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On the *Cryptocellus peckorum* and *Cryptocellus adisi* groups, and description of a new species of *Cryptocellus* from Brazil (Arachnida: Ricinulei)

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Abstract. A new species of Ricinulei of the genus *Cryptocellus* Westwood 1874 is described from the Madeira-Purus Interfluve, Amazonas, Brazil. It shares a set of apomorphies with *Cryptocellus peckorum* Platnick & Shadab 1977 and *Cryptocellus tarsilae* Pinto-da-Rocha & Bonaldo 2007, with which it forms an assemblage of related species herein named the *peckorum* group. A second group of species, the *Cryptocellus adisi* group, is formed by the following species: *Cryptocellus adisi* Platnick 1988, *Cryptocellus florezi* Platnick & García 2008, and *Cryptocellus lisbethae* González-Sponga 1998.

Keywords: New World, Amazon rainforest, Madeira-Purus interfluve, BR-319 highway, taxonomy, systematics

The arachnid order Ricinulei has been increasingly capturing attention of New World specialists, and over the last seven years several new species have been described: *Cryptocellus abaporu* Bonaldo & Pinto-da-Rocha 2003; *C. icamiabas* Tourinho & Azevedo 2007; *C. tarsilae* Pinto-da-Rocha & Bonaldo 2007; *C. florezi* Platnick & García 2008; *C. platnicki* Botero-Trujillo & Pérez 2008; *C. luisedieri* Botero-Trujillo & Pérez 2009 (Bonaldo & Pinto-da-Rocha 2003; Botero-Trujillo & Pérez 2008, 2009; Pinto-da-Rocha & Bonaldo 2007; Platnick & García 2008; Tourinho & Azevedo 2007); and advances undertaken in the fields of functional, structural biology, and genetics (Talarico et al. 2005, 2006).

The taxonomy and systematic foundation of New World representatives of the order Ricinulei were established by Platnick and his co-workers (e.g. Platnick & Shadab 1976, 1977, 1981; Platnick & Paz 1979; Platnick, 1980; Platnick & Pass 1982). Several new species were described from the New World, and the current generic and species-group divisions were established. The groups proposed by Platnick are stable and mostly supported by the characters of the male tarsal process. However, species of Ricinulei seem to be conservative, bearing very similar external morphology, and some species give the impression of a morphological mosaic of several different species (Tourinho & Azevedo 2007).

In this paper we describe a new species from Brazil, *Cryptocellus conori*, and propose the *Cryptocellus peckorum* group. The group includes the new species herein described and three related species previously described: *C. peckorum* Platnick & Shadab 1977; *C. tarsilae* and *C. lampeli* Cooke 1967. The four species share characters present on the accessory piece, basitarsus and teleotarsus II of leg III, cucullus and ventral abdomen. A second group of species, the *Cryptocellus adisi* group, is also defined on the basis of characters of the male tarsal process.

We also report some new records of *C. becki* Platnick & Shadab 1977 from the city of Manaus, Amazonas state. The new species was collected in a remote site in the Amazonas State in Brazil, between the rivers Madeira and Purus, one of the most important Amazonian regions for biodiversity (Py-Daniel et al. 2007) and under strong anthropogenic pressure (Fearnside 2005; Fearnside & Graça 2006).

METHODS

The specimens of *C. conori* were collected using both Winkler extractors and visual nocturnal search and are preserved in 70% ethanol. The specimens of *C. becki* were collected using Winkler extractors, and all geographical coordinates provided were obtained from the site coordinates report in the website Large Scale Biosphere Experiment in Amazonia (online at http://www.lbaeco.org/cgi-bin/web/sites/sites_report.pl). The morphological terminology follows Platnick & Shadab (1976, 1977, 1981) and Cokendolpher (2000); the general description is based on Cokendolpher (2000) and Cokendolpher & Enriquez (2004), who focused essentially on significant taxonomic structures and colors. All measurements are in mm. The specimens are lodged in the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas, Brazil.

TAXONOMY

Family Ricinoididae Ewing 1929

Genus *Cryptocellus* Westwood 1874

Cryptocellus foedus Westwood 1874:201.

Type species.—*Cryptocellus foedus* Westwood 1874, by monotypy.

