

A NEW SPECIES AND RECORDS OF *PSEUDOCELLUS* (ARACHNIDA: RICINULEI: RICINOIDIDAE) FROM CAVES IN YUCATÁN, MEXICO AND BELIZE

James C. Cokendolpher and Tamara Enríquez

Invertebrate Collection, Natural Science Research Laboratory
Museum of Texas Tech University
Lubbock, Texas 79409

ABSTRACT

The most highly troglomorphic member of the order is described as a new species of *Pseudocellus*. It is only known from Cebada Cave, Belize. New distribution records are listed and mapped for *Pseudocellus pearsei* (Chamberlin and Ivie) on the Yucatan Peninsula. The first gynandromorphic member of the order is recognized and discussed. Two additional undescribed species of *Pseudocellus* are mentioned from caves in Coahuila, Mexico, and Petén, Guatemala. The record from Cueva Sasaparilla, Rancho Las Pilas, Coahuila, is the most northern record for the order, exceeding that of the previous southern Texas, U.S.A., record.

INTRODUCTION

The arachnid order Ricinulei currently consists of a single family Ricinoididae, three genera (one in Africa and the other two in the Americas), and 56 species (Bonaldo and Pinto-da-Rocha, 2003; Harvey, 2003). Although the species from Africa and Central/South America are generally found in litter and soils, many of those (*Pseudocellus* spp.) from North America and Cuba inhabit caves. As noted by Platnick and Pass (1982), our knowledge of Central American *Pseudocellus* species is still fragmentary. This is also true for *Pseudocellus* from

Mexico. Many species have been inadequately described/illustrated and frequently one of the sexes is unknown. Several undescribed species are known from surface litter habitats. During the course of this study, we examined many *Pseudocellus* previously unreported from Mexico and Central American caves including at least three undescribed species. The purpose of the present contribution is to introduce a new troglobitic species and to document other material from caves in the Yucatan Peninsula.

METHODS

All measurements are in mm and were made following the procedure outlined by Cooke and Shadab (1973). We have named the segments of the legs following Shultz (1989). They are coxa, trochanter (= trochanter I of legs III, IV of other authors), femur of legs I, II (= basifemur, telofemur in legs III, IV), patella, basitarsus (= metatarsus), telotarsus (= tarsus). The basifemur of legs III, IV is the same as trochanter II of other authors. Male leg III structure names follow those used by Cokendolpher (2000). Specimens are deposited at the

Texas Memorial Museum unless specifically indicated otherwise. Geographical coordinates are provided for the entrances of caves which have been investigated in recent years. Earlier records were mapped from data presented in Gertsch (1977) and Reddell (1977). This latter publication is especially helpful as it provides details on the locations of the various caves as well as information about the biological, physical, and historical features of the caves. Some additional information was obtained from Reddell (1981).

SYSTEMATICS

Pseudocellus Platnick

Diagnosis.—Body elongate, segment 12 longer than wide, ocelli either absent or an elongated light, translucent region on lateral sides of cephalothorax. Color of body generally pale orange to red; new species recorded below from cave in Guatemala very dark brown, like members of genus *Cryptocellus*.

Comments.—There are eighteen described species of *Pseudocellus* from Cuba, extreme southern U.S.A. and countries south to Panama (Harvey, 2003). Members of the genus are found in caves as well as in ground litter and soils. Those from southern Mexico and northern Central America are mapped in Fig. 1.

Pseudocellus krejcae, new species

Figs. 1-4

Type-data.—Belize: Cayo District, Cebada Cave, 8 May 1998 (J. Krejca), male holotype to be deposited at the American Museum of Natural History, New York.

Distribution.—Known only from the type locality (Fig. 1).

Etymology.—This species is named after Jean Krejca, for her many efforts in biological explorations of caves.

Diagnosis.—Copulatory apparatus with tips of fixed and movable pieces equal in lengths; tip of fixed process ending in single sharp point (Fig. 3). Distance from distal end of tibia to the basitarsal process, much greater than length of basitarsal process (Fig. 2). Tibiae II not enlarged, without clasping spines or tubercles. All leg femora longer than cephalothorax; all legs at least about twice as long as the total length of body (Fig. 4). Eleventh abdominal tergite without median raised area.

