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DESCRIPTION OF THE ADULT MALE OF *PSEUDOCELLUS PACHYSOMA* TERUEL & ARMAS 2008 (RICINULEI: RICINOIDIDAE)

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Abstract: The adult males of the Cuban endemic ricinulid *Pseudocellus pachysoma* Teruel & Armas 2008 are herein described on the basis of a sample recently collected in a cave locality of northern Guantánamo province. As a result, the taxonomic diagnosis of this species is updated and further data on its morphological, morphometric and chromatic variability are given. Also, its habitat and microhabitat are described, as well as some aspects about its behavior under both natural and captive conditions.
Key words: Ricinulei, Ricinoididae, *Pseudocellus*, Cuba.

Descripción del macho adulto de *Pseudocellus pachysoma* Teruel & Armas 2008 (Ricinulei: Ricinoididae)
Resumen: Se describen los machos adultos del ricinuleido endémico cubano *Pseudocellus pachysoma* Teruel & Armas 2008, sobre la base de un lote capturado recientemente en una localidad cavernaria del norte de la provincia de Guantánamo. Como consecuencia, se actualiza la diagnosis taxonómica de esta especie y se aportan datos adicionales sobre su variabilidad morfológica, morfométrica y cromática. Además, se describe su hábitat y microhábitat, así como algunos aspectos de su comportamiento en condiciones naturales y de cautividad.
Palabras clave: Ricinulei, Ricinoididae, *Pseudocellus*, Cuba.

Introduction

After the partial revision of Armas (1980), the ricinulid fauna of Cuba was for more than 25 years believed to be represented by only two endemic species: *Pseudocellus paradoxus* (Cooke, 1972) widespread across the eastern region of the country (Las Tunas, Holguín, and Santiago de Cuba provinces), and *Pseudocellus silvai* (Armas, 1977) very localized in the central region (Sancti Spíritus). However, Armas (2007: 184) very briefly referred to the discovery of four undescribed species: three from Pinar del Río (implying the first records of this arachnid order from the western region) and one from Guantánamo. The western species have remained unpublished, but the latter was described by Teruel & Armas (2008) under the name *Pseudocellus pachysoma*, on the basis of two adult females collected from localities situated very near each other. In the same paper, a single juvenile found inside a cave named Cueva de Majana (= Cueva de los Murciélagos), located roughly 20 km to the west, was mentioned but explicitly excluded from the type-series (Teruel & Armas, 2008).

During the last 15 years, more than 20 field trips to these localities and their surroundings were conducted by the senior author where this species is known to occur, though, no further specimens of *P. pachysoma* could be found until the summer of 2013. During the fifth search at the cave locality, a population of this ricinulid species was found in one of the deepest chambers so far not sampled before.

We confirmed the presence of at least 25 individuals, of which a representative sample of six adults and five juveniles was collected. Amongst these adult specimens were the first males ever recorded for this taxon. Therefore, herein we describe and illustrate this sex in detail, and further provide supplementary information on its habitat, microhabitat, and behavior.

Material and methods

All specimens were found by direct search using standard caving headlamps. Of the 11 individuals we collected, one adult male, three adult females and one nymph were brought alive to the laboratory to observe their behavior during two months. The ricinulids were reared in small plastic tubes, with wet tissue paper or commercially available coco humus as substratum. Small live individuals of termites (*Kalotermes* sp.), crickets (*Acheta domestica*) and collembolans were offered as food twice a week .

Specimens were studied under a Zeiss Stemi 2000-C stereomicroscope, equipped with a line scale and a Canon PowerShot A620 digital camera; all other photographs were taken with a Nikon Coolpix S8100 digital camera. High-resolution images were processed with Adobe Photoshop® 8.0 to optimize resolution and brightness, and to remove artifacts or unnecessary details from the background. All measurements are given in millimeters: total length of the body (= size) corresponds to the sum of the individual lengths of the cucullus, carapace and the abdomen, all measured along midline with exclusion of the pygidium. All specimens are deposited in the personal collections of the authors (RTO, FDS).

