

THE CENTIPEDE GENUS *ARTHROHABDUS* POCOCK, 1891, IN THE WESTERN HEMISPHERE: POTENTIAL OCCURRENCE OF *A. PYGMAEUS* (POCOCK, 1895) IN BELIZE (SCOLOPENDROMORPHA: SCOLOPENDRIDAE: SCOLOPENDRINAE)

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ABSTRACT.—The scolopendrid centipede genus *Arthrorhabdus* Pocock, 1891, comprises 6 species: *A. formosus* Pocock, 1891, the type species, occurring in southern Africa (Mpumalanga, Free State, Western and Northern Cape Provinces, South Africa, and southern Namibia); *A. somalus* Manfredi, 1933, in Somalia and Yemen; *A. jonesii* Verhoeff, 1938, from southern India (Kerala Province); *A. mjobergi* Kraepelin, 1916, and *A. paucispinus* Koch, 1984, in Australia (Western and South Australia, Northern Territory, and Queensland); and *A. pygmaeus* (Pocock, 1895), in the south central and southwestern United States, Mexico, and, potentially, Belize. This sporadic occurrence suggests that the genus is polyphyletic, and the monotypic synonym, *Arthrorhabdinus* Verhoeff, 1907, is available for *pygmaeus*, which is not referable to another established genus. *Arthrorhabdus spinifer* (Kraepelin, 1903), known only from Belém, Pará State, Brazil, is transferred to *Rhoda* Meinert, 1886, thereby constituting a new combination. Sixteen new localities are reported for *A. pygmaeus*, 14 in Mexico and 2 in the U.S.; a specimen from Belize, intercepted in quarantine in Miami, suggests occurrence in this country. The 2 U.S. sites, in Cameron County, Texas, and Pima County, Arizona, extend the generic and specific ranges around 400 miles (640 km) to the southeast and west, respectively. In Mexico, *A. pygmaeus* ranges southward through the mainland, possibly excluding the Yucatan Peninsula, and also inhabits the southern half of Baja California Sur (BCS). Its apparent absence from the rest of the Baja peninsula suggests that the BCS populations may result from rafting across the Gulf of California from Sinaloa, where the species occurs.

Key words: *Arthrorhabdus*, *A. pygmaeus*, *A. spinifer*, Arizona, Texas, Baja California Sur, Mexico, Belize.

This contribution is the 2nd in a series of planned collaborative publications on the Neotropical scolopendromorph centipede fauna, the 1st being a study of Mexican representatives of *Newportia* Gervais, 1847 (Scolopocryptopidae: Newportiinae) (Chagas and Shelley 2003). The objective is to produce comprehensive treatments and consolidated literature reviews of taxa in regions of the Neotropics to supersede the piecemeal accounts and scattered records that exist today in scores of miscellaneous publications. It is virtually impossible for students even to retrieve this polyglot literature, much less decipher anatomical features and distinguish taxa, and yet substantive contributions are essential for knowledge of this fauna to advance. Beyond professional myriapodologists, considerable interest in scolopendromorphs, especially the large scolopendrids, exists among the general public. Scolopendromorphs are marketed at pet stores in the United States; internet websites and chat

lines on centipedes have been established by amateur enthusiasts; and a number of people maintain live scolopendrids in their homes as part of a hobby in arthropod husbandry. The time has arrived to capitalize on this base level of enthusiasm and to develop publications that will facilitate a degree of expertise among both professionals and this lay audience. Shelley's monograph (2002) illuminated U.S. and Canadian scolopendromorphs, but the diversity to the south is vastly greater, and this fauna warrants attention to elevate its knowledge to a comparable level.

