

Phrynus gervaisii (Pocock, 1894) is a junior synonym of *Phrynus barbadensis* (Pocock, 1893) (Amblypygi: Phryniidae)

Luis F. de Armas¹ & Michael Seiter²

¹ Apartado Postal 4327, San Antonio de los Baños, Artemisa 32500, Cuba – dearmas@ecologia.cu

² Group of Arthropod Ecology and Behavior, Division of Plant Protection, Department of Crop Sciences, University of Natural Resources and Life Sciences, Peter Jordan Strasse 82, 1190 Vienna, Austria – michael.seiter@boku.ac.at

Abstract: The comparison of topotypes of *Phrynus barbadensis* (Pocock, 1893) with specimens of *Phrynus gervaisii* (Pocock, 1894) from Costa Rica, Colombia, Venezuela and Trinidad and Tobago has shown that the latter species is a junior synonym of the former. Also, for the first time, this species is recorded from Aruba (Netherland Antilles).

Key words: Amblypygi, Phryniidae, Phryninae, *Phrynus*, taxonomy, South America, Central America, Antilles.

***Phrynus gervaisii* (Pocock, 1894) es un sinónimo más moderno de *Phrynus barbadensis* (Pocock, 1893) (Amblypygi: Phryniidae)**

Resumen: La comparación de topotipos de *Phrynus barbadensis* (Pocock, 1893) con una amplia muestra de *Phrynus gervaisii* (Pocock, 1894) procedente de Costa Rica, Colombia, Venezuela y Trinidad y Tobago ha demostrado que esta última especie es un sinónimo más moderno de aquella otra. Además, por primera vez se registra esta especie para Aruba, Antillas Holandesas.

Palabras clave: Amblypygi, Phryniidae, Phryninae, *Phrynus*, taxonomía, Sudamérica, Centroamérica, Antillas.

Taxonomy/taxonomía: *Tarantula gervaisii* Pocock, 1894 = *Tarantula barbadensis* Pocock, 1893, **syn. n.**

Introduction

Pocock (1893) described *Tarantula barbadensis* (at the present in the genus *Phrynus* Lamarck, 1801) from Barbados, Lesser Antilles. A year later, he described *Tarantula gervaisii* from “Magdaleine”, Colombia, but he also recorded “specimens of apparently the same species from Venezuela, Trinidad and British Guiana” (Pocock, 1894: 286). Pocock (1902b: 51) recorded *Phrynus barbadensis* from Panamá, Colombia, Venezuela and Trinidad, but Quintero (1981) recognized those populations as *Phrynus gervaisii*, while he mentioned *P. barbadensis* only from Barbados and Saint Vincent.

Kraepelin (1912: 28) recorded *P. barbadensis* (as *Tarantula palmata barbadensis*) from Colombia, whereas Schenkel (1953: 1) mentioned this species from Venezuela. Dealing with those records, Harvey (2003: 26) suggests that they might be misidentifications. On the other hand, Alexander (1962a, b) mentioned this taxon from Trinidad Island, a record overlooked by Quintero (1981) and subsequent authors (Armas, 2006: 232).

Undoubtedly, *P. barbadensis* and *P. gervaisii* are morphologically similar (Quintero, 1981; Armas, 2006). Taken in account its likeness, Chiriví Joya & Armas (2012: 398) suggested that both nominal taxa might be the same species.

We have examined *P. barbadensis* from Barbados (type locality), Costa Rica, Colombia, Venezuela, Aruba, Trinidad and Tobago, but we have not found relevant taxonomic characters for recognize more than one species.

Material and methods

The studied specimens are deposited in the following collections: ACJ: Arachnological Collection of the Pontificia Universidad Javeriana, Bogotá, Colombia.

ICN: Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Bogotá, Colombia.

IES: Instituto de Ecología y Sistemática, Havana, Cuba.

NHMW: Natural History Museum Vienna, Austria.

SM: Seiter Michael's personal collection, Pottendorf, Austria.

USNM: U. S. National Museum (Smithsonian Institution), Washington, D. C.

Only synonyms and most relevant references are included, as well as those posterior to Harvey (2003). For the Colombian localities, the term “vereda” correspond to an administrative section of the municipality.

Nomenclature of pedipalp spines follows Quintero (1983), modified according with Shultz (1990): F, femur; P, patella; T, tibia; d, dorsal; v, ventral.

Taxonomy

Phrynus barbadensis (Pocock, 1893)

Fig. 1–3.

Tarantula barbadensis Pocock, 1893: 529–530, pl. 40, fig. 1.