Systematics

***Pseudocellus pachysoma* Teruel & Armas, 2008**
Fig. 1–6. Tables I–III

DIAGNOSIS (emended): adults of moderately large size for the genus (males 4.8–5.2 mm, females 4.5–5.4 mm). Coloration uniformly very dark to blackish red without any discernible patterns; ocular spots absent. Body and appendages stout (length/width ratio of abdomen 1.58–1.61 in males, 1.25–1.57 in females); leg II conspicuously thick (length/width ratio of femur 2.75–3.18 in males, 2.29–4.43 in females; length/width

ratio of tibia 2.45–2.89 in males, 2.24–3.43 in females). Median plate of tergites XI-XIII essentially square-shaped (XI slightly wider than long, XII approximately as long as wide, XIII slightly longer than wide), the latter with a large raised dome in the discal portion. Cucullus, carapace, tergal plates and legs moderately to densely covered with rough granules. Pygidium not notched.

TYPE DATA: holotype ♀ (RTO): GUANTÁNAMO province: MAISÍ municipality: Sabana: Santa Rosa; April 17, 1998; R. Teruel.

NEW RECORDS: GUANTÁNAMO province: BARACOA municipality: Cueva de Majana [= Cueva de los Murciélagos]; September 11, 2013; R. Teruel, F. Schramm, M. Seiter, J. Nigl; 3♂♂, 3♀♀, 3 juveniles (RTO), 2 juveniles (FDS).

ADULT MALE (fig. 1a–b, 2, 4a, 6; tabs. I–III): similar to female in habitus and coloration, sexual dimorphism present in: **1)** leg III copulatory organ well-developed; **2)** leg I femur and tibia conspicuously thicker, the internal surface of the latter remarkably convex and armed with a short conical spur covered by coarse granules; **3)** carapace shorter, more square-shaped; **4)** abdomen slightly more slender.

VARIATION: differences herein observed among adults suggest the existence of two size-classes in both sexes (tabs. I–II). Also, some minor variation in certain taxonomically relevant morphometric ratios is evident, in some cases apparently related to size (tab. III).

TAXONOMIC REMARKS: the copulatory organ of leg III of was herein illustrated (fig. 2c–d) but not described in detail, because it is currently under study to define the variability range and the true homologies of every structure in all Cuban species (R. Teruel, in progress). In the meantime, all other morphological characters stated in the diagnosis are clear enough to separate this species from its closest relatives on the basis of both sexes. As a complement to the diagnosis originally given by Teruel & Armas (2008) and emended herein, both sexes of *P. pachysoma* can be reliably distinguished from *P. paradoxus* and *P. silvai* by its conspicuously more robust body and appendages, the great development of tegumentary granulation, and to a lesser extent, also by its darker coloration (fig. 6). Furthermore, the adult male of *P. pachysoma* is unique by the greater thickness of leg I (especially femur and tibia) and the poor development of its tibial spur (fig. 6).

In the original description of *P. pachysoma*, Teruel & Armas (2008) studied one juvenile from this same cave population, but it was explicitly excluded from the type-series because its immaturity did not allow a definitive identification. Now a representative series has become available and the status of this cave population can be evaluated. Among the adults, some differences in certain taxonomically relevant morphometric ratios are evident when compared to the holotype. These differences are minor but appear to be consistent, nevertheless, at the moment we remain cautious and do not accord these any taxonomic-level implications.

We found this decision on the fact that equivalent morphometric differences were identified between the two female types from very nearby localities, wherefore, both specimens most likely belong to the same population (Teruel & Armas, 2008). Also, no adult males are known from the type-locality yet, thus, it is not possible to know if morphological data on this sex concur with the observed differences. Whether these two supposedly allopatric populations belong to a single species or not, will only be evaluable when representative samples from the type-locality become available for comparison.

ECOLOGICAL NOTES: this cave is located inside the Majayara coastal hill, a northwestern to southeastern-oriented, 7 km to 2.5 km wide elevation lying less than 2 km east from Baracoa city. The relief of this hill is karstic, with staggered limestone cliffs on the northern (coast-faced) watershed tableland and a steep slope in the south (inland-faced). The original vegetation was semicaducifolious forest, but it has been almost completely replaced by crops, mostly coconut and cacao plantations.

The cave has its entrance on top of the second uppermost level of the limestone terraces. It is the largest and most complex part of an underground system of several interconnected caves and sinkholes of different sizes. The access is made through a double entrance composed of a 15 m deep vertical tube surrounded by a narrow spiral conduct joining together at the point the descent levels. The bottom of this vertical tube is the starting point of a labyrinth system of chambers and corridors which gently go down in different directions.