We address herein the genus *Arthrorhabdus* Pocock, 1891. This is 1 of 3 in the Scolopendrinae recorded from 5 continents. The others are *Scolopendra* L., 1758, which inhabits all 6 populated continents and, though often introduced, most oceanic islands between 35° north and south latitudes, and *Cornocephalus* Newport, 1845, occurring in South America, Central America, Asia, Australia, and on islands

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in the Caribbean Sea and western Pacific Ocean. *Arthrorhabdus* currently comprises 7 species, 1 each in North America, South America, and southern Asia (India), and 2 apiece in Africa (1 also occurring on the Arabian Peninsula) and Australia (Attems 1930, Manfredi 1933, Verhoeff 1938, Lawrence 1955a, 1955b, 1959, 1975, Chelazzi 1977, Koch 1983, 1984, Khanna 2001). The type species is *A. formosus* Pocock, 1891 (= *A. interveniens* Porat, 1893), occurring in Western and Northern Cape Provinces, Free State, Mpumalanga, South Africa, and the Great Namaland region of southern Namibia (Pocock 1891, Porat 1893, Kraepelin 1903, Attems 1930, Lawrence 1955a, 1955b, 1959, 1975). The other African species, *A. somalus* Manfredi, 1933, occurs in Somalia, over 3300 miles (5280 km) to the northeast, and directly across the Gulf of Aden in Yemen on the Arabian Peninsula (Manfredi 1933). Kraepelin (1916) described *A. mjobergi* from Kimberley Division, Western Australia, which record was reiterated by Chamberlin (1920). Koch (1984) described *A. paucispinus*, which is widespread in the interior of Western Australia, and reported that *A. mjobergi* occurs throughout this state and also in South Australia, Northern Territory, and Queensland. Verhoeff (1938) proposed *A. (Trachycormocephalus) jonesii* for an individual from Trivandrum (= Travancore), in the Ponmudi Hills of Kerala Province, at the southern tip of India, and Khanna (2001) subsequently cited it without the subgenus because Lewis (1986) demonstrated that *Trachycormocephalus* Kraepelin, 1903, is a junior synonym of *Scolopendra*. Lewis further suggested that *Arthrorhabdus* may be another synonym of *Scolopendra*, and the numerical analyses of Australian scolopendrids by Koch and Colless (1986) showed that *A. mjobergi* fits with this genus in many respects.

The 2 American species are *A. pygmaeus* (Pocock, 1895), occurring in southeastern Arizona and central/southern Texas, USA, Baja California Sur (BCS) and mainland Mexico (unknown from the Yucatan Peninsula), and, potentially, Belize (Shelley 2002, plus records cited herein); and *A. spinifer* (Kraepelin, 1903), known only from Belém, Pará State, Brazil. The latter was described in *Cupipes* Kohlrausch, 1878, and transferred to *Arthrorhabdus* by Attems (1930); subsequently, it has been reported from Belém and/or Pará by Chamber-

lin (1914), Bücherl (1939, 1941, 1974), and Schileyko (2002). We borrowed the holotype from the Zoologisches Museum, Hamburg, Germany, and found that the 1st tergite overlaps the cephalic plate, which has a partial middorsal suture, that all tarsi possess spurs, and that the 1st tarsi are shorter than the 2nd. These features are characteristic of *Rhoda* Meinert, 1886, and we therefore propose *R. spinifer* (Kraepelin, 1903), **comb. nov.**

With this action, *pygmaeus*, whose type locality is Amula, Guerrero, Mexico, becomes the only known representative of *Arthrorhabdus* in the Western Hemisphere. It was described in *Scolopendra* by Pocock (1895), transferred to *Arthrorhabdus* by Kraepelin (1903), and is 1 of 5 scolopendrids inhabiting the Central Plains of the U.S. and the Chihuahuan Desert of the U.S. and Mexico. The others are *Hemiscolopendra marginata* (Say, 1821), unknown at present from Mexico, and 3 species of *Scolopendra* that occur in both countries: *S. viridis* Say, 1821; *S. polymorpha* Wood, 1861; and *S. heros* Girard, 1853 (Shelley 2002). Based on samples then available, Shelley (2002) characterized the range in the U.S. as a generally triangular area in west Texas, extending from the Red River in Hardeman County at the base of the panhandle, to Val Verde County on the Rio Grande at the top of the "bend," to Hudspeth County east of El Paso. Pocock (1895) also reported *A. pygmaeus* from San Diego, Duval County, west of Corpus Christi, a record that Shelley (2002) considered dubious because it lies some 250 miles (400 km) southeast of the then otherwise coherent range.