Neophrynus palmatus barbadensis: Kraepelin, 1895: 33–34 (in part).

Tarantula palmata barbadensis: Kraepelin, 1899: 244 (in part). Shear, 1970: 183.

Tarantula gervaisii Pocock, 1894: 285–286, pl. 7, fig. 5 (**syn. n.**).

Phrynus barbadensis: Pocock, 1902b: 51, pl. 10, fig. 6. Mello-Leitão, 1931: 41. Quintero, 1979: 5, 9. Quintero, 1981: 127, 133, 145–146, 149, 160, 162, figs. 78–83, 111, 153, 169, map 2. Quintero, 1983: 4, 44, fig. 14. Armas & Pérez González, 2001: 64. Peretti, 2002: 588–599. Harvey, 2003: 26. Armas, 2004: 41. Colmenares García & Villarreal, 2008: 92. Chiriví Joya & Armas, 2012: 398.

Neophrynus palmatus: Kraepelin, 1895: 30–34 (in part).

Tarantula palmata: Kraepelin, 1899: 244 (in part). Weygoldt, 1977: 273–275, 277, 283, 284, 285, fig. 1 a-c, 3 a.

Phrynus caracasanus Pereyaslawzewa, 1901: 117–304 (synonymized by Quintero, 1981: 147).

Phrynus gervaisii: Mello-Leitão, 1931: 41. Quintero, 1981: 121, 123, 127, 133, 146, 147, 148, 149, 150, 160, 162, fig. 84–89, 113, 147–148, 152, 167, map 2. LeClerc *et al.*, 1978: 129–130. Weygoldt, 1994: 245. Armas, 1999: 29. Weygoldt, 2000: 135. Armas & Pérez González, 2001: 64. Weygoldt, 2001: 300. Viquez, 2003: 126, 128, unnumbered figures. Harvey, 2003: 27. Armas & Colmenares García, 2006: 28. Viquez & Armas, 2006: 312. Armas & Angarita Arias, 2008: 25, 26. Colmenares García & Villarreal, 2008: 89, 92, 93. Armas, 2011: 37. Chiriví Joya & Munévar-Lozano, 2011: 111. Chiriví Joya & Armas, 2012: 395, 396, 397, 398, 400, 401, 402, fig. 2, 4 A-F.

Admetus barbadensis: Alexander, 1962a: 380–382. Alexander, 1962b: 25–36, fig. 1 a-b, 3 a-c, 4 a-b.

Tarantula (Phrynus) palmata: Weygoldt, 1977: 271, 272.

Ph[rynus]. barbudensis: Armas, 2006: 242 (*lapsus calami*).

TYPE DATA. Of *Tarantula barbadensis*: Male holotype from Barbados, West Indies, in the British Museum of Natural History (not

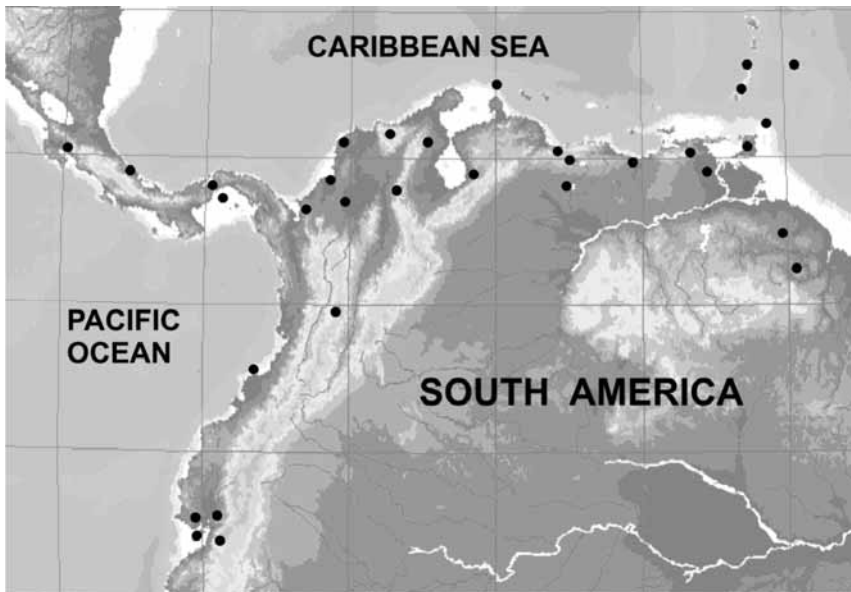


Fig. 1. *Phrynus barbadensis*. Geographical distribution.

examined); according with Quintero (1981: 145), the specimen is “in poor condition, legs and pedipalps fractured”. Of *Tarantula gervaisii*: Male holotype from Magdaleine, Colombia, in the British Museum of Natural History (not examined). *Phrynus caracasanus* was described on basis to embryo sections only; the adult female identified as the type of this species in the Muséum National d’Histoire Naturelle (Paris) is not a type specimen (Quintero, 1981: 147).