The larger chambers host a massive bat community (mostly *Phyllonycteris poeyi*), and thus, the soil is covered by a deep layer of guano and the air is extremely hot (around 40°C) and water-saturated. The smaller chambers and corridors are inhabited by much smaller and less dense colonies of other bat species and the soil has a thin cover of guano. In these chambers the water-saturated air is much cooler (25–30°C). This climatic differences between the chambers is accompanied by an interesting change in the dominant species of detritivorous fauna: the hot chambers host a large community of the introduced cockroach *Periplaneta americana* and only a few individuals of a native cave cricket of the genus *Cophus*, however, this proportion is totally reversed in the colder sections.

The population of *P. pachysoma* was found exclusively in the deepest, colder chamber. All observed individuals were located under small rocks and broken fragments of the cave secondary formations, half-buried in the wet, muddy clay-sandy soil. Most individuals were situated on the underside of their shelter and, as usual for a ricinulid, remained still for some time before starting to walk slowly, trying to enter any crevice available. Despite its restricted localization inside the cave, the population does not appear to be small: we sampled this chamber for less than two hours and about 25 individuals were observed, including adults of both sexes as well as all nymphal instars and larvae.

Under laboratory conditions, ricinulids reacted very sensitively to light and started to retreat after exposure. However, as lights were turned off, they left their shelters for active foraging. All individuals readily accepted food but never while lights were turned on, thus, the prey-capture behavior was not witnessed. Directly related to this, we were able to determine that the blackish patch that has repeatedly been described in the literature as a coloration pattern on the abdominal venter is not a true morphological character, but an artifact of feeding instead. Starving to poorly fed individuals always lack this spot, but as soon as they start to feed well, it appears and becomes larger as the food intake increases. This

seems to indicate that the blackish spot is just the full mesenteric ceca.

No mating or aggression were observed, but we observed the same inverse correlation between moisture degree and aggregation behavior already recorded by Teruel & Cala (2007) for *P. paradoxus*: all individuals remained scattered all over the substratum when it was homogeneously wet, but as it became progressively drier through the days, they packed closer and closer above the wettest spots.

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Table I. Measurements (mm) of three adult males of *Pseudocellus pachysoma* from Cueva de Majana. Abbreviations: length (L), width (W). tergite (ter).

Measurements		♂	♂	♂
Cucullus	L / W	0.90 / 1.05	0.55 / 1.00	0.55 / 1.00
Carapace	L / W	1.50 / 1.40	1.35 / 1.35	1.35 / 1.35
Abdomen	L / W	2.80 / 1.75	2.90 / 1.80	2.85 / 1.80
Median plate, ter XI	L / W	0.65 / 0.85	0.65 / 0.85	0.70 / 0.80
Median plate, ter XII	L / W	0.85 / 0.80	0.85 / 0.85	0.85 / 0.80
Median plate, ter XIII	L / W	1.00 / 0.85	1.10 / 0.80	1.05 / 0.80
Pedipalp	L	2.25	2.20	2.25
Telofemur	L / W	0.25 / 0.25	0.25 / 0.25	0.25 / 0.25
Tibia	L / W	0.75 / 0.25	0.80 / 0.25	0.80 / 0.25
Tarsus	L / W	1.25 / 0.15	1.15 / 0.10	1.20 / 0.15
Leg II	L	6.55	6.60	6.65
Femur	L / W	1.65 / 0.60	1.75 / 0.55	1.70 / 0.55
Patella	L / W	0.80 / 0.40	0.75 / 0.40	0.80 / 0.40
Tibia	L / W	1.30 / 0.45	1.35 / 0.55	1.35 / 0.55
Basitarsus	L / W	1.30 / 0.25	1.35 / 0.20	1.35 / 0.25
Telotarsus	L / W	1.50 / 0.25	1.40 / 0.25	1.45 / 0.30
Total	**L**	**5.20**	**4.80**	**4.75**

Table II. Measurements (mm) of three adult females of *Pseudocellus pachysoma* from Cueva de Majana. Abbreviations: length (L), width (W). tergite (ter):

