, puede afectar las características morfológicas individuales. Tampoco se ha estudiado el dimorfismo sexual en el género *Brachypelma*. Nuestro estudio se enfoca en determinar si existen dimorfismos sexual y geográfico en poblaciones específicas de *B. vagans*. Se observó que la abundancia de tarántulas encontradas por población suele ser diferente de acuerdo con las áreas geográficas donde fueron observadas. Registramos datos morfológicos de tarántulas adultas en 6 sitios geográficos distribuidos en el sureste de México. Encontramos dimorfismo sexual únicamente en un sitio que presenta un número de arañas muy alto y donde las hembras son más pequeñas que en otras localidades. Nuestros resultados, considerando la variación en número de individuos por localidades a lo largo del sureste mexicano, tienen consecuencias para la conservación de esta especie.

Palabras clave: *Brachypelma*; Tarántulas; Densidad; Morfometría; Dimorfismo sexual; Conservación

* Corresponding author.
E-mail address: yhenaut@ecosur.mx (Y. Hénaut).
Peer Review under the responsibility of Universidad Nacional Autónoma de México.

http://dx.doi.org/10.1016/j.rmb.2015.07.003

Introduction

The large "tarantula" family Theraphosidae Thorell, 1869 (Araneae, Mygalomorphae) consists of 128 genera and 975 species distributed worldwide (World Spider Catalog, 2015). *Brachypelma* Simon, 1891 comprises 21 species that can be found within the Mesoamerican biological corridor; 14 species occur in Mexico, including 13 endemics and 1 (*Brachypelma vagans*) that is widely distributed in Mexico and Central America (World Spider Catalog, 2015). All are listed in Appendix II of the CITES convention (Convention on International Trade in Endangered Species), primarily to protect them from the illegal pet trade in the black market, as these highly sought species are very docile, large, and beautifully colored (West, 2005). Species of *Brachypelma* face other serious problems such as habitat destruction, high juvenile mortality, and late sexual maturity (Machkour-M'Rabet et al., 2007), leading to population decline or local extinction. Due to the vulnerability of the entire genus, some studies have concentrated on understanding their ecology (Criscuolo, Font-Sala, Bouillaud, Poulin, & Trabalon, 2010; Dor, Machkour-M'Rabet, Legal, Williams, & Hénaut, 2008; Machkour-M'Rabet, Hénaut, Rojo, & Calmé, 2005; Machkour-M'Rabet et al., 2007; Vilchis-Nestor, Machkour-M'Rabet, Barriga-Sosa, Winterton, & Hénaut, 2013; Yáñez & Floater, 2000); behavior (Dor, Calmé, & Hénaut, 2011; Dor & Hénaut, 2011, 2012, 2013; Locht, Yáñez, & Vázquez, 1999; Reichling, 2000; Yáñez, Locht, & Macías-Ordóñez, 1999); genetic structure (Longhorn, Nicholas, Chuter, & Volger, 2007; Machkour-M'Rabet, Hénaut, Calmé, & Legal, 2012; Machkour-M'Rabet et al., 2009), and traditional use by local populations (Machkour-M'Rabet, Hénaut, Winterton, & Rojo, 2011). The *Brachypelma* species are restricted to small and specific areas, with one exception, the Mexican redrump tarantula *B. vagans* Ausserer, 1875. This is the only species of the genus that is widely distributed and has been subject to several studies during recent years (Dor et al., 2008, 2011; Machkour-M'Rabet et al., 2005, 2007, 2009, 2011, 2012), also *B. vagans* was identified in Florida (Edwards & Hibbard, 1999) and Cozumel Island (Machkour-M'Rabet et al., 2012) as an invasive exotic tarantula. These studies demonstrate that this tarantula may be present in high densities in rural villages with low levels of anthropogenic disturbance and closed to medium semi-evergreen forests (Machkour-M'Rabet et al., 2005). In these areas, soil structure appears to be an important factor explaining the presence and high density of *B. vagans* due to their burrower condition (Machkour-M'Rabet et al., 2007). In this context, Hénaut and Machkour-M'Rabet (2005) observed that coexisting females are very aggressive toward congeners and commonly attack other females, which are detected by chemical cues (Dor et al., 2008).

Many species of animals with wide distribution ranges exhibit geographical variations in growth and life history traits (Stillwell & Fox, 2009). The body size of many animals varies with latitude and altitude (Blanckenhorn & Demont, 2004; Stillwell, Morse, & Fox, 2007), and the most common environmental variable advocated to explain body size variation is temperature (thermocline) (Stillwell & Fox, 2009). The geographic adaptations of animals, which include variations in body size, are generally genetically based (Armbruster, Bradshaw, Ruegg, & Holzapfel, 2001; Karl, Janowitz, & Fisher, 2008). Studies show that a thermocline (or other factors which vary with latitude or altitude) can result in both intra-specific and inter-specific size dimorphism (Blanckenhorn, Stillwell, Young, Fox, & Ashton, 2006; Stillwell & Fox, 2007; Teder & Tammaru, 2005). The body size of animals may also be correlated with population density (Robinson & Redford, 1986). Studies on *Nephila clavipes* Leach, 1815 (Araneae, Nephilidae) (Higgins, 1992, 1993, 1995) demonstrated that environmental variations result in differences in the size of individuals between spider populations. Higgins (2000) showed that seasonal variations or prey availability result in dissimilarities in spider size; females strategically adapt to these fluctuations by reaching maturity earlier when ecological conditions are degraded or reproduce before the end of the favorable season. Furthermore, Higgins (2000) demonstrated that late maturing *N. clavipes* females present lower reproductive success in strongly seasonal habitats. In *B. vagans*, a recent study (Vilchis-Nestor et al., 2013) showed that individuals recently introduced to an island (Cozumel Island, Quintana Roo, Mexico), had larger adults and a lower diversity of body patterns than individuals from mainland populations (e.g., the Yucatán Peninsula, Mexico).

The principal type of dimorphism in spiders is sexual dimorphism, with males usually smaller than females (Hormiga, Scharff, & Coddington, 2000). According to Darwin (1871) and present day authors, the first example of sexual dimorphism in animals was observed in spiders, principally web-building species from various families, but also for non-web-building groups such as the Lycosidae *Rabidos rabida* (Walker & Rypstra, 2001). Although sexual dimorphism is extreme in web-building spiders, non-web-building spiders generally have a lower degree of dimorphism (Walker & Rypstra, 2001). Sexual dimorphism is also evident in the relative size of body parts, with males having comparatively longer legs than females (Prenter, Montgomery, & Elwood, 1995). In Theraphosidae, males and females appear to be similar sized, but they present sexual dimorphism with respect to metabolic rates (Shillington, 2005). Tarantula females are sit-and-wait predators that remain in the same location during large periods of time. In contrast, males disperse by walking and actively search for females over large distances (Machkour-M'Rabet et al., 2012; Shillington, 2002).

This study compares populations of *B. vagans* from different geographical locations in Southeast Mexico. First, the study aims to determine if tarantula population size varies according to different geographical locations. Second, we focus on dimorphism among females from different populations to determine if geographical dimorphism occurs in *B. vagans*.

Materials and methods

All data for the morphology of *B. vagans* were obtained from a total of 6 sites in four different states of southern Mexico (Table 1, Fig. 1). In Chiapas, we sampled 2 sites, El Castaño (CH-EC; 15°17′N, 92°58′W, 16 masl) near the Pacific coast, and in Frontera Corozal (CH-FC; 16°49′N, 90°53′W, 117 masl)