Cryptocellus conori new species
(Figs. 1–20)

Type material.—BRAZIL: Amazonas: Male holotype, 30 km Igapó -Açu, Careiro, 04°54'57"S, 61°06'45.4"W, 23 July 2007, visual nocturnal search, E.H. Wienskoski (INPA 23). Paratypes: 1 female, Careiro (Area 1, Forest 2), 04°09'55.4"S, 60°08'00.37"W, 5 July 2007, Winkler extractor (INPA 25); 1 nymph, Careiro, 04°09'26.3"S, 60°07'53"W, 6 July 2007, visual nocturnal search, E.H. Wienskoski (INPA 24).

Etymology.—A noun in apposition. In Amazonian mythology Conori was the powerful and brave queen of the female warriors "Icamiabas", related to the Amazon warriors from Capadocia and described in the chronicles of Dominican friar Gaspar de Carvajal.

Diagnosis.—*Cryptocellus conori* shares with all other species of the *peckorum* group three basic synapomorphies: fixed male

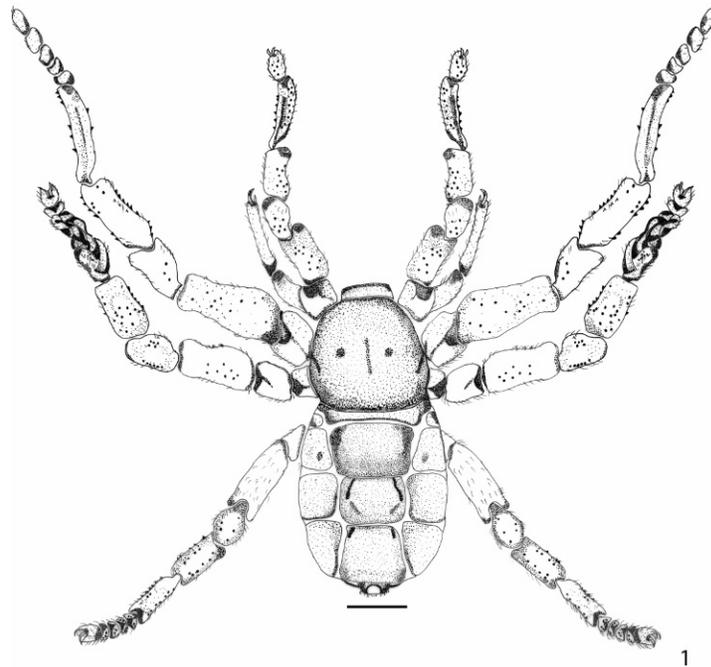
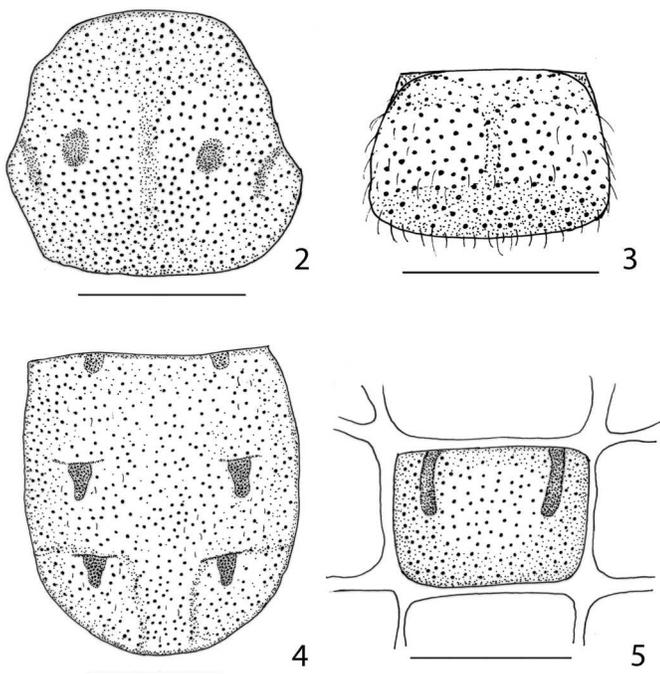


Figure 1.—*Cryptocellus conori* new species, male holotype, dorsal view. Scale bar = 1.0 mm.