DISTRIBUTION. Central America (Costa Rica, Panama), South America (Colombia, Venezuela, Trinidad, Tobago, Guyana, Ecuador), and the Lesser Antilles (Aruba, St. Vincent, Grenadines, Barbados) (Fig. 1).

DIAGNOSIS (emended). Total length 12–22 mm; general color dark reddish brown, spotted with brown on the tergites; carapace with two distinct pale yellow spots on each posterior ectal angle; legs II–IV with three yellow bands on the femora. Carapace: anterior margin slightly emarginate, frontal area well to moderately definite. Pedipalps (fig. 2 C–F): trochanter with five anteroventral spines (one of them on the central area); femur: Fd-3>Fd-2, Fv-1 and Fv-2 on a common base, near to Fv-3; patella: Pd-2>Pd-4>Pd-6, in most specimens Pd-5 is the longest; tibia: Td-1 short, approximately one-third as long as Td-3; tarsus without a dorsobasal internal spine. Chelicerae: basal segment with two external teeth, of which the proximal (superior) is a blunt ridge (fig. 2 A–B). Leg IV with basitibia tripartite. Female: gonopods with two sclerites moderately wide in its base, and the apical part bent towards the ventral surface (fig. 3 A–D; Peretti, 2002: fig. 9–10).

VARIATIONS. The proximal external tooth of the basal segment of the chelicera (a in fig. 2 A–B) may be poorly developed (Chiriví Joya & Armas, 2012). Tibial articles of leg I commonly vary from 30 to 32, rarely with a higher count; tarsal articles vary from 64 to 66. In largest specimens, the carapace granulation seems to be finer than in the smaller ones (fig. 3 E–F). Frontal process of the prosoma may be concealed. Frontal area of the carapace may be distinctly or poorly delimited (fig. 3 E–F). In some specimens, pedipalp spine Pd-4 is similar or noticeably shorter than Pd-2; in shortest specimens, spine Fd-6 is lacking. General color pattern is also variable, principally on carapace and abdomen (dark brown spots may be vanished or well-defined).

ANOMALOUS PEDIPALP SPINATION. The examined male from La Orchila, Perijá Range (Venezuela) has left pedipalp with spine Pd-3 slightly shorter than Pd-2.

COMPARISONS. *Phrynus barbadensis* clearly differs from its congeneric by having the basal segment of the chelicerae with only two external teeth, the proximal one being modified into a blunt ridge

(fig. 2 A–B). This character is only shared with *Phrynus santarensis* (Pocock, 1894), from Brazil, but the sclerites of the female gonopods of *Ph. barbadensis* are noticeably stouter [slender in the Brazilian taxon (Quintero, 1981, fig. 150)].

Another South American species, *Phrynus pulchripes* (Pocock, 1894) has two external teeth on the basal segment of the chelicerae, but they are conic. Also, in this taxon the pedipalp tarsus has a minute dorsal basal spine in the internal surface, and female gonopods are characteristic (Quintero, 1981; Armas & Pérez González, 2001; Chiriví Joya & Armas, 2012).

As suggested by Armas & Pérez González (2001), *P. barbadensis* seems to be closely related to *P. santarensis*.

According with Quintero (1981: 147), *P. gervaisii* differs from *P. barbadensis* by having a poorly defined frontal area, and by the dark variegated abdomen. But, as expected in a widespread species, those characters are variable. For example, he mentioned a Trinidad specimen with “a well-defined frontal area, distinct from the rest of carapace”. We have not detected relevant differences among the large amount of examined specimens from several countries, including the type locality. Upon this result, we propose relegate *Tarantula gervaisii* Pocock, 1894 (at the present in the genus *Phrynus*) as a junior synonym of *Phrynus barbadensis* (Pocock, 1893).

