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ANELUS RICHARDSONI (POCOCK), A GULF COASTAL
MILLIPED OF THE UNITED STATES AND MEXICO
(SPIROBOLIDA: ALLOPOCOCKIIDAE)

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ABSTRACT

The monotypic milliped genus *Anelus* Cook and its sole component species, *A. richardsoni* (Pocock), occur along the Gulf of Mexico from Willacy County, Texas, to southern Tamaulipas, Mexico, and inland to eastern Nuevo Leon. *Anelus reduncus* Cook and *A. emarginatus* Loomis are placed in synonymy under *A. richardsoni*, which appears relatively common in the lower Rio Grande Valley, Texas. *Anelus* is assigned to the family Allopocockiidae because the gonopods of *A. richardsoni* conform most closely to illustrated representatives of this family. Past taxonomic accounts are reviewed, and gonopod drawings and a distribution map are presented.

The milliped order Spirobolida is well represented in North America by the families Spirobolidae and Atopetholidae. The former occurs in the east from the Atlantic Ocean to the Central Plains and from southern Quebec, Canada, to the south Florida Keys, the Gulf of Mexico, and Kerr and Goliad counties, Texas; it also occurs along the Pacific Coast from southern Oregon to Baja California Norte, Mexico, extending inland into southwestern Utah and southern Arizona, and southward to southwestern Guatemala (Keeton 1960a, Shelley 1988, plus unreported specimens examined by the first author). The Atopetholidae, primarily a western group, occurs along the Pacific Coast from Santa Barbara, California, to northern Baja California Norte, extending inland to southern Utah and southern Texas, and southward into central Mexico (Hoffman & Orcutt 1960, plus unreported specimens examined by the first author). The Rhinocricidae, occurring in the Caribbean and in Central and South America from Guatemala southward (Hoffman 1980), is absent from the Nearctic region, as the records of *Rhinocricus vancouveri* Chamberlin, from Vancouver Island, British Columbia, Canada, and *Eurhinocricus tidus* (Chamberlin) and *R. vagans* Chamberlin, both from California, represent obvious labeling errors (Chamberlin 1947, 1951; Hoffman 1953; Chamberlin & Hoffman 1958; Shelley 1990). However, an additional family, the Floridobolidae, occurs in Florida, where it is represented by a single species, *Floridobolus*

penneri Causey, in the Lake Wales Ridge, Highlands County (Causey 1957, Keeton 1959).

In addition to the representatives of these families, one other spiroboloid genus occurs in the United States, *Anelus* Cook, which traverses the Rio Grande along the Gulf Coast, occurring in Willacy, Cameron, and Hidalgo counties, Texas, and Nuevo Leon, Tamaulipas, and San Luis Potosi, Mexico. Its representatives are readily distinguished by two somatic features: the broad, truncated collum, whose margins terminate at the same level as the ventrolateral corners of the succeeding pleurotergite (Fig. 1), and the prolonged epiproct, which extends well beyond the paraprocts (Figs. 2-3). In the Spirobolidae and Floridobolidae, the collum terminates well above the margin of the second pleurotergite; they terminate at the same level in the Atopetholidae, but the margin of the collum angles caudad to the caudolateral corner instead of being truncate (Keeton 1960a, Hoffman & Orcutt 1960). The epiproct terminates at or before the distal extremity of the paraprocts in all other Nearctic spiroboloids, and the prolonged structure is the most recognizable diagnostic feature of *Anelus*. Chamberlin & Hoffman (1958) assigned *Anelus* to the Atopetholidae, but Hoffman & Orcutt (1960) removed it and left it unassigned, stating that the genus departed sufficiently from the normal atopetholid pattern to be excluded from the family. Reddell & Mitchell (1971) placed *Anelus* in the Messicobolidae, but Hoffman (1980) returned it to the Atopetholidae as a genus of uncertain subfamily because its gonopods do not conform to the messicobolid pattern. The first author has reviewed all the atopetholid genera for a family revision and concurs with Hoffman & Orcutt's conclusion (1960) that *Anelus* cannot be accommodated by the Atopetholidae. Its gonopods, collum, and epiproct differ from the corresponding structures in true atopetholids, and representatives of *Anelus* lack the invaginated paraprocts characteristic of this family. Their gonopods conform most closely to the pattern exhibited by the family Allopocockiidae as represented by those of *Chelogonobolus nahuus* (Saussure & Humbert), illustrated by Carl (1919) and Keeton (1960b). We therefore assign *Anelus* to the Allopocockiidae pending detailed studies of the other three component genera — *Allopocockia* Brolemann, *Chelogonobolus* Carl, and *Schmidtolus* Chamberlin. According to Loomis (1968a) and Hoffman (1980), these taxa occur in El Salvador, Guatemala, and the "Eastern Cordillera" of Mexico, so *Anelus* is the northernmost genus, somewhat detached from the main area of the family, and the only representative of the family in the United States.