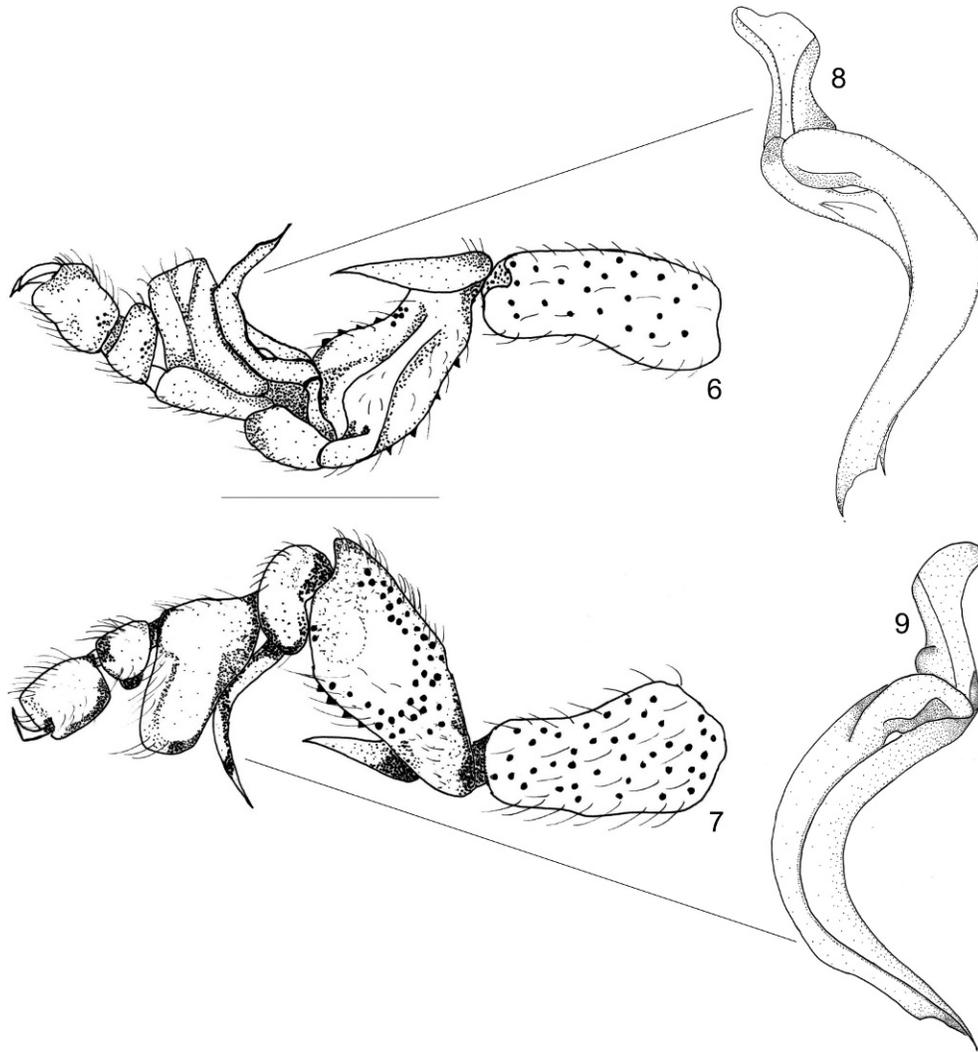
accessory piece of leg III thin; both movable and fixed piece curved, and with a sinuous contour; and basitarsus of leg III moderately inflated (longer than wide). The species possess a ventral opisthosoma with three pairs of median pits containing tubercles, the anterior pair smaller than the posterior pair, those with darker and smoother tegument (Fig. 4); no abdominal pits have been reported for *C. tarsilae*, *C. peckorum*

and *C. lampeli*; proximal telotarsus II distally without prolateral tubercles as in *C. peckorum*. Apex of accessory piece distally crenulated (Figs. 8, 9), inner half of spermathecae trilobate, outer half acuminate (Fig. 15), in *C. tarsilae* both inner and outer spermathecae bilobate, female of *C. lampeli* and *C. peckorum* not known.