Measurements		♀	♀	♀
Cucullus	L / W	0.85 / 1.05	0.55 / 1.00	0.60 / 1.00
Carapace	L / W	1.50 / 1.45	1.40 / 1.45	1.40 / 1.35
Abdomen	L / W	3.00 / 2.00	2.90 / 1.85	2.85 / 1.90
Median plate, ter XI	L / W	0.65 / 1.00	0.60 / 0.85	0.60 / 0.90
Median plate, ter XII	L / W	0.85 / 0.95	0.85 / 0.85	0.80 / 0.80
Median plate, ter XIII	L / W	1.25 / 1.00	1.10 / 0.95	1.10 / 0.95
Pedipalp	L	2.40	2.35	2.30
Telofemur	L / W	0.25 / 0.30	0.30 / 0.25	0.25 / 0.25
Tibia	L / W	0.85 / 0.30	0.85 / 0.25	0.80 / 0.25
Tarsus	L / W	1.30 / 0.15	1.20 / 0.15	1.25 / 0.10
Leg II	L	6.60	6.25	6.10
Femur	L / W	1.65 / 0.45	1.65 / 0.45	1.55 / 0.35
Patella	L / W	0.75 / 0.35	0.70 / 0.80	0.70 / 0.35
Tibia	L / W	1.35 / 0.40	1.25 / 0.40	1.20 / 0.35
Basitarsus	L / W	1.35 / 0.20	1.25 / 0.20	1.25 / 0.20
Telotarsus	L / W	1.50 / 0.20	1.40 / 0.25	1.40 / 0.25
Total	**L**	**5.35**	**4.85**	**4.85**

Table III. Morphometric ratios in adults of *Pseudocellus pachysoma* from Cueva de Majana. Abbreviations: length (L), width (W).

Ratios	♂	♂	♂	♀	♀	♀
Carapace (L/W)	1.07	1.00	1.00	1.03	0.97	1.04
Abdomen (L/W)	1.60	1.61	1.58	1.50	1.57	1.50
Median plate, tergite XI (L/W)	0.76	0.76	0.87	0.65	0.71	0.67
Median plate, tergite XII (L/W)	1.06	1.00	1.06	0.89	1.00	1.00
Median plate, tergite XIII (L/W)	1.18	1.37	1.31	1.25	1.16	1.16
Leg II femur, (L/W)	2.75	3.18	3.09	3.67	3.67	4.43
Leg II tibia (L/W)	2.89	2.45	2.45	3.38	3.13	3.43
Total (L)	**5.20**	**4.80**	**4.75**	**5.35**	**4.85**	**4.85**