NATURAL HISTORY. *Phrynus barbadensis* has been found in several habitats, including termite and ant nest, caves, primary and secondary forest, anthropogenic areas, cacao plantations, mangrove forest, from sea level to 1440 m a.s.l. (Pocock, 1894; Quintero, 1981; LeClerc *et al.*, 1987; Weygoldt, 1994; Viquez, 2003; Chiriví Joya & Armas, 2012). Observations on its reproductive biology are in Alexander (1962a, b), Weygoldt (1977), Quintero (1981), and Peretti (2002). Females have been recorded carrying 9–52 eggs or embryos (Quintero, 1981; Armas, 1999; Viquez, 2003; Chiriví Joya & Armas, 2012).

EXAMINED SPECIMENS. COSTA RICA: Limón province: Hone Creek: Alberto Moore farm (N 09.67546 – W 82.80554, 11 m a.s.l.), 8–11 October, 2004, parcel of land #4, cacao-banana plantation, under trunk, C. Viquez, 1♂ (IES). Alberto Moore farm (N 09.67546 – W 82.80554, 11 m a.s.l.), 3 September, 2004, parcel of land #3, cacao-*Cordia* plantation, under trunk, C. Viquez, 1♀ (IES). Waldeck Farm, lower course of the Rio Pacuare, E. Reimoser, 2♀♀ (NHMW). COLOMBIA: Atlántico department: Usiacurí (N 10° 45' 0"; W 74° 58' 0"): 20 June, 2010, W. Galvis, 300 m asl, 1♀ (ICN). Bolívar department: Cipacoa (N 10° 23' 57"; W 75° 17' 3"): Turbaco: Tierra Buena farm, 9 August, 2011, R. Roncallo, 1♀, 2♂♂ (IES); La Granja, 31 December, 2008, J. A. Vargas Roncallo & C. Roncallo, 1♀ (IES); La Granja, 18 January, 2008, J. A. Vargas Roncallo & C. Roncallo,