LITERATURE REVIEW

The history of *Anelus* begins with the description and illustrations of *Spirobolellus richardsoni* by Pocock (1908) for a male and female from Tampico, Tamaulipas, Mexico. Cook (1911) erected *Anelus* for *S. richardsoni* and *A. reduncus* Cook, from Brownsville, Cameron County, Texas; he did not illustrate either species and designated the latter as type species. Brolemann (1914) briefly described the anterior gonopods of *A. richardsoni*, the last characterization of a male of *Anelus*. Chamberlin & Hoffman (1958) and Loomis (1968a) included *A. reduncus* and *A. richardsoni*, respectively, in their milliped checklists of North America and Mexico/Central America, and Hoffman & Keeton (1960) and Jeekel (1971) likewise included *Anelus* in their lists of genera in the order Spirobolida and the class Diplopoda. Loomis (1968b) proposed *A. emarginatus* for a female from near Iturbe, Nuevo Leon, Mexico, and Reddell and Mitchell (1971) cited juveniles of an unidentified species of *Anelus* from Sotano del Arroyo, San Luis Potosi. The last reference to *Anelus* is that of Hoffman (1980), who recognized two component species and listed it as one of three atopetholid genera of uncertain subfamilial position.

SYSTEMATICS

Genus *Anelus* Cook

Anelus Cook, 1911:160-162. Chamberlin & Hoffman, 1958:152. Hoffman & Orcutt, 1960:113. Hoffman & Keeton, 1960:7. Loomis, 1968a:82; 1968b:390. Jeekel, 1971:192. Hoffman, 1980:78.

Type species: *Anelus reduncus* Cook, 1911, by original designation.

Diagnosis: An allopocockiid genus characterized by broad, truncated ends of collum, terminating at level of ventrolateral corners of succeeding pleurotergite; epiproct prolonged, overhanging and extending beyond distal extremity of paraprocts; 1st and 2nd legs of male incrassate, prefemora swollen on caudal surface; tibiae of 3rd male legs without papillae; 3rd to 7th male legs with tarsi and tarsal claws of normal size, not inflated or vestigial, subequal to those of succeeding tarsi; anterior gonopods with long, slender, nearly linear sternum, coxites slightly enlarged, angling ventrad medially, narrowly segregated in midline, telopodites relatively small, widely separated, apical corners slightly reflexed; posterior gonopods with single, broad endite, apodeme long and slender, articulating with medial projection of coxite, latter terminating in two short, falcate, spiniform projections.

Species: One. If undiscovered species exist, they will be to the south in Mexico. Sufficient sampling has taken place in Texas to virtually eliminate any possibility of finding additional forms to the north.

Distribution: From Willacy County, Texas, to southern Tamaulipas and eastern San Luis Potosi, Mexico, extending inland to eastern Neuvo Leon.

Anelus richardsoni (Pocock)

Figs. 1-8

Spirobolellus richardsoni Pocock, 1908:87, pl. VII, figs. 7a-e.

Anelus reduncus Cook, 1911:162-163. Chamberlin & Hoffman, 1958:153. NEW SYNONYMY.

Anelus richardsoni: Cook, 1911:163. Loomis, 1968a:62.

Anelus emarginatus Loomis, 1968b:390-391, figs. 11-12. NEW SYNONYMY.