South of the U.S., *A. pygmaeus* ranges some 1235 miles (1976 km) to the vicinity of Tehuantepec, Oaxaca, Mexico. An individual from Belize that was intercepted in quarantine in Miami indicates that the distribution may extend into this country, around 1380 miles (2210 km) south of the northernmost locality in Texas (Shelley 2002), but we hesitate to cite Belize definitely based solely on this specimen. Mexican records extend southward from the U.S. border primarily through the central states and along the Pacific Coast (Fig. 1), and none are available from the Yucatan Peninsula or Chihuahua, Sonora, or Baja California Norté (BCN). Documented sites in west Texas and Arizona mandate occurrence in Chihuahua and the eastern half of Sonora; however, *A. pygmaeus* may truly be absent from the Yucatan



Fig. 1. Distribution of *Arthrorhabdus pygmaeus*. The dot in Belize, denoted by the arrow, indicates potential occurrence in this country and is placed centrally because the exact locality of the intercepted specimen is unknown.

and BCN. The centipede has been collected repeatedly in the southern half of BCS, and we think its occurrence there may be attributable to rafting from Sinaloa, directly across the Gulf of California, with subsequent dispersion northward in the Baja Peninsula that apparently has not yet reached BCN. The breadth of the Gulf in this area varies from 110 to 190 miles (176–304 km), plausible distances for rafting events involving centipedes. Shelley (2002) postulated that the Florida populations of *Scolopendra alternans* Leach, 1813, arose by rafting across the Straits of Florida from the Greater Antilles in general and Cuba in particular, and Shelley and Kiser (2000) suggested that rafting from the coasts of Ecuador and Peru, a much greater distance than that postulated here, is the most likely explanation for the occurrence of *S. galapagoensis* Bollman, 1889, in the Galápagos Archipelago. In the order Geophilomorpha (family Schendyli-

dae), Pereira et al. (1999) implied that rafting was operative in the dispersal of *Pectiniunguis halirrhytus* (Crabill, 1959), which has been found on beaches in seaweed and “beach drift” in the lower Keys of Florida, and in Cozumel and Quintana Roo, Mexico.

As noted by Shelley (2002), *A. pygmaeus* possesses small spines on the 1st tarsi of leg pairs 1–20 and long, narrow tooth plates; additionally, the 1st tergite lacks the transverse, procurved sulcus, and the cephalic plate and 1st tergite abut, instead of either overlapping the other (see Shelley 2002:42, figs. 66–68). It can be readily distinguished from representatives of the sympatric scolopendrine genera *Scolopendra* and *Hemiscolopendra* Kraepelin, 1903, in which the cephalic plate overlaps the 1st tergite, and the latter exhibits a conspicuous procurved sulcus. While examining assorted and unidentified scolopendromorphs in the following U.S. repositories, we discovered 17

additional samples of *A. pygmaeus* that we detail below to augment the localities in Shelley (2002); the number of specimens follows the institutional acronym, and the overall distribution is depicted in Figure 1. Repository acronyms are AMNH—American Museum of Natural History, New York; NMNH—National Museum of Natural History, Smithsonian Institution, Washington, DC; and TMM—Texas Memorial Museum, Austin.

USA.—**Arizona:** Pima Co., Tucson, Santa Catalina Mountains, 5 August 1948, G.E. Ball, H.E. Evans (NMNH 1) (*first definite state record*). **Texas:** Cameron Co., Brownsville, 9 December 1911, collector unknown (NMNH 1).

MEXICO.—**Baja California Sur:** canyon near San José de Comondu, 15 February 1966, V. Roth (AMNH 4). San José del Cabo, 18 March 1945, collector unknown (NMNH 1). La Laguna, 4 November 1944, Correo (NMNH 4). **Hidalgo:** 7 miles (11.2 km) SE Zimapan, El Tablon, 19 August 1964, J. & W. Ivie (NMNH 1). **Morelos:** Puente de Ixtla, 10 August 1943, C. Bolivar, F. Bonet, B. Osario (NMNH 2). **Nayarit:** Jesus Maria, 23 June 1955, B. Malkin (NMNH 1) (*new state record*). **Nuevo León:** 10 miles (16 km) N Bustamente, 26 September 1964, J.R. Reddell (TMM 1). Monterrey, 3 January 1950, S. & D. Mulaik (NMNH 2). **Oaxaca:** Suchinxtepec, 21 March 1966, G.E. Ball, D.R. Whitehead (NMNH 1). **Sinaloa:** Mazatlan, 22 August 1962, G.E. Ball (NMNH 4). 30 miles (48 km) NE Jimenez, Matamoros Rd., precise location, date, and collector unknown (NMNH 2). [The vial label places this site in Sinaloa, but map and web searches do not show towns by these names.] **Tamaulipas:** 19 miles (30.4 km) S Ciudad Victoria, 28 December 1947, collector unknown (NMNH 5); 14 miles (22.4 km) S Ciudad Victoria, 8 January 1950, S. & D. Mulaik (NMNH 8); 12 miles (19.2 km) SE Ciudad Victoria, 14 August 1964, J. & W. Ivie (NMNH 1) (*new state record*).