Description.—*Male holotype*: Body total length, excluding pygidium, 3.9, cucullus 0.5 long, greatest width 0.8, prosoma 1.0 long, 0.9 wide between legs II and III; opisthosoma 2.9 long, 1.9 wide near middle of tergite; legs I 3.8, II 6.8, III 5.0, IV 4.8. General body color (in 70% ethanol) dark red, intersegmental membranes orange; median and posterior portion of ventral opisthosoma lighter. Cucullus dark red, but lighter than prosoma, orange in middle. Prosoma, opisthosoma, legs and cucullus covered with numerous tubercles (Fig. 1); iridescent tubercles, showing shades of purple and dark green, present on: prosoma (Fig. 2), opisthosoma, ventral opisthosoma (Fig. 4), legs and sternal region. Prosoma dark red, much darker at lateral and posterior margin. Tergal tubercles uniformly distributed (Fig. 5). Legs and lateral margin of prosoma covered by both straight and curved whitish setae; ventral opisthosoma covered with numerous setae, concolorous with the body. Prosoma as long as wide, with numerous tubercles uniformly distributed (Fig. 2). One pair of lateral eyes, cucullus densely covered with tubercles, wider than long; anterior margin straight, posterior depressed and rounded (Fig. 3); covered with many white setae, the longest on median portion. Chelicerae: fixed finger with four teeth (distal longer than others); movable finger with 9 teeth (basal almost vestigial). Sternal region with coxa I not meeting tritosternum; coxae II, III and IV touching medially. Opisthosomal tubercles uniformly distributed. Pygidium with very slight distal dorsal notch on basal segment; no ventral notch. Pedipalps orange, with discrete tubercles. Distal leg coxae darker, leg tarsi light



Figures 2–5.—*Cryptocellus conori* new species, male holotype: 2. Prosoma, dorsal view; 3. Cucullus, dorsal view; 4. Opisthosoma, ventral view; 5. Tergite XI. Scale bars = 1.0 mm.



Figures 6–9.—*Cryptocellus conori* new species, male holotype: 6. Male leg III, anterior view; 7. Male leg III, posterior view; 8. Accessory tarsal process, anterior view; 9. Accessory tarsal process, posterior view. Scales bar = 0.5 mm.

red. Leg formula II > III > IV > I; trochanter prolateroventral apophysis of leg III and IV absent. Apex of accessory piece distally crenulated (Figs. 8, 9), basitarsus of leg III moderately inflated (longer than wide). Legs with numerous tubercles.

Female paratype: Similar to male, except as follows. Body total length, excluding pygidium, 5.1, cucullus 0.8 long, greatest width 1.0, prosoma 1.9 long, 2.0 wide between legs II and III; opisthosoma 3.2 long; 2.7 wide near middle tergite; legs I 4.2, II 8.0, III 6.0, IV 6.1. Leg formula II > IV > III > I. Opisthosoma: abdominal tubercles absent only in paramedian portion, lighter than other regions (Fig. 14). Cucullus: rounded tubercles concentrated on median portion and posterior margin (Fig. 12). Pygidium with “V” notch on dorsal margin of basal segment. Spermathecae wide and short, inner half trilobate, outer half acuminate (Fig. 15).

Nymph paratype: Body total length, excluding pygidium 4.3, cucullus 0.5 long, greatest width 0.6, prosoma 1.3 long, 0.8 wide between legs II and III; opisthosoma 3.0 long; 2.8 wide near middle of tergite; legs I 3.1, II 5.8, III 3.6, IV 4.0. Leg formula II > IV > III > I. General body color (in 70%

ethanol) orange, intersegmental membranes dark yellow (dorsal view). Ventral opisthosoma lighter than prosoma, intersegmental membranes light yellow. Cucullus, legs (femur, patella and tibia of legs I and II: orange), sternal region and pedipalps (distal segment: dark yellow) light yellow. Carapace more densely covered with tubercles than male and female, absent on anterolateral border (Fig. 17). Cucullus slightly wider than long (Fig. 18), slightly depressed in posterior margin.

Distribution.—This species is known only from the type locality (Fig. 20).

Notes on the biotope.—Specimens of *C. conori* were collected at a location in the Solimões formation (Araújo et al. 1978; Rosseti et al. 2005). Its topography is predominantly flat, with tabular interfluvials and hills with Tertiary sedimentary deposits, known as “paleo-várzea” (Mauro et al. 1978). The soil is reddish-yellow (podzolic) and the vegetation is characterized as Dense Tropical Forest (Araújo et al. 1978; Doi 1978). This region has areas of savanna-like vegetation, spotted-like mosaic field islands distributed in large areas of continuous upland forest, and this landscape pattern contrib-