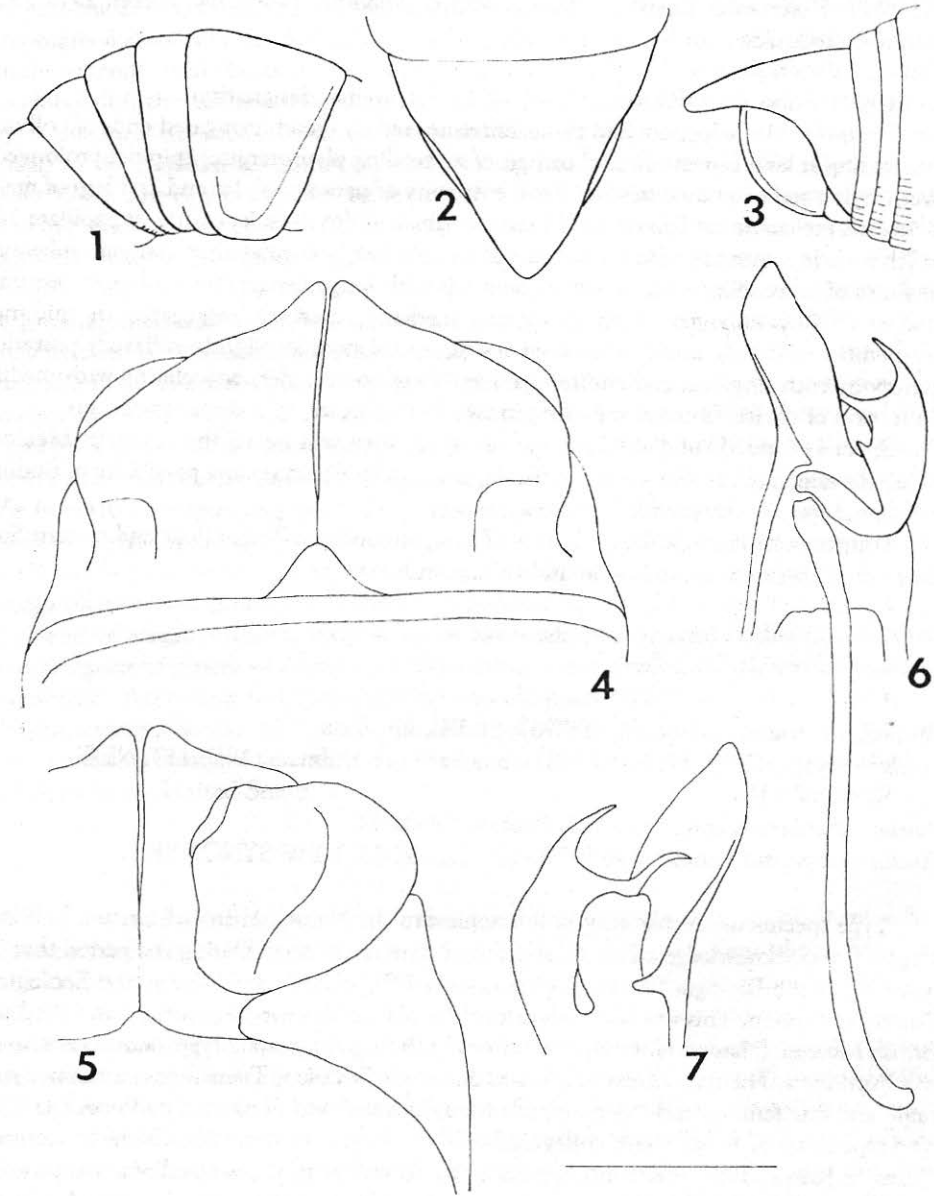
Type specimens: Apparently lost; a request to the Natural History Museum, London, England, was acknowledged, but the specimens were never sent. During the period that he worked on the *Biologia Centrali-Americana*, 1903-1910, Pocock was at the Zoological Society of London. This was after he went to the Natural History Museum, then called the British Museum (Natural History), and few of the *Biologia* myriapod types were ever sent to this institution. The type series of *S. richardsoni*, from Tampico, Tamaulipas, contained one male and one female, and the gonopods were dissected and illustrated by Pocock (1908). The type series of *A. reduncus*, collected by O. F. Cook at Brownsville, Cameron County, Texas, in January 1905, is also lost; according to Cook (1911), it consisted of a male and an unspecified number of females. The type series of *A. emarginatus*, consisting of a single specimen, the female holotype, is housed at the National Museum of Natural History, Smithsonian Institution, Washington, DC (NMNH).

Diagnosis: With the characters of the genus.

Description (based primarily on specimens from Cameron County, Texas): Body generally 45-50 mm long, typically curled, impossible to unroll without breakage, 4.0-4.5

mm wide. Adults of both sexes with 44-45 segments, last 2-3 segments much smaller than rest, distinctly telescoped.