Comparisons.—Males similar to *P. sbordonii* (Brignoli) from Chiapas, Mexico, in that leg II is not enlarged or otherwise modified with spines or tubercles and copulatory apparatus ends in single sharp point (Brignoli, 1974: fig. 3G). These two species are easily distinguished by the differences in appendage lengths: those of *P. sbordonii* being much shorter.

Description, male (female unknown).—Total length excluding pygidium 6.72; cucullus 0.89 long, 1.33 greatest width; cephalothorax 1.69 long, greatest width 1.46; abdomen 4.58 long, 2.45 wide and 0.83 tall near front of tergite 12 (where widest). Appendage lengths (Table 1). Entire animal reddish-amber color; abdomen yellowish-amber; central portion of abdominal sternites 11, 12, anterior half of 13 darker reddish-brown; cephalothorax and legs light orangish-brown, distal ends of the leg segments lighter in coloration. Body large and elongate, without scales or obvious megaspines. Cephalothorax longer than wide, unicolorous, without ocelli. Cucullus wider than long, weakly bilobed anteriorly, rounded with base constricted, unicolorous, covered with fine granules, without tubercles. Abdomen dorsoventrally flattened; individual tergites flat or slightly convex, entire dorsal surface of the abdomen slightly depressed. Basal segment of pygidium distally notched, deeply dorsally and weakly ventral. Leg formula II>IV>III>I, with II being about twice as long as other legs. Legs without special armament or other obvious modifications (Fig. 4), no segment unusually widened; all femora approximately equal in width, femur I about 18.5 times as long as maximum width, femur II about 33 times as long as wide. Telotarsus II very elongate. Ends of the telotarsi (especially last two pairs) strongly bilobed and splayed, ventrally covered with brush of setae. Tarsal claws very slender, evenly curved (Fig. 2). Copulatory apparatus

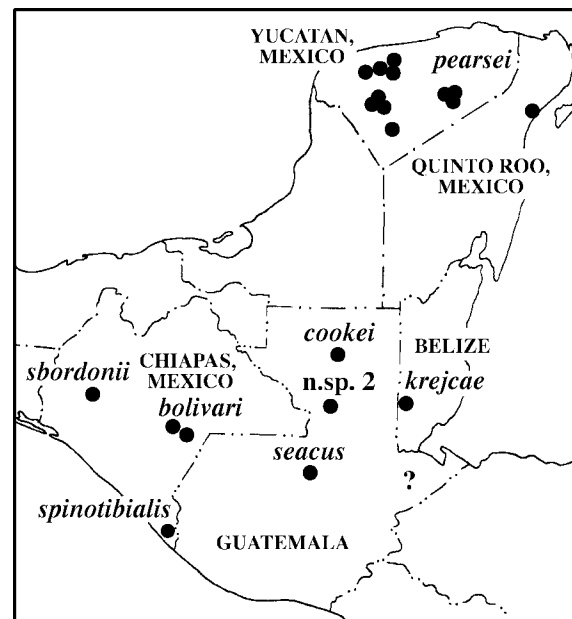


Fig. 1.—Map of northern Middle America depicting distributions of *Pseudocellus*; (from caves): *P. bolivari* (Gertsch), *P. cookei* (Gertsch), *P. krejcae* n. sp., *P. pearsei* (Chamberlin and Ivie), *P. sbordonii* (Brignoli), *P. n. sp. 2*; (surface habitats): *P. seacus* Platnick and Pass, *P. spinotibialis* (Goodnight and Goodnight), and ? = immature specimen described by Ewing (1929).