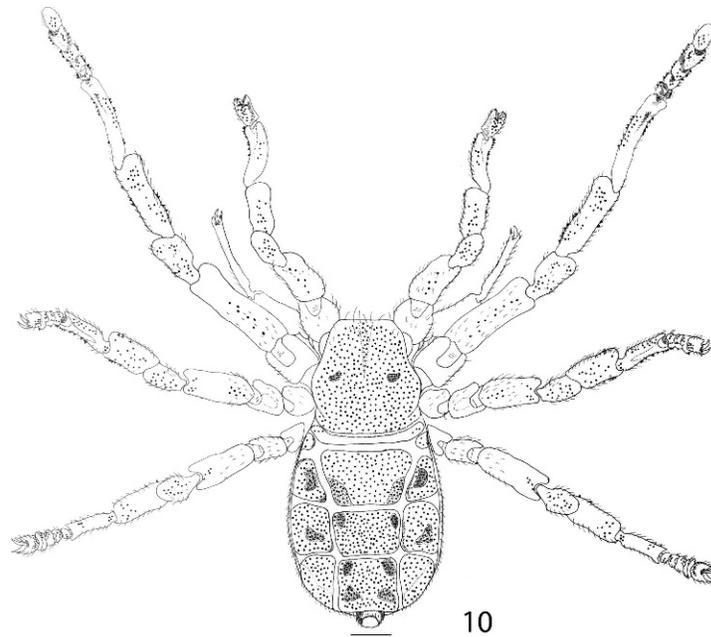
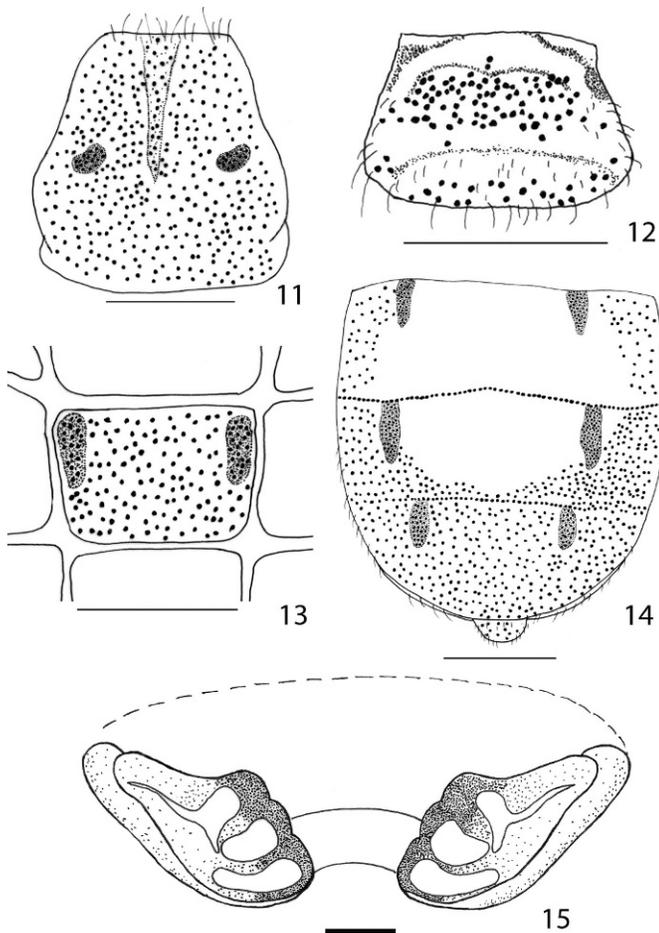


Figure 10.—*Cryptocellus conori* new species, female paratype, dorsal view. Scale bar = 1.0 mm.



Figures 11–15.—*Cryptocellus conori* new species, female paratype: 11. Prosoma dorsal view; 12. Cucullus, dorsal view; 13. Tergite XI; 14. Opisthosoma, ventral view; 15. Spermathecae, ventral view. Scales bars 11–14 = 1.0 mm; scale bar 15 = 0.5 mm.

utes directly to regional-scale diversity in the Amazon basin (Py-Daniel et al. 2007). This region is characterized by open vegetation, hosting a complex of several Amazonian natural fields, locally called “campinas”, which are very numerous in this interfluvial region of the Madeira and Purus Rivers. The fields and forests host several unique species and are regarded as one of the most diverse sites in the Amazon forest (Py-Daniel et al. 2007). Several species of animals and plants were collected during these campaigns. Along with *C. conori* several new species of harvestmen and spiders are still being processed in our laboratory at Instituto Nacional de Pesquisas da Amazônia. New species of vertebrates and plants were collected on the same field trip: one new subspecies of saddleback tamarin, *Saguinus fuscicollis* Röhe, Silva-Junior, Sampaio & Raylands, 2009 (Röhe et al. 2009), a new species of palm has been diagnosed but not yet published (T. Emilio, pers. comm.), and a new species of crow, endemic to these local savanna-like spot fields in the interfluvials (M. Cohn-Haft, personal communication).