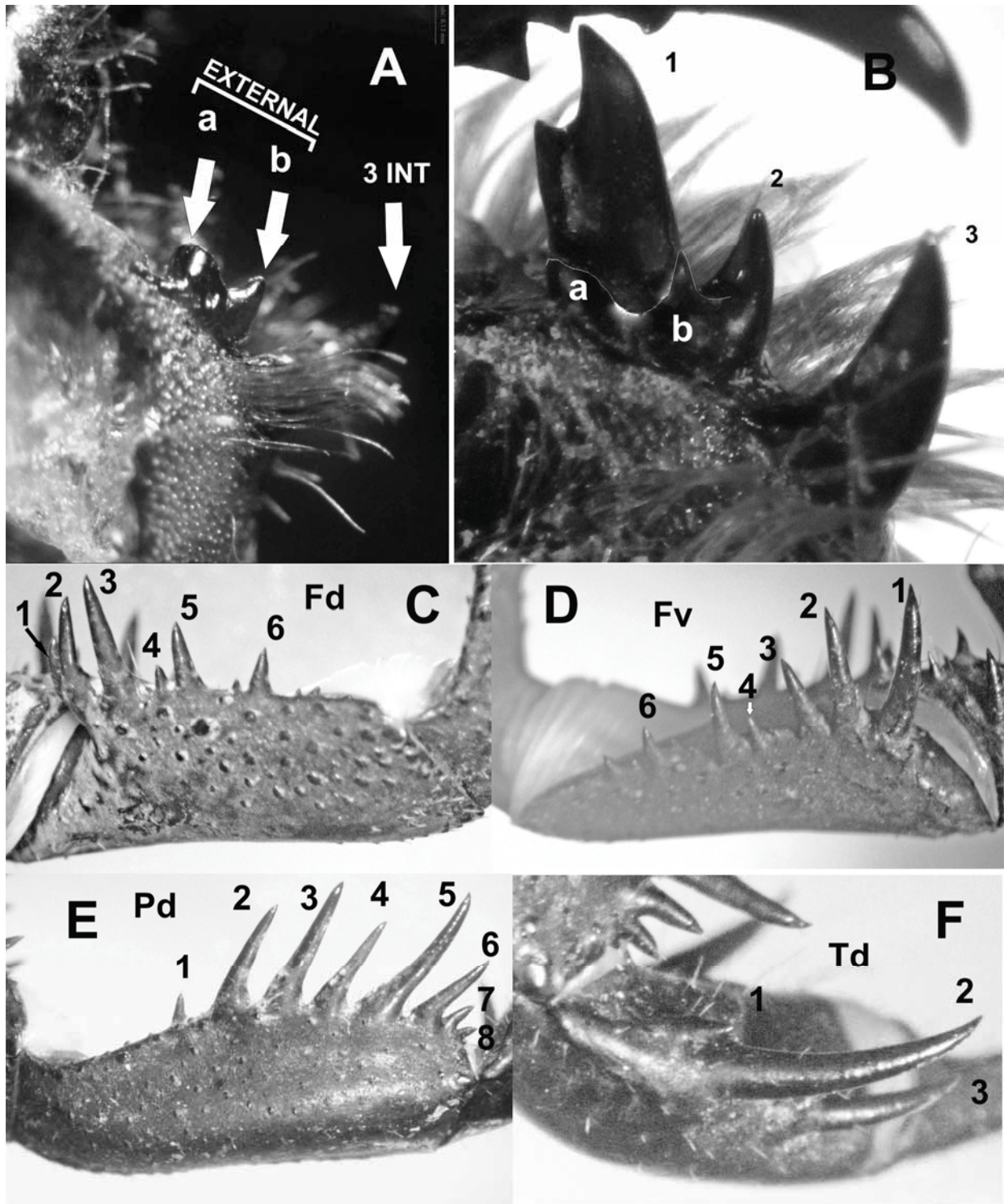


Fig. 2. *Phrynus barbadensis*. A-B: teeth on basal cheliceral segment, external view (a, b, external; 1-3, internal): A. from Aruba; B. from Limón province, Costa Rica. C-F: right pedipalp (female from Barbados): femur in dorsal (C) and ventral (D) aspect; E. patella, dorsal aspect; F. tibia, dorsal aspect.

1♀ (IES). Cartagena (N 10° 23' 59"; W 75° 30' 52"): 1 January, 1975, no additional data, 1♂ (ICN-Am-006). Cartagena, Barú Island (N 10° 12' 58"; W 75° 36' 0"): 14 October, 2006, J. Cubillos, 40 m a.s.l., pitfall trap, 1♂ (ACJ 44); 1 January, 1975, 1♂ (ICN-AM 6). Cartagena, Islas del Rosario, J. Blaich, 1♀ (NHMW 21844). Zambrano (N 9°37'48"; W 74°54'44"): Monterrey Ranch, 30 November, 1999, F. Fernández & G. Ulloa, 70 m a.s.l., 1♀ (ICN-AM 46). CÓRDOBA: San Autero: Cispata Bay, mangrove forest, December 1999, G. Ulloa, 4 ♀♀ (ICN-AM 21). CUNDINAMARCA: Mesitas del Colegio (N 4° 44' 57"; W 73° 27' 39"): 1♂ (ICN-AM 68), Pardilla vereda, 25 April, 2009, J. Rodríguez. Magdalena de-

partment: Santa Marta (N 11° 14' 26"; W 74° 11' 56"): 1♂ (ICN-AM 63), Reserva Calache, 1 August, 2006, J.C. Aguirre. Norte de Santander department: Cúcuta (N 7° 53' 0"; W 72° 30' 19"): 1♂ (MUD-AR 9), 9 March, 2009, J. Flórez, 320 m a.s.l. SUCRE: San Marcos (N 8° 35' 0"; W 75° 10' 0"): 5 ♂♂ (ICN-AM 56), La Florida vereda, Cocodrillia ranch, 23 October, 2004, G. Amat & students of Animal Systematics, 46 m a.s.l. Tolima department: Honda (N 5° 15' 0"; W 74° 50' 0"): 1♀ (ICN-AM 38), Tupingaba ranch, Tambor ravine, 1 September, 1999, J. Pinzón. VENEZUELA: Zulia State: Mara municipality: La Orchila (N 10° 48' 44"; W 72° 21' 13"), Perijá Range, 6 April, 2006, L. F. de Armas & P. A. Colmenares, under trunk,