BELIZE.—**Locality unknown:** discovered in bromeliads from Belize by an unknown inspector during quarantine in Miami, Florida, on 3 January 1961 (NMNH 1) (*potential new country record*).

The Arizona locality expands the generic and specific ranges in the U.S. some 400 miles (640 km) westward from Hudspeth County, Texas, and confirms the general records from the state by Chamberlin (1911) and Crabill

(1960), which were deleted along with 1 from California (Chamberlin 1911) by Shelley (2002). By spanning New Mexico, the record also corroborates Crabill's statement (1960) that *A. pygmaeus* occurs in this state. The Cameron County locality, at the southern tip of Texas near the Gulf of Mexico, expands the ranges the same distance southeastward and lends credence to Pocock's record (1895) from Duval County, some 130 miles (208 km) to the north-northwest, which we show as a definite site in Figure 1. The centipede should therefore be expected along the entire southern border of Texas and potentially may be discovered in the panhandle per se and southwestern Oklahoma. The distribution from Texas westward may parallel that of *S. heros* (see Shelley 2002: fig. 42) by extending across southern New Mexico, south of high elevations in the Sacramento, Capitan, and Black Mountains, and spreading northward to the east and west, along the Pecos and Gila Rivers, respectively.

Generic definitions in the Scolopendridae need critical assessment. Classical revisions are in order but beyond our scope at present and ideally should incorporate molecular techniques. Although 6 component species are presently assigned to *Arthrorhabdus*, true congeneric status has not been demonstrated, and the sporadic distribution pattern, with Gondwanian (African, Indian, and Australian species) and Laurasian elements (*A. pygmaeus*), suggests that the genus is polyphyletic. While the types and other specimens must be examined for a definitive conclusion, published illustrations provide clues to this query, and Pocock's illustrations (1891: figs. 1a–d) of *A. formosus*, the type species, seem reasonably similar to conditions in *A. pygmaeus* such that the 2 could conceivably be congeneric despite the geographic hiatus; the size of the spines on the 1st tarsi and the articulation between the cephalic plate and 1st tergite appear especially close to those in *A. pygmaeus*. However, the tooth plates of *A. somalus*, which are short, broad, and compatible with *Scolopendra* (Mantredi 1933: fig. 1), are markedly different from the long, narrow structures in *A. pygmaeus*, and the coxopleurae of *A. paucispinus* are not extended and have linear caudal margins (Koch 1984: figs. 2, 4), whereas they project strongly caudad in *A. pygmaeus* and are armed with apical and lateral spines. From these and other

differences among published illustrations of the putative congeners, we believe that comprehensive evaluation of *Arthrorhabdus* will result in partitioning, and the monotypic synonym, *Arthrorhabdinus* Verhoeff, 1907, is available for *pygmaeus*. *Arthrorhabdus*, as represented by *A. formosus*, may indeed be a synonym of *Scolopendra* as Lewis (1986) suggests, but *Arthrorhabdinus* is clearly distinct because the longer and narrower tooth plates of *pygmaeus* and different articulation between the cephalic plate and 1st tergite are unmistakable. These differences are equivalent to, if not greater than, accepted distinctions between such anatomically similar scolopendrine genera as *Scolopendra* and *Hemiscolopendra*, and *Cormocephalus* and *Rhoda*. We therefore believe that *pygmaeus* is incompatible with *Scolopendra* and requires a different genus; whether the taxon is properly *Arthrorhabdus* or *Arthrorhabdinus* remains to be determined.

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