All of these species are endangered by the construction of the BR-319 highway, which is planned to connect the city of Manaus (Amazonas State) to Porto Velho (Roraima State). The highway will link the Amazonas State with the deforestation arc, the largest deforested area in the north of Brazil, including the states of Rondônia, Pará, Acre and northern Mato Grosso and Tocantins, and it would be a focus for migration and unordered human occupation, illegal occupation of lands by land grabbers, and mechanized agricultural crops of soybean and rice. These factors together will accelerate the destruction of the forest along the highway, in several sites physically distant from the road, although under its influence (Fearnside 2005; Fearnside & Graça 2006; Fearnside et al. 2009). Along with the highway there are projects to build powerful hydroelectric power plants in this interfluvial region, which will contribute heavily to the environmental damage and degradation along the interfluvials, as has already occurred

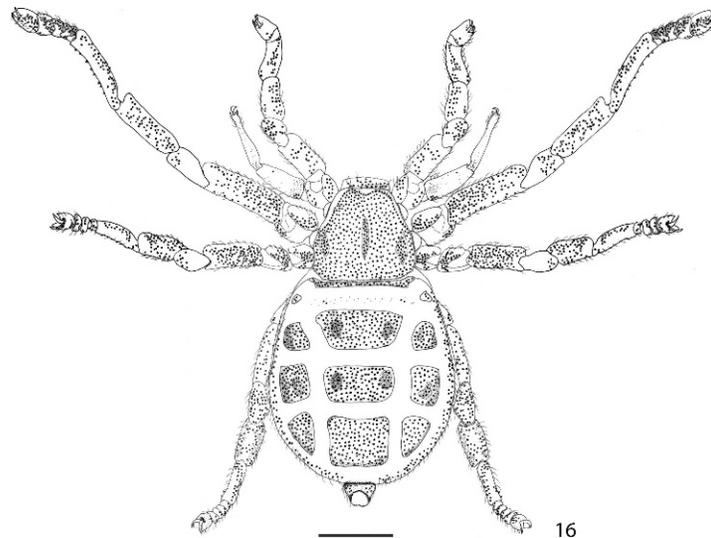


Figure 16.—*Cryptocellus conori* new species, paratype nymph, dorsal view. Scale bar = 1.0 mm.

with the lake of Balbina, and the region where the Balbina power plant was built (Fearnside 1989).

Cryptocellus becki Platnick & Shadab 1977

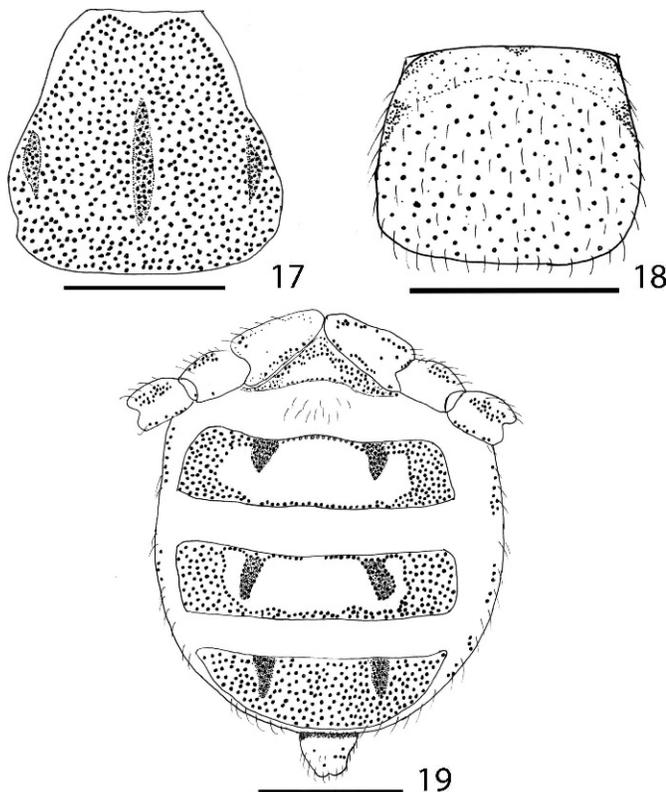
Cryptocellus becki Platnick & Shadab 1977:11, figs. 37–50.