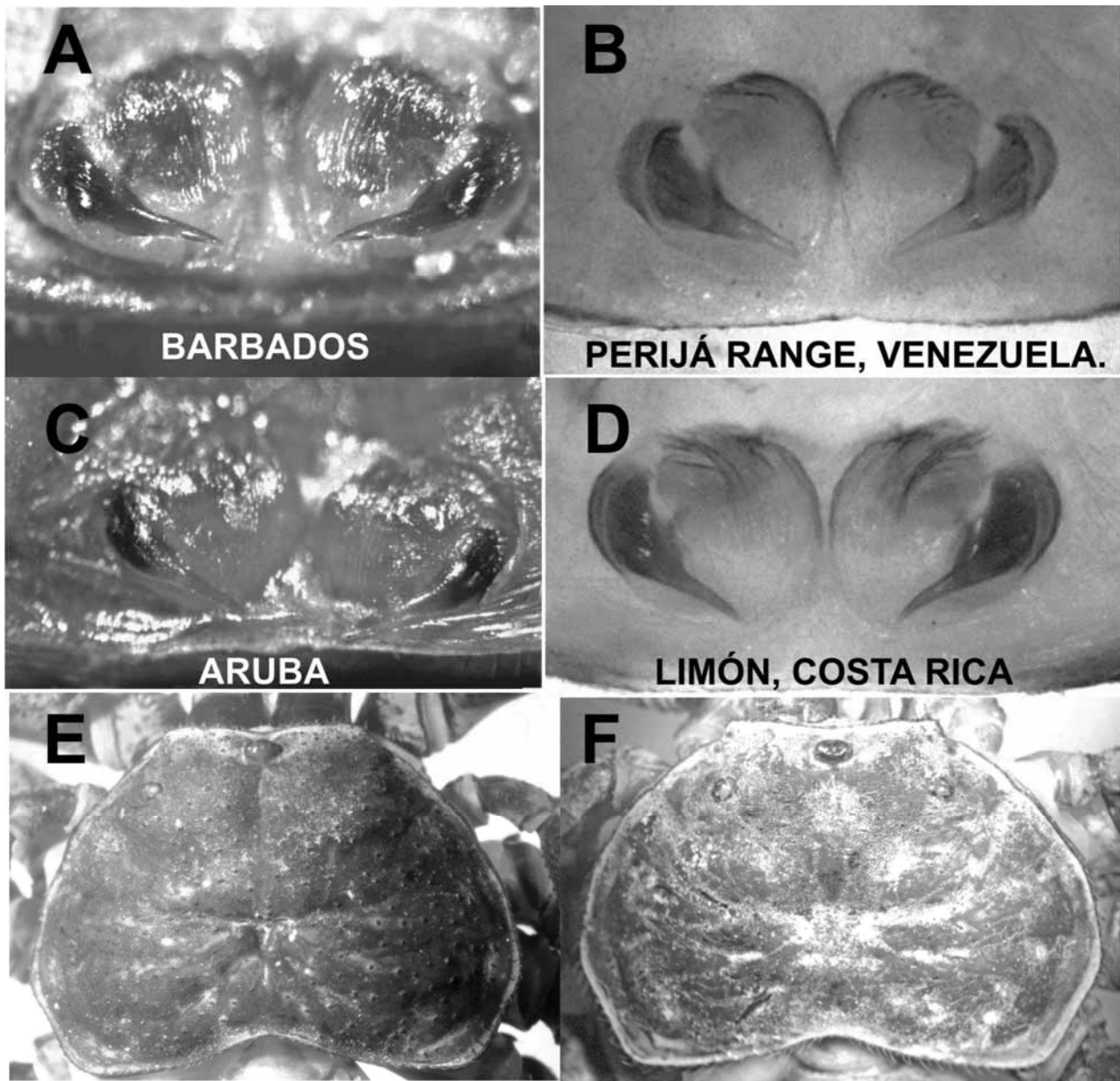


Fig. 3. *Phrymus barbadensis*. A–D: female gonopods. E–F: carapace: E. from Barbados; F. from La Orchila, Perijá Range, Venezuela.

semideciduous forest, 230 m a.s.l., 1♀, 1♂ (IES). Carabobo State: Puerto Cabello (N 10° 28'; W 68° 00'), 2 February 1889, Z. Riemann, 3 juveniles (NHMW 9285); 3 February 1889, Z. Riemann, 12 juveniles (NHMW 9286). TRINIDAD AND TOBAGO: Trinidad, 6 February, 1984, J. Coddington, 3♀♀ (USNM). Tobago: St. John province: Hermitage River Bridge, Charlotteville, 12–21 March, 1979, D. Hardy & W. Rowe, 1♀ (USNM). ARUBA: without another data, 2♀♀, 1♂ (IES), 1♀, 2♂♂ [SM 42(B)3–47]. BARBADOS: without another data, 2♀♀, 2♂♂ (IES), 5♀♀, 2♂♂ [SM 42(B)3–26], 4 deuteronymphs [SM 42(B)3–34].