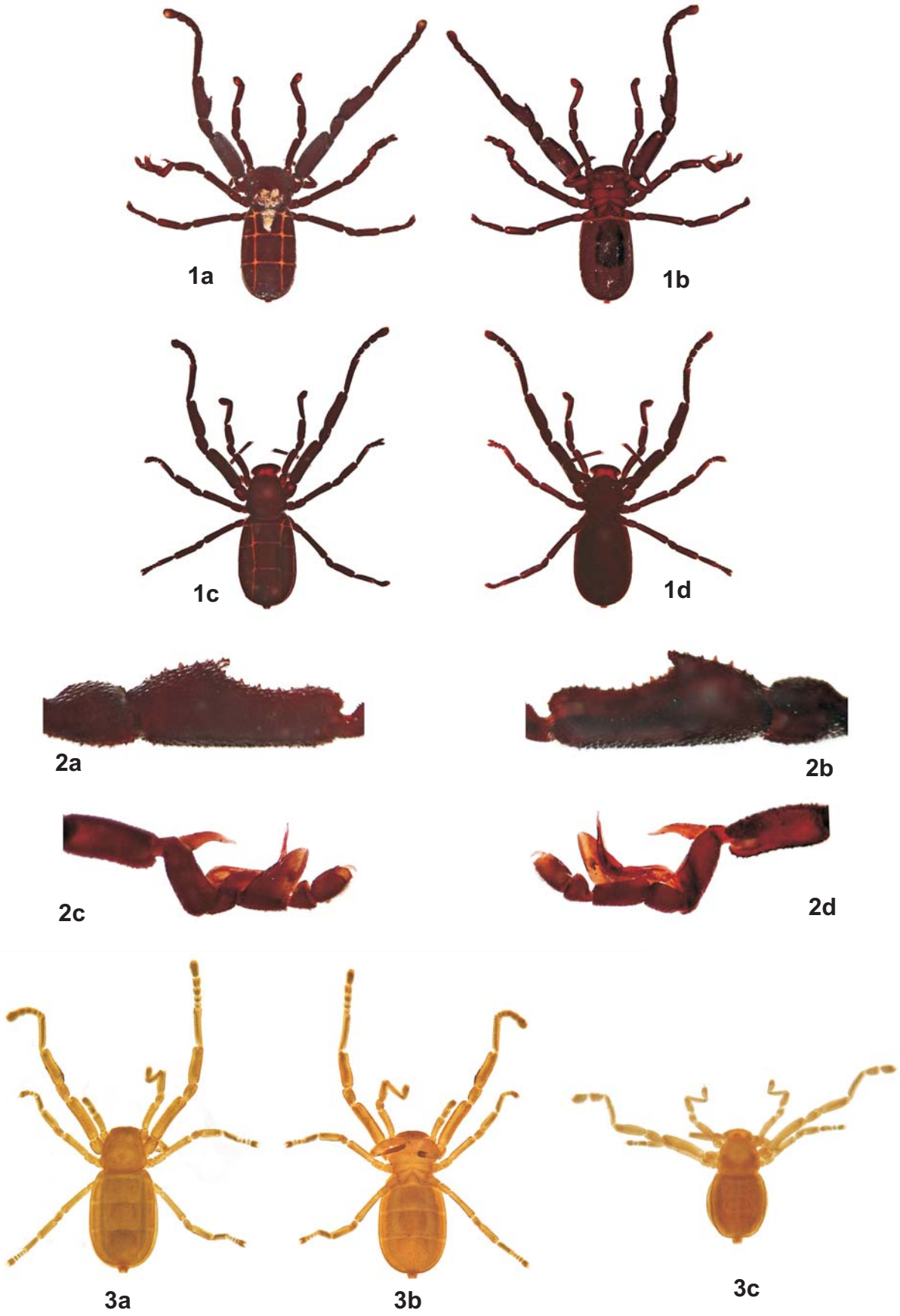
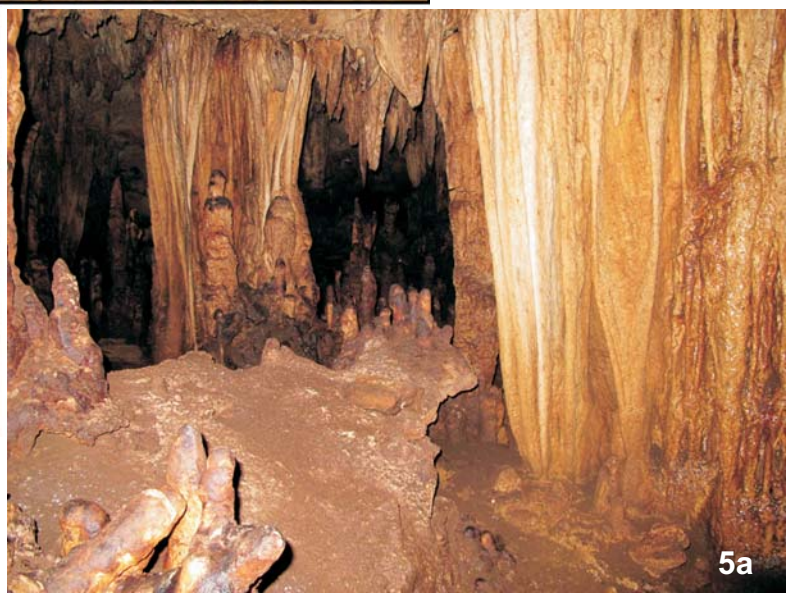


Fig. 1: Adults of *Pseudocellus pachysoma* from Cueva de Majana, complete dorsal and ventral views: **a-b)** male; **c-d)** female. **Fig. 2:** Adult male of *Pseudocellus pachysoma* from Majana Cave: **a)** tibia of leg I, dorsal view; **b)** tibia of leg I, ventral view; **c)** copulatory organ of leg III, dorsal view; **d)** copulatory organ of leg III, ventral view. **Fig. 3:** Juveniles of *Pseudocellus pachysoma* from Majana Cave: **a-b)** tritonymph, complete dorsal and ventral views; **c)** larva, dorsal view.











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Fig. 4: Live individuals of *Pseudocellus pachysoma* from Majana Cave, in captivity: **a)** male, the dirty parts on carapace and abdomen are covered in mud; **b)** female; **c)** tritonymph. **Fig. 5:** Two views of the chamber that hosts the population of *Pseudocellus pachysoma* in the cave; the close-up shows the exact spot where some individuals were found under the rocks and broken fragments of secondary formations semi-buried in the soil. Photos courtesy Michael Seiter. **Fig. 6:** Live adult males of *Pseudocellus pachysoma* (below) and its closest-relative *Pseudocellus pachysoma* (from Verraco, Santiago de Cuba), "face to face" to show the easy recognition of both species to unaided eye.