Type locality.—Brazil, Amazonas, near Manaus, Reserva Ducke.

Material examined.—Brazil: Amazonas: Manaus, LBA Farm (Km 34, Br 174), 02°36'32"S, 60°12'32"W, 1 male, 12 August 2005, S.M. Ketelhut et al.; 1 female, 25 August 2006, F.B. Baccaro et al.; 1 nymph, 25 August 2006, F.B. Baccaro et al.; 1 nymph, 25 August 2006, F.B. Baccaro et al.; 2 nymphs, 16 May 2006, F.B. Baccaro et al.; 1 nymph, 15 November 2004, S.M. Ketelhut et al.; 3 nymphs, 8 August 2005, S.M. Ketelhut et al. Cabo Frio Farm, 02°25'S, 60°W, 1 nymph, 24 November 2005, S.M. Ketelhut et al.; 1 nymph, 24 July 2006, F.B. Baccaro et al. ZF 2 Farm (Km 14, Br 174), 02°35'20"S, 60°06'54"W, 3 nymphs, 20 October 2004, S.M. Ketelhut et al.; 1 nymph, 20 October 2004, S.M. Ketelhut et al. ZF 3 Farm (Km 37, Br 174), 02°35'55"S, 60°03'09"W, 1 nymph, 16 August 2005, S.M. Ketelhut et al.; 1 nymph, 16 August 2005, S.M. Ketelhut et al.; 1 nymph, 22 November 2005, S.M. Ketelhut et al.; 1 nymph, 20 July 2004, S.M. Ketelhut et al.; 1 nymph, 16 August 2005, S.M. Ketelhut et al.

Distribution.—This species is now known from Reserva Ducke (type locality), Tarumã-Mirim river (Adis et al. 1989), LBA Farm (Km 34, Br 174), ZF 2 Farm, ZF 3 Farm (Km 37, Br 174) and Cabo Frio Farm, located in Manaus municipality, Amazonas State, Brazil.

Relationships.—The *foedus* group was suggested by Platnick & Shadab (1977) as a monophyletic unit supported by the following synapomorphies: male cucullus with strong depression below its dorsal margin; expanded male basitarsus III; male with apophyses on trochanters of legs III and IV; and female spermathecae short and wide. For this study it is proposed that species included in this group also share a very inflated basitarsus (as long as wide) of leg III; a protuberance on the accessory piece of male leg III; and a large fixed male accessory piece forming an acute angle. *Cryptocellus foedus* was said by Platnick & Shadab (1977) to be closely related to the species *C. peckorum*, suggested as the plesiomorphic sister-taxon of *C. foedus*. However, they stated that *C. peckorum* and *C. lampeli* were not closely related to each other. *Cryptocellus peckorum* is herein included in a third assemblage of species, the *peckorum* group, which is composed of *C. peckorum*, *C. tarsilae*, *C. lampeli* and the new species *C. conori*. The basic



Figures 17–19.—*Cryptocellus conori* new species, paratype nymph: 17. Prosoma dorsal view; 18. Cucullus, dorsal view; 19. Opisthosoma, ventral view. Scale bars = 1.0 mm.