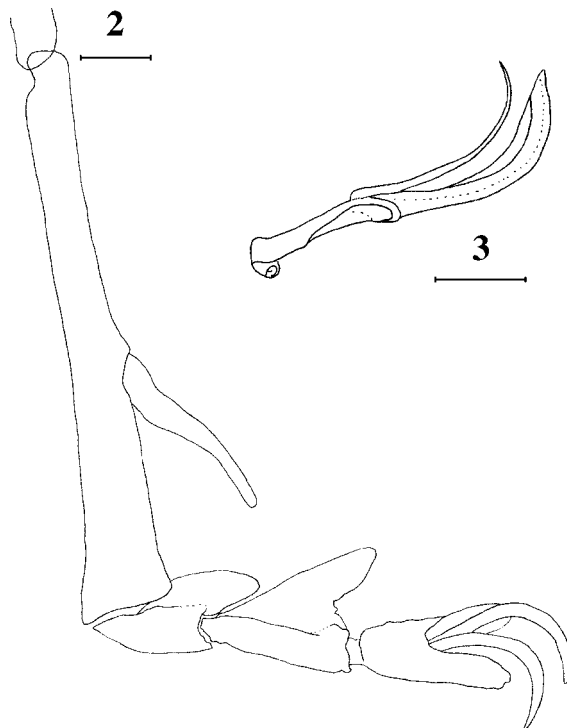
slender and elongate, with fixed process evenly curved anteriorly; tip of fixed process pointed, without enlarged ventral lobe; process strongly grooved, movable piece sheathed by fixed process; movable piece slender, smoothly rounded, ending in single fine tip (Fig. 3).

Comments.—This species is extraordinary in many characters, so much so that it would be easily placed in a separate genus if it were not for the fact that these differences are all related to troglomorphisms. The very elongated, smooth appendages, large body size, lack of ocelli, bilobed leg telotarsi with long claws and tufts of setae are the most obviously troglomorphic characters.

This species is also significant in that it is the most troglomorphic member of the order, thus far encountered. In the previously described more troglomorphic species [*Pseudocellus reddelli* Gertsch and *Pseudocellus sardonii* (Brignoli) from Durango and Chiapas, Mexico, respectively], femur II is approximately 2-2.5 times the length of the cephalothorax, whereas femur II of the new species is 3.5 times longer than the cephalothorax.

The apparent lack of ocelli may be because the body is so pale in coloration that the lighter colored ocelli do not contrast. This is the case with immatures of other congeners.

The single known specimen was collected from the water surface as it was 'walking' its way across the surface tension of a still pool that was knee to waist deep



Figs. 2-3.—*Pseudocellus krejcae*, n. sp., male holotype: 2, leg III, anterior view (with copulatory apparatus removed); 3, enlargement of copulatory apparatus, anterior view (scale lines = 0.25 mm).