Head smooth and polished, sunk in collum nearly to edge of ocellaria. Labral sinus narrow, relatively indistinct; clypeal foveolae 3-3, lower setae more widely separated. Genae broadly rounded, unmarginated, exceeded by third antennomere. Ocellaria separated by



Figs. 1-7. *Anelus richardsoni*, specimen from Brownsville, Cameron County, Texas. 1, collum and succeeding three pleurotergites, lateral view of right side. 2, epiproct, dorsal view. 3, epiproct, hypoproct, paraproct, and caudalmost tergites, lateral view of right side. 4, anterior gonopods, anterior view. 5, left anterior gonopod, caudal view. 6, left posterior gonopod, anterior view. 7, the same, caudal view. Scale line = 10.00 mm for fig. 2, 5.00 mm for fig. 4, 3.33 mm for figs. 1 and 3, 1.00 mm for figs. 5-7.

around three times their diameter, nearly round, ocelli arranged in five rows — 2, 4, 5, 4, 3. Antennae short and stout, reaching back to near midlength of collum, slightly overlapped by latter *in situ*, first and second antennomeres situated in deep groove, 3rd and more distal articles extending beyond head and curving anteriorly, sparsely hirsute except for ultimate and distal half of penultimate articles, relative lengths of antennomeres $2 > 1 > 6 > 3 > 4 > 5 > 7$.

Collum very broad, overhanging most of epicranium and extending nearly to level of ocellaria, ends sublinear, terminating at level of succeeding pleurotergite, anterior corner blunt, caudolateral corner broadly rounded, fitting in groove on 2nd pleurotergite (Fig. 1). Latter broad, with short but deep marginal groove near midlength. Remaining pleurotergites with prozonites smooth, mesozonites distinctly punctate, metazonites smooth except for ventrolateral striae arising on caudal half of mesozonite and extending entire length of metazonite, striae becoming progressively stronger, more pronounced, and more numerous caudad. Epiproct smooth, broadly triangular, overhanging and extending well beyond level of paraprocts, apically rounded in profile (Figs. 2-3). Ozopores small, located near caudal margins of mesozonites.

First two legs of males reduced in size, incrassate especially prefemora, latter strongly swollen on caudal margins. 3rd male legs of normal length and thickness except for slight caudal extension on prefemora. Remaining legs subsimilar throughout body, podomeres without modifications, tarsal claws gently curved. Hypoproct short, semicircular, margin linear; paraprocts with margins not thickened, not invaginated.

Sympleurite of 7th segment narrowing abruptly in midline, leaving moderate, rounded opening, median suture visible. Anterior gonopods (Figs. 4-5) with narrow sternum extending linearly across anterior face; coxites with lateral impressions, angling ventrad and becoming progressively longer medially, obscuring nearly entire posterior gonopod *in situ*, separated dorsally by short, rounded vinculum, contiguous distal to latter and narrowly segregated thereafter; telopodites relatively small and well separated, rounded basally, narrowing distad, apically blunt and slightly reflexed. Posterior gonopods (Figs. 6-7) with very long, slender apodeme articulating apically in depression on basomedial extension of coxite; latter bending strongly ventrad, expanding broadly with truncated flap on caudal face and medial tooth on anterior surface, terminating in two long, slender, gently curved spiniform projections directed medially; endite long and broad, narrowly rounded apically, extending well beyond distal extremity of coxite, lateral face cupulate, basal margins produced, overlapping coxite.

Distribution: Same as that of the genus. The species occurs along the Gulf of Mexico from near Raymondville, Willacy County, to Tampico, Tamaulipas, a distance of some 480 km (300 mi), and inland about 224 km (140 mi) to Iturbe, Nuevo Leon (Fig. 8). The distribution is similar to that of the xystodesmid *Rhysodemus texicolens* (Chamberlin), as depicted by Hoffman (1970). The latter species occurs farther north and inland, occurring near Laredo, Webb County, Texas, and in northern Nuevo Leon. All the available material of *A. richardsoni* is housed at the NMNH; sample data are as follows:

USA: TEXAS: Willacy Co., 6.4 km (4.0 mi) E Raymondville, F, 3 June 1939, S. Mulaik. Hidalgo Co., Edinburg, M, 30 January 1939, S. Mulaik, and juv., 4-15 September 1940, S. & D. Mulaik. Cameron Co., Brownsville, Los Borregos, 3M, F, 21 May 1904, H. S. Barber, and Palm Jungle, 2M, 2F, 2 October 1951, O. L. Cartwright.