Acknowledgement

We greatly appreciate specimens provided by César Augusto Roncallo (Riohacha, La Guajira, Colombia), Carlos Viquez (INBio, Costa Rica), Pío A. Colmenares (Maracaibo, Zulia, Venezuela). The first author (LFA) extends his gratefulness to Eduardo Flórez Daza, David Luna Sarmiento and Ingrid Catalina Romero Ortiz (ICN), and Daniel Chiriví Joya (ACJ), for their permission and assistance during examination of specimens in their museums; special thanks to E. Flórez Daza and his family for warm hospitality on November–December, 2011. Rolando Teruel (Bioeco, Santiago de Cuba) revised the manuscript and contribute to its improvement. We also extend our gratitude to anonymous referees for their utile comments.

Bibliography

- ALEXANDER, A. J. 1962a. Courtship and mating in amblypygids (Pedipalpi, Arachnida). *Proceedings of the Zoological Society of London*, **138**: 379-383.
- ALEXANDER, A. J. 1962b. Biology and behavior of *Damon variegatus* Perty of South Africa and *Admetus barbadensis* Pocock of Trinidad, W.I. (Arachnida, Pedipalpi). *Zoologica*, **47**: 379-383.
- ARMAS, L. F. DE 1999. Ampliación del área de distribución de algunos *Phrynus* (Amblypygi: Phrynidae) y *Centruroides* (Scorpiones: Buthidae) de América Central y las Antillas. *Cocuyo* (La Habana), **8**: 29-30.
- ARMAS, L. F. DE 2004. Arácnidos de República Dominicana. I. Palpigradi, Schizomida, Solifugae, Thelyphonida (Arthropoda: Arachnida). *Revista Ibérica de Aracnología*, special monographic volume, **2**: 1-64.
- ARMAS, L. F. DE 2006. Sinopsis de los ambliopígidos antillanos (Arachnida: Amblypygi). *Boletín de la Sociedad Entomológica Aragonesa*, **38**: 223-245.
- ARMAS, L. F. DE 2011. Diversidad de Amblypygi en las Américas. III Latino-American Congress of Arachnology, 4-9 December, 2011, Montenegro, Quindío, Colombia. *Proceedings and Abstracts*, pp. 35-42.
- ARMAS, L. F. DE & A. A. ANGARITA ARIAS 2008. Nueva especie de *Phrynus* Lamarck, 1801 (Amblypygi: Phrynidae) de Colombia. *Boletín de la Sociedad Entomológica Aragonesa*, **43**: 25-28.
- ARMAS, L. F. DE & P. A. COLMENARES GARCÍA 2006. Nuevo género de Hubbarthiidae (Arachnida: Schizomida) del Zulia, Venezuela. *Boletín de la Sociedad Entomológica Aragonesa*, **39**: 27-30.
- ARMAS, L. F. DE & A. PÉREZ GONZÁLEZ 2001. Los ambliopígidos (Arachnida: Amblypygi) de República Dominicana. *Revista Ibérica de Aracnología*, **3**: 47-66.
- CHIRIVÍ JOYA, D. & L. F. DE ARMAS 2012. La subfamilia Phryninae (Amblypygi: Phrynidae) en Colombia. *Boletín de la Sociedad Entomológica Aragonesa*, **50**: 395-402.
- CHIRIVÍ JOYA, D. & K. MUNÉVAR-LOZANO 2011. Distribución de ambliopígidos para Colombia (Arachnida: Amblypygi). III Latino American Congress of Arachnology, December 4-9, 2011, Montenegro, Quindío, Colombia. *Proceedings and Abstracts*, p. 111.
- COLMENARES GARCÍA, P. A. & O. VILLARREAL MANZANILLA 2008. Una nueva especie de *Phrynus* Lamarck, 1801 (Amblypygi: Phrynidae), de la Sierra de Perijá, Venezuela. *Boletín de la Sociedad Entomológica Aragonesa*, **43**: 89-93.
- HARVEY, M. S. 2003. *Catalogue of the smaller arachnid orders of the World: Amblypygi, Uropygi, Schizomida, Palpigradi, Ricinulei and Solifugae*. CSIRO Publishing, Collingwood Victoria, Australia. 385 pp.
- KRAEPELIN, K. 1895. Revision der Tarantuliden Fabr. (Phryniden Latr.). *Verhandlungen des Naturwissenschaftlichen Vereins in Hamburg*, **13**: 1-53, 1 plate.
- KRAEPELIN, K. 1899. Skorpiones und Pedipalpi. *Das Tierreich* **8**: i-xviii, 1-265.