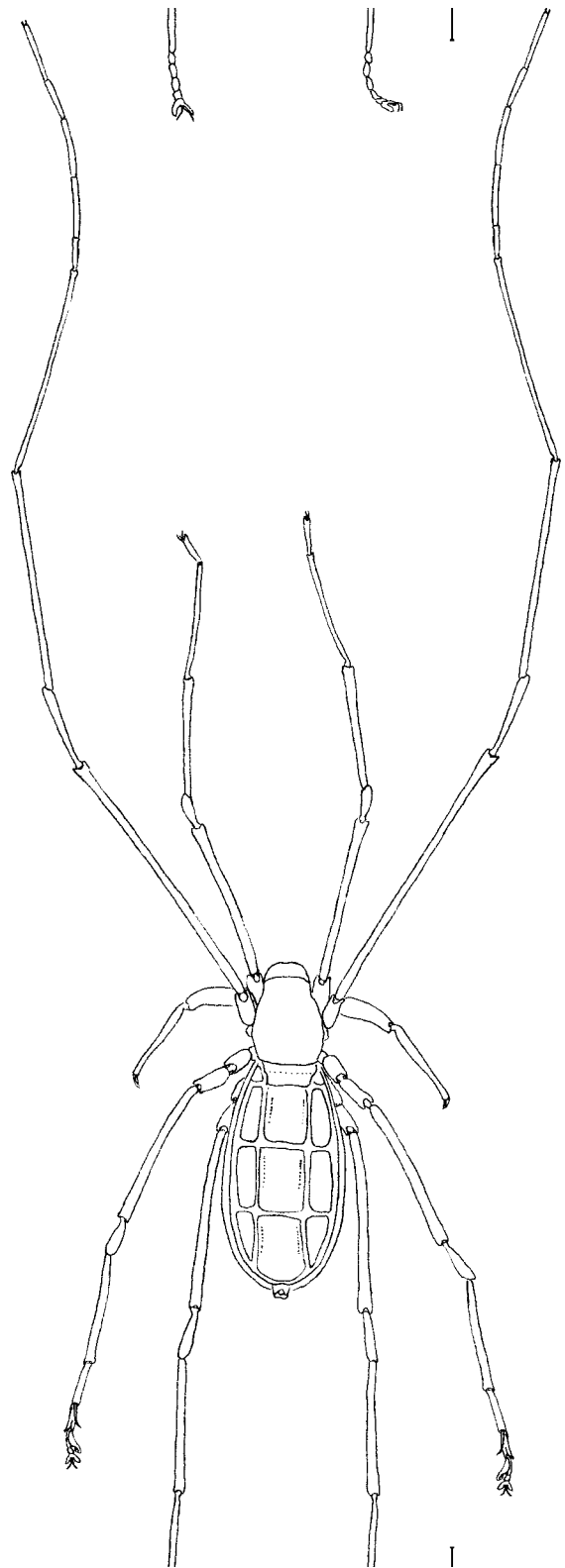


Fig. 4.—*Pseudocellus krejcae*, n. sp., male holotype: 4, dorsal aspect (scale line = 1 mm).

Table 1.-Appendage lengths (= width of femur) in mm.

Appendage	I	II	III	IV	Palp
Coxa	0.84	0.94	0.84	0.76	0.76
Trochanter	0.68	0.84	0.72	0.78	0.56
Basifemur	—	—	0.76	0.76	0.38
Femur (Telofemur)	3.32 / 0.18	5.98 / 0.18	3.34/0.20	3.70/0.20	1.30
Patella	0.90	1.72	1.04	0.96	—
Tibia	2.64	4.88	2.48	2.74	1.90
Basitarsus	2.76	4.50	1.96	2.08	—
Telotarsus (Tarsus)	0.88	6.12	1.30	1.48	0.29
Total	12.02	24.98	12.44	13.26	5.19

(Krejca, pers. comm., 2003). It is unknown if this species commonly travels over water, but the very elongated slender legs and flattened body would certainly aid in such activity. The leg claws and telotarsi are also very elongate. The ends of the telotarsi (especially last two pairs) are strongly bilobed, splayed and ventrally covered with setae. These modifications could also help keep the animal from breaking the surface tension of the water.

The type locality is part of the longest cave system in Central America. Cebada Cave is a segment in the Chiquibul Cave System of west-central Belize and eastern Guatemala. Over 65 km of large cave passages have been surveyed, including the largest known passages and cave room in the Western Hemisphere. Further details on these remarkable caves and the known biology are presented by Miller (1996), Reddell and Veni (1996), Williams (1996), and Czaplowski et al. (2003). The only known specimen of this species was collected in a section of Cebada Cave called "The Limp." This area of the cave is 5 km due east of the entrance (UTM 269200E, 1842250N).

Pseudocellus pearsei (Chamberlin and Ivie)

Fig. 1

Cryptocellus pearsei Chamberlin and Ivie, 1938:104-107. Gertsch, 1977:134-136.

Pseudocellus pearsei: Platnick, 1980:352; Harvey, 2003:181-182.

New Records.—MEXICO, *Quintana Roo*, Gruta de las Caritas, 8 km N Akumal (20°25'N -87°18'W), 3 July 2003 (F. Devos, J. Mis, J. Reddell, M. Reyes), 2 males, 1 female; Grutas de los Aluxes, Gruta Sur, Pueblo Puerto Aventuras, 4 July 2003 (H. Beltram, F. Devos, J. Reddell, M. Reyes), 2 males. *Yucatán*, Actun Bek, 3.3 km SE San Francisco Grande (UTM 0349433, 2288149, WGS84), 14 July 2003 (J. Reddell, M. Reyes), 3 males, 1 female; Actun Kaua, Kaua, 10 December 2001 (J.