MEXICO:

TAMAULIPAS: Ciudad Victoria, F, 28 December 1943, collector unknown; and "Rancho Nuevo," exact location unknown, F, juv F, 4 December 1943, B. Bonet.

NUEVO LEON: along hwy. 60 east of Iturbe at Lopez Mateos carving, F, 7 June 1967, H. F. Loomis.

The following sample is lost but originally contained 4-6 specimens with at least one adult male, from which gonopod drawings were made.

MEXICO:

TAMAULIPAS: Sierra Azul, ca 33 km (20.6 mi) E Villa de Casas, ca. 1966-1967, G. E. Ball, D. R. Whitehead.

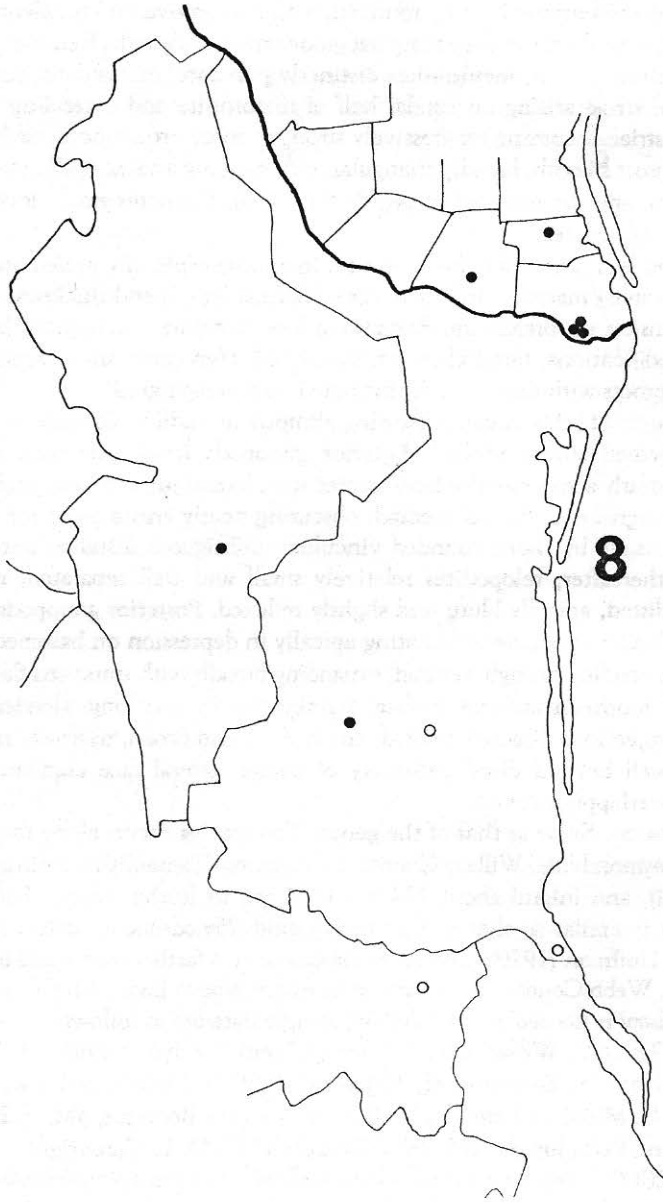


Fig. 8. Distributions of *Anelus* and *A. richardsoni*. The circles represent literature records deemed reliable and the lost sample from Sierra Azul, Tamaulipas.

The following additional literature record is considered referable to *A. richardsoni*:
MEXICO: SAN LUIS POTOSI: Sotano del Arroyo, ca. 15 km (9.4 mi) NNE Ciudad de Valles (Reddell and Mitchell 1971).

Remarks: Although the type specimens are unavailable, the gonopods of males from Hidalgo and Cameron counties conform closely to Pocock's illustrations (1908:figs. 7b-e), leaving no doubt that a single species is represented throughout the known range.

The San Luis Potosi record, of an unknown number of juveniles, is nearly due west of Tampico, about 58 km (36 mi) from this city, and is assigned to *A. richardsoni* because of its proximity to the type locality.

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