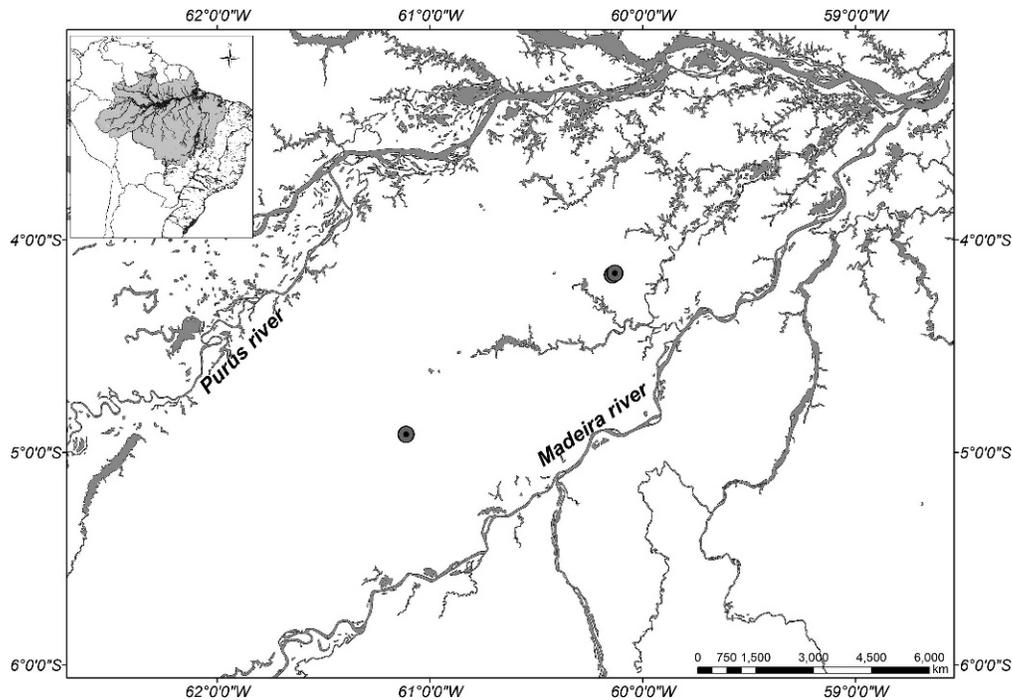


Figure 20.—Type locality of *Cryptocellus conori* new species, Careiro, Amazonas State, Brazil.

synapomorphies supporting this group are fixed male accessory piece of leg III thin; both movable and fixed piece curved, and with a sinuous contour; basitarsus of leg III moderately inflated (longer than wide).

The *Cryptocellus magnus* group was first suggested by Platnick & Paz (1979) based on species that share a massive and straight accessory piece of the male tarsal process. This character was hypothesized to be a derived character also present in *C. pseudocellatus*, known only from female specimens. *Cryptocellus glenoides* was originally included in the *magnus* group, as the most plesiomorphic lineage (Platnick & Paz 1979), but was later transferred to the *centralis* group which was based on a single apomorphic character, the presence of a peculiar anteroventral ledge on the tarsal process of male leg III, which is the basic synapomorphy for the *centralis* group, composed of 10 species (Platnick & Shadab 1981). We suggest that *C. platnicki* Botero-Trujillo & Pérez 2008 also belongs in the *centralis* group, based on its close relationship with *C. glenoides*. However, evidence for further synapomorphies is needed in order to state precisely the position of *C. glenoides* + *C. platnicki* in the *magnus* or *centralis* group (Platnick & Shadab 1981).

Among the five remaining species of *Cryptocellus*, three of them are here hypothesized to form a fifth group, the *adisi* group: *C. adisi*, *C. lisbethae*, and *C. florezi*. This group is based on a single shared character: the fixed accessory piece of male leg III is thin, curved and with a rounded contour. Platnick & García (2008) suggested the last species is more closely related to *C. lisbethae*, and that *C. adisi* resembles and could be related to *C. albosquamatus* (Platnick 1988). *Cryptocellus albosquamatus* is known only from female specimens, and its relationships and placement inside the established groups can only be properly done when and if the male of this species is found.

The current arrangement suggested in this paper for species included in the genus *Cryptocellus* is:

***Adisi* group**

Cryptocellus adisi Platnick 1988 (Brazil, Amazonas, Tarumã-Mirim river), known only from male.

Cryptocellus florezi Platnick & García 2008 (Colombia, Department of Caquetá), known from male and female.

Cryptocellus lisbethae González-Sponga 1998 (Venezuela, Bolívar), known from male and female.

***Centralis* group** (Platnick & Shadab 1981)

Cryptocellus centralis Fage 1921 (Costa Rica, Heredia, La Caja), known from male and female.

Cryptocellus chiriqui Platnick & Shadab 1981 (Panama, Chiriquí), known only from male.

Cryptocellus fagei Cooke & Shadab 1973 (Costa Rica, Golfito), known only from male.

Cryptocellus gamboa Platnick & Shadab 1981 (Panama, Canal Zone, Gamboa Pipeline), known from male and female.

Cryptocellus glenoides Cooke & Shadab 1973 (Colombia, Valle, 5 km of Delfina and Panama, Panama Province, Cerro Campana), known from male and female.

Cryptocellus goodnighti Platnick & Shadab 1981 (Costa Rica, Heredia, near Puerto Viejo de Sarapiquí), known only from male.