Reddell, M. Reyes), 2 males; Actun Olem, 1.4 km N Xbohom (UTM 0346032, 2275404, WGS84), 10 July 2003 (J. Reddell, M. Reyes), 3 males, 1 immature; Actun Oxloft, 1 km W Kaua, 5 January 2002 (J. Reddell, M. Reyes), 1 male; Cenote Jabin, 1.5 km W Kaua (UTM 0350366, 2280759, WGS84), 5 January 2003 (J. Reddell, M. Reyes), 1 male, 1 female, 1 immature; Cenote Katak Chukum, 2 km SW Kaua (UTM 0349836, 2279276, WGS84), 5 January 2002 (J. Reddell, M. Reyes), 1 male, 1 immature; Cenote Kudzil, 2 km N San Lorenzo (UTM 353911, 2288818, WGS84), 6 January 2003 (J. Reddell, M. Reyes), 3 males, 3 females, 7 immatures; Cenote Xcopteil, 4 km SW Dzeal (UTM 0346969, 2272309, WGS84), 30 December 2002 (J. Reddell, M. Reyes), 2 males, 1 female, 1 immature; 2 January 2003 (J. Reddell, M. Reyes), 1 male, 3 females (TMM), 1 male, 1 female, 1 gynandromorph (Museum of Texas Tech University); Cueva de Agua Escondida, 2 km S Muchucuxcah, 29 December 2001 (J. Reddell, M. Reyes), 3 males; 6 January 2002 (J. Reddell, M. Reyes), 1 male; Cueva de Arrollada, 5.4 km N Kaua (UTM 0351998, 2286338, WGS84), 14 July 2003 (J. Reddell, M. Reyes), 1 female.

Comments.—There is a distinct median raised area on the 11th abdominal tergite of males of this species. Previous authors have not mentioned this character. The tibial II clasping spines on the prolateral side of the males can be much smaller than that illustrated by Gertsch (1977: fig. 6), but are always present. The variation in size is apparently not correlated with geography and in one case males with shorter and longer spines occurred in the same cave. Some males had a normal-sized spine on the prolateral margin and a smaller spine on the retrolateral margin of the tibia. The morphology of the male third legs is indistinguishable.

Gynandromorphs have been recorded from several arachnid orders (Cokendolpher and Sissom, 1988; Reddell and Cokendolpher, 1995). The specimen reported here is the first for the order Ricinulei. It appears to be female except for the right leg III which has a copu-

latory apparatus. The copulatory apparatus has only the basal piece, the distal pieces apparently broken off. The abdomen lacks the raised area found on males as well as clasping spines on leg tibiae II. The genital lip and spermathecae are of normal female size and shape.

Pseudocellus n. spp.

Comments.—Among the material examined were specimens of two unnamed species. Because these are not from the Yucatan Peninsula, we are not naming the new species here. However, we are providing a few notes which will help others to recognize these species. Although both of the unnamed species are from caves, only the northern species is a troglobite with slender, elongated appendages.

Pseudocellus n. sp. 1.—Mexico, Coahuila, Cueva Sasaparilla, Rancho Las Pilas, 130 km WSW Ciudad Acuña, 23 August 1997 (D. A. Hendrickson, J. Krejca, J. C. Brown), 1 male, 1 female. This locality was listed as “Cueva de Rancho Las Pilas”, “90 km SW” of Ciudad Acuña by Hendrickson et al. (2001: p. 318, 328, fig. 1). A brief description of the cave and mention of the ricinulei was also made by those authors. This is an unnamed large troglobitic species with the male tibiae II enlarged. It is similar to *P. osorioi* (Bolívar y Peltain), except that species does not have an enlarged tibia II. This is the most northern record for the order, exceeding that of the southern Texas, U.S.A., record for *P. dorotheae* (Gertsch and Mulaik).

Pseudocellus n. sp. 2.—Guatemala, Petén, Dos Pilas, Sayaxché (16°31'N, 90°10'W), Cueva del Río Murciélagos, 25 March 1993 (A. Cobb, B. Luke), 2 males, 2 immatures; Xaxon Pec (Cave), May 1993 (A. Cobb), 2 females. This is an unnamed species that exhibits no characters suggesting that it is restricted to life in caves. The body is very large and robust. The coloration is very dark brown, almost black. Males have two large pointed tubercles (not connected at base) on tibia I.

ACKNOWLEDGMENTS

We thank Jean Krejca for collecting the new species and for her observations on its behavior and habitat. Mark Harvey, René Fonseca, Ricardo Pinto-da-Rocha, and James Reddell are acknowledged for their helpful comments on the manuscript. We also thank James Reddell and Marcellino Reyes for providing most of the material recorded in this paper. George Veni provided some UTM/location data, for which we are grateful.