- KRAEPELIN, K. 1912. Beitrag zur Kenntniss der Skorpione und Pedipalpen Columbiens. In: Dr O. Fuhrmann & Dr Eug. Mayor, Voyage d'exploration scientifique en Colombie. *Memoires de la Société Neuchâtoise des Sciences Naturelles*, **5**: 15-28.
- LECLERC, M. G., D. C. MCCLAIN, H. L. BLACK & C. D. JORGENSEN 1987. An inquiline relationship between the tailless whip-scorpion *Phrynus gervaisii* and the giant tropical ant *Paraponera clavata*. *Journal of Arachnology*, **15**: 129-130.
- MELLO-LEITÃO, C. 1931. Pedipalpos do Brasil e algumas notas sobre a ordem. *Archivos do Museu Nacional*, **33**: 7-72.
- PERETTI, A. V. 2002. Courtship and sperm transfer in the whip spider *Phrynus gervaisii* (Amblypygi, Phrynidae): A complement to Weygoldt's 1977 paper. *Journal of Arachnology*, **30**: 588-600.
- PEREYASLAWZEWA, S. 1901. Développement embryonnaire des Phrynes. *Annales des Sciences Naturelles, Zoologie*, (8) **13**: 117-304.
- POCOCK, R. I. 1893. Contribution to our knowledge of the arthropod fauna of the West Indies. Part II. Supplement on the Pedipalpi of the West Indies. *Journal of the Linnean Society of London (Zoology)*, **24**: 527-542.
- POCOCK, R. I. 1894. Notes on the Pedipalpi of the family Tarantulidae contained in the collection of the British Museum. *Annals and Magazine of Natural History*, series 6, **14**: 273-298.
- POCOCK, R. I. 1902a. A contribution to the systematics of the Pedipalpi. *Annals and Magazine of Natural History*, **9**: 157-165.
- POCOCK, R. I. 1902b. Arachnida. Scorpiones, Pedipalpi, and Solifugae. In *Biologia Centrali-Americana* (Taylor & Francis, eds.), London, 71 pp., 12 plates.
- QUINTERO, D., JR. 1979. Comportamiento ritualístico: amenaza y sumisión en *Paraphrynus laevifrons* (Pocock) (Amblypygi: Phrynidae). *Cuadernos de Ciencias*, Editorial Universitaria, Panamá, **3**: 1-14.
- QUINTERO, D., JR. 1981. The amblypygid genus *Phrynus* in the Americas (Amblypygi, Phrynidae). *Journal of Arachnology*, **9**(2): 117-166.
- QUINTERO, D., JR. 1983. Revision of the amblypygid spiders of Cuba and their relationships with the Caribbean and continental American amblypygid fauna. *Studies on the Fauna of Curaçao and other Caribbean Islands*, **65**: 1-54.
- SCHENKEL, E. 1953. Bericht über einige Spinnentiere aus Venezuela. *Verhandlungen der Naturforschenden Gesellschaft in Basel*, **64**: 1-57.
- SHEAR, W. A. 1970. Stridulation in *Acanthophrynus coronatus* (Butler) (Amblypygi, Tarantulidae). *Psyche*, **77**(2): 181-183.
- SHULTZ, J. W. 1990. Evolutionary morphology and phylogeny of Arachnida. *Cladistics*, **6**: 1-38.
- VÍQUEZ, C. 2003. The whip spiders from Costa Rica (Amblypygi, Arachnida). *Skipkan*, **8**(4): 124-130.
- VÍQUEZ, C. & L. F. DE ARMAS. 2006. Los ambliopígidos (Arachnida: Amblypygi) de Guatemala. Pp. 307-318, in: *Biodiversidad de Guatemala*. Vol. 1 (E. B. Cano, ed.), Universidad del Valle de Guatemala, Guatemala.
- WEYGOLDT, P. 1977. Kampf, paarungsverhalten, spermatophoren-morphologie und weibliche genitalien bei neotropischen geißel-spinnen (Amblypygi, Arachnida). *Zoomorphologie*, **86**: 271-286.
- WEYGOLDT, P. 1994. Amblypygi. Pp. 241-247 in *Encyclopaedia Biospéologica* (C. Juberthie & V. Decu, eds.). Moulis, Bucarest. Tome **I**.
- WEYGOLDT, P. 2000. *Whip spiders (Chelicerata: Amblypygi). Their biology, morphology and systematics*. Apollo Books, Stenstrup, Denmark. 163 pp.
- WEYGOLDT, P. 2001. Amblypygi. Pp. 293-300 in *Amazonian Arachnida and Myriapoda* (J. Adis, ed.), Pensoft, Sofia. 590 pp.