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DISTRIBUTION AND NATURAL HISTORY OF MEXICAN SPECIES OF *BRACHYPELMA* AND *BRACHYPELMIDES* (THERAPHOSIDAE, THERAPHOSINAE) WITH MORPHOLOGICAL EVIDENCE FOR THEIR SYNONYMY

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ABSTRACT. This comparision of *Brachypelmides* and *Brachypelma* species is based on newly collected spiders and more than 100 specimens from five museum collections. The results show that there are six endemic species of *Brachypelma* in western Mexico (*B. auratum, B. baumgarteni, B. boehmei, B. emilia, B. pallidum, B. smithi*), presenting a gap in their distribution only where *Brachypelmides klaasi* is found. *Brachypelma vagans* is distributed along both coasts of Mexico and *Brachypelmides ruhnaui* is found in the central part of Mexico. Notes on natural history, a morphological comparison of 27 characters of these genera, and a discussion of the generic affinities are included.

RESUMEN. De junio de 1997 a Octubre de 1998 se hizo un estudio comparativo de *Brachypelmides* y de las especies de *Brachypelma*. Se revisaron especímenes de ambos géneros obtenidos en el campo recientemente y más de 100 especímenes de cinco diferentes colecciones para realizar este estudio. Los resultados muestran que hay seis especies endémicas al Pacífico mexicano de *Brachypelma* (*B. auratum, B. baumgarteni, B. boehmei, B. emillia, B. pallidum, B. smithi*), presentando una distribución continua a lo largo de la costa del Pacífico, siendo interrumpida por la distribución de *B. klaasi. Brachypelma vagans* se distribuye en ambas costas y *Brachypelmides ruhnaui* en el centro del país. Se incluyen notas de historia natural, una comparación morfológica de 27 características de estos géneros y una discusión de las afinidades genéricas.

The subfamily Theraphosinae is a speciose group from the New World, representing some of the most beautiful species of the family Theraphosidae (Pérez-Miles 1992; Schmidt 1993; Smith 1993; Pérez-Miles et al. 1996). The genus *Brachypelma* can be found from Mexico to Costa Rica (Valerrio 1980; Smith 1994). The species from the west coast of Mexico are particularly docile and colorful. These traits have led to their being collected in large numbers for the pet trade. The destruction of the natural habitat and the high mortality before sexual maturity (99%) (Baerg 1958) are two factors that affect the populations of these species, and combined with the illegal trade that normally involves the capture of preadult and adult tarantulas, can cause the extinction of these tarantulas. To regulate this trade and prevent their endangerment, all the species of this genus have been listed in appendix II of CITES.

In 1856 White described the first *Brachypelma* species, *B. emilia*, that is endemic to the Pacific coast of Mexico. Since then, another five species have been described that are endemic to this area (*B. auratum, B. baumgarteni, B. boehmei, B. pallidum, B. smithi*) (Schmidt 1992; Smith 1993; Schmidt & Klaas 1994; F.O.P. Cambridge 1897). *Brachypelma vagans* Ausserer 1875 inhabits the same area but populations also exist along the Gulf of Mexico down to Costa Rica. *Brachypelma epicureanum* (Chamberlin) 1925 is found only in the Yucatan peninsula (Smith 1994).

Schmidt & Krause (1994) described a new species of Theraphosinae from the west coast of Mexico. Although this tarantula is very similar to those of *Brachypelma*, they argued that it should be placed in a new genus because it has a pad of plumose hairs on the femur IV, the males present a sharp tapered embolus, and the females have a bipartite and wide spermatheca. The species was named *Brachypelmides klaasi*. However, in the same

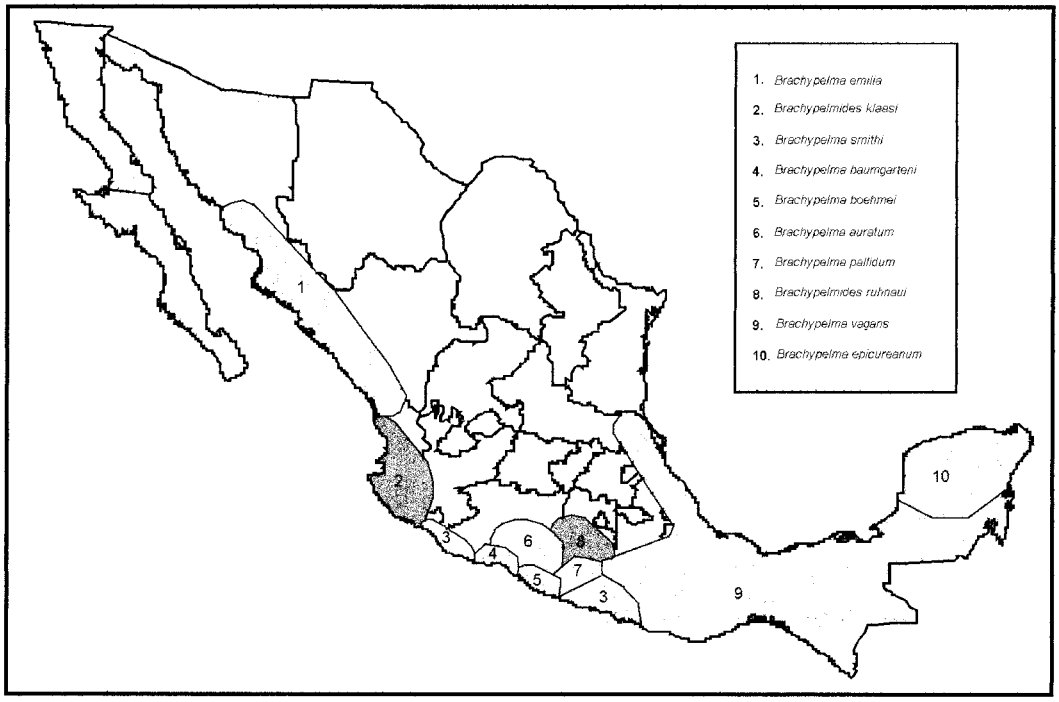


Figure 1.—Distribution of the species of *Brachypelma* and *Brachypelmides* in Mexico.

year Smith (1994), after examining the types, concluded that *B. klaasi* belongs to the *Brachypelma* group, being only ''its most extreme form.'' Pérez-Miles et al. (1996) made a systematic revision and a cladistic analysis of Theraphosinae, but they did not include *Brachypelmides* in their analysis. Schmidt (1997) described another new *Brachypelmides* species from the central region of Mexico, *B. ruhnaui,* adding support to his idea that *Brachypelmides* is a valid genus.

Our research of the species of *Brachypelma* and *Brachypelmides* brings more data to the question of the distinctness of these genera. It also adds information on the natural history and distribution data for these tarantulas.

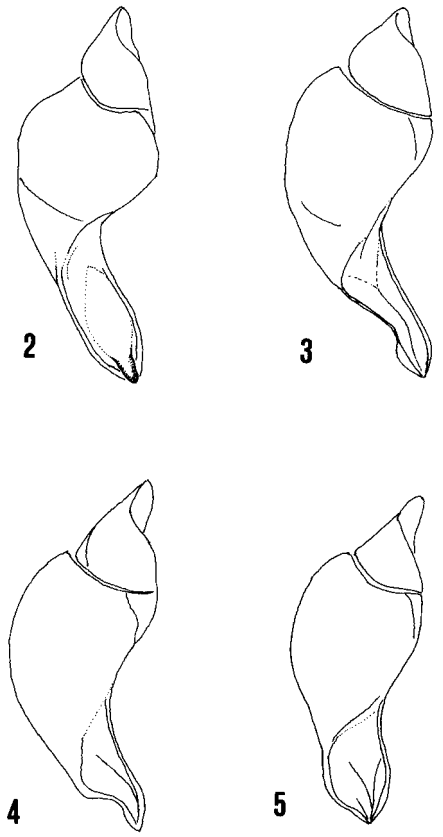
METHODS

The collections visited and used for the study included the following: the American Museum of National History, the California Academy of Sciences, Field Museum, Instituto de Biología, UNAM, in Mexico City (IBUNAM), and Estación de Biología, Chamela, in Jalisco. The five collections have together more than 100 specimens of both genera. All collection data were recorded. No types were studied.

Fifteen field trips were made to the west coast of Mexico from June 1997 to October 1998, and two more to the east coast in this same period. Ecological and geographical data were taken, and the specimens were brought to the lab in Mexico City Laboratorio de Acarología ''Anita Hoffmann.'' Live specimens were put in controlled environment chambers where their reproductive behavior was studied (Yáñez & Locht 1998). The morphological characteristics of preserved specimens were analyzed in more detail, and the figures presented in this work were made from them. The specific collecting data for specimens are not given, but a range map (Fig. 1) is included because we wish to protect the species from the illegal pet trade.

DISTRIBUTION

Brachypelma is a common genus in the Pacific and Gulf coasts of México; the distribution of species along the west coast is only interrupted by that of *Brachypelmides klaasi,* and in the central part by *B. ruhaui* (Fig. 1).



Figures 2–5.—Frontal view of the right bulbs of four species of tarantulas. 2. *Brachypelma vagans* right bulb; 3. *Brachypelmides ruhnaui* right bulb; 4. *Brachypelmides klaasi* right bulb; 5. *Brachypelma smithi* right bulb.

Brachypelma smithi has a disjunct distribution, and *B. vagans* has the largest distribution. The only distribution that we could not verify was that for *B. epicureanum*, which is endemic to the Yucatan peninsula (Smith 1994). Field and collection data corresponded in all other species. The distributions given by Smith (1994) did not correspond with ours in all cases, but they are generally not contradictory. The other collecting data found in the descriptions of the species coincide with the areas shown in Fig. 1 (White 1856; Ausserer 1875, F.O.P. -Cambridge 1897; Schmidt 1992; Schmidt 1993; Smith 1993; Schmidt & Klaas 1994; Schmidt 1997; Locht et al. 1998).

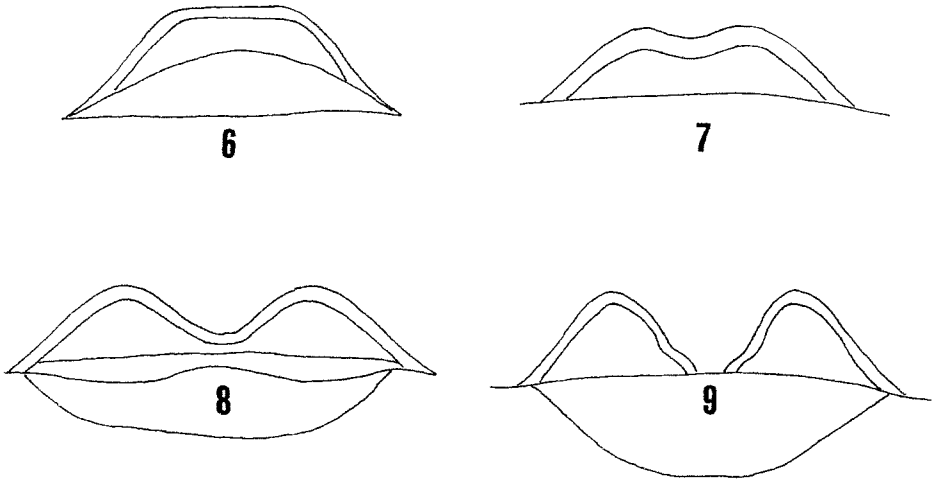
NATURAL HISTORY

The natural history of *Brachypelma* species differs little if at all from the *Brachypelmides* species. The following data are field and laboratory observations of the two genera.

Burrow Construction.—All the species studied live in burrows found in the soil, sometimes near rocks or trees, sometimes in open field, but not far from vegetation. They have only one entrance, a little wider than the tarantula's body size. When the tarantula is active this entrance is clean and some silk can be found. When the tarantula is inactive for a long period the entrance is covered by soil and leaves that the tarantula gathers with silk. A horizontal tunnel leading from the entrance is normally three times larger than the tarantula. This tunnel is followed by a chamber 2–3 times bigger than the tarantula, where it molts, then a vertical tunnel shorter than the first one that ends with a larger chamber, where the tarantula rests and eats its prey. The mature female's burrow in the reproductive season has more silk in the entrance than usual.

Phenology.—The tarantulas of these genera are long-lived. The males can reach maturity in 7–8 years, living only one year or less after the last molt, while the females reach maturity in 9–10 years, then live 10 more years. Compared to other genera of the same subfamily, they grow slowly (Smith 1994). In all species pre-adults and adults molt at the end of the dry season (June–November), males begin to wander in search of the females after they molt, and the females lay an egg-sac before they molt. The egg-sac hatches 3–4 weeks before the rainy season begins. Males of all west coast species wander during daylight, particularly in the morning and in the evening, while the species of the east coast and center wander at night.

Color pattern.—*Brachypelma klaasi* coloration is very similar to that of the six species of *Brachypelma* that are endemic to the west coast. *Brachypelma boehmei* is the more similar, having, like *B. klaasi*, black tarsi, orange-yellow metatarsi, tibias and patellas, black femora and coxae and orange-yellow hairs on the opistosoma. It differs only in the carapace, which is yellow-orange in *B. boehmei* and black in *B. klaasi*. *Brachypelma baumgarteni* is also very similar, but it has a more reddish patella. *Brachypelmides ruhnaui* has the same coloration of *B. vagans* and *B. epicureanum*, differing only in having a yellow carapace, rather than black as in the others. Although all the species have striking col-



Figures 6–9.—Dorsal view of the cleared spermathecae of four species of tarantulas. 6. *Brachypelma auratum*; 7. *Brachypelma emilia*; 8. *Brachypelma vagans*; 9. *Brachypelmides klaasi*.

oration, they are in fact cryptic within their native habitat, making it very difficult to see the tarantulas, even when they are out of their burrows in daylight.

DISCUSSION OF GENERIC AFFINITIES

The data on distribution and natural history provide support for the hypothesis that these species are closely related. In the cladistic analysis of Pérez-Miles et al. (1996) 27 characters were used. The characters in *Brachypelma* are: palpal bulb with concave/convex apical region; relative width of sclerites II + III (measured at 20% of its length, from the apex) wide (equal to or more than 10% of the length of the bulb); lack of the paraembolic and digitiform apophysis; presence of smooth peripheric and supernumerary keels; and a large subtegulum. The male's tibia lacks a lateral process in the retrolateral region, a retrolateral cluster of spines and a prolateral process. It has two tibial apophyses; metatarsus I lacks a basal process and is not strongly curved, its flexion provided by the outer side of the tibial spurs. Spermatheca widely fused and with unilobulated receptacles; femur III and tibia IV not incrassate; femur IV without a retrolateral scopula; urticating hairs type I and III present, type IV are absent. Trochanteral and coxal stridulatory hairs absent; coxal spinules are absent; numerous labial cusps present; fovea without a spherical process.

We compared all 27 characters among the 10 species analyzed and found that *Brachypelmides* has only one character that distinguishes it from *Brachypelma*. This character is the presence of a spermatheca with two receptacles separated or only partly fused. However, in the genus *Brachypelma* some spermathecae are widely fused (*B. smithi, B. auratum*), some semi-divided (*B. emilia, B. baumgarteni, B. boehmei*) and some only partly fused (*B. vagans*) (Figs. 6–9).

The palpal bulb morphology, principally in the embolus, is distinctive in all the species. *Brachypelmides klaasi* and *B. runhaui* have the embolus sharper and more tapered, but do not differ in the characteristics above listed from *Brachypelma*. The palpal bulb of *B. klaasi*, being wider, is more similar to that of *Brachypelma* species from the Pacific coast. The bulb of *B. ruhnaui* bulb is more similar to the thinner bulb of *B. vagans* (Figs. 2–5).

The diagnosis of *Brachypelma* (Pérez-Miles et al. 1996) shows that this genus does not have retrolateral scopulae on femur IV. We examined the two species of *Brachypelmides*, and we found no scopulae on the retrolateral face of the femur IV. We found plumose hairs in both genera. The patch of plumose hairs mentioned for *B. klaasi* as a new character separating these genera is not mentioned in *B. ruhnaui* (Schmidt & Krause 1994; Schmidt 1997); and we could not find it in this species, so this would only be a characteristic that distinguishes *B. klaasi*. Another characteristic that *Brachypelmides klaasi* shares with the

species of *Brachypelma* is that it is very popular in the pet trade, but *Brachypelmides* is not listed in appendix II of CITES.

Although, the distribution and morphology likely provide strong evidence that *Brachypelmides* and *Brachypelma* are one and the same genus, a revision of all the species of these genera, not just those from Mexico, using cladistic analysis will provide a strong basis for placing the two species of *Brachypelmides* in the genus *Brachypelma*.

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