LITERATURE CITED

- Bonaldo, A. B., and R. Pinto-da-Rocha. 2003. On a new species of *Cryptocellus* from the Brazilian Amazon (Arachnida, Ricinulei). *Revista Ibérica de Aracnología*, 7:103-108.
- Brignoli, P. M. 1974. On some Ricinulei of Mexico with notes of the morphology of the female genital apparatus (Arachnida, Ricinulei). *Quaderno Accademia Nazionale dei Lincei, Problemi Attuali di Scienza e di Cultura* (1973), no. 171, part 2, pp. 153-174.
- Chamberlin, R. V., and W. Ivie. 1938. Arachnida from Yucatan caves. VII. Arachnida of the orders Pedipalpida, Scorpionida and Ricinulida. *Carnegie Institution of Washington Publication*, no. 491, pp. 101-107.
- Cokendolpher, J. C. 2000. First *Cryptocellus* from Suriname (Arachnida: Ricinulei). *Memorie della Societa Entomologica Italiana*, 78(2):515-520.
- Cokendolpher, J. C., and W. D. Sissom. 1988. New gynandromorphic Opiliones and Scorpiones. *Bulletin British Arachnological Society*, 7(9):278-280.
- Cooke, J. A. L., and M. U. Shadab. 1973. New and little known ricinuleids of the genus *Cryptocellus* (Arachnida, Ricinulei). *American Museum Novitates*, no. 2530, 25 pp.
- Czaplewski, N. J., J. Krejca, and T. E. Miller. 2003. Late Quaternary bats from Cebada Cave, Chiquibul Cave System, Belize. *Caribbean Journal of Science*, 39(1):23-33.
- Ewing, H. E. 1929. A synopsis of the American arachnids of the primitive order Ricinulei. *Annals of the Entomological Society of America*, 22:583-600.
- Gertsch, W. J. 1977. On two ricinuleids from the Yucatan Peninsula (Arachnida, Ricinulei). *Bulletin of the Association for Mexican Cave Studies*, 6:133-138.
- Harvey, M. S. 2003. Catalogue of the smaller arachnid orders of the world: Amblypygi, Uropygi, Schizomida, Palpigradi, Ricinulei and Solifugae. *CSIRO Publishing, Collingwood, Victoria*, 385 pp.
- Hendrickson, D. A., J. Krejca, and J. C. Brown. 2001. Mexican blindcats genus *Prietella* (Siluriformes: Ictaluridae): an overview of recent explorations. *Environmental Biology of Fishes*, 62:315-337.
- Miller, T. E. 1996. Geologic and hydrologic controls on karst and cave development in Belize. *Journal of Cave and Karst Studies*, 58(2):100-120.
- Platnick, N. I. 1980. On the phylogeny of Ricinulei. 8. *Internationaler Arachnologen-Kongreß, Wien*, pp. 349-353.
- Platnick, N. I., and G. Pass. 1982. On a new Guatemalan *Pseudocellus* (Arachnida, Ricinulei). *American Museum Novitates*, no. 2733, 6 pp.
- Reddell, J. R. 1977. A preliminary survey of the caves of the Yucatan Peninsula. *Bulletin of the Association for Mexican Cave Studies* 6:215-296.
- Reddell, J. R. 1981. A review of the cavernicole fauna of Mexico, Guatemala, and Belize. *Bulletin Texas Memorial Museum*, 27:1-327.
- Reddell, J. R., and J. C. Cokendolpher. 1995. Catalogue, bibliography, and generic revision of the order Schizomida (Arachnida). *Texas Memorial Museum, Speleological Monographs*, no. 4, 177 pp.
- Reddell, J. R., and G. Veni. 1996. Biology of the Chiquibul Cave System, Belize and Guatemala. *Journal of Cave and Karst Studies*, 58(2):131-138.
- Shultz, J. W. 1989. Morphology of locomotor appendages in Arachnida: evolutionary trends and phylogenetic implications. *Zoological Journal of the Linnean Society*, 97:1-56.
- Williams, N. 1996. An introduction to cave exploration in Belize. *Journal of Cave and Karst Studies*, 58(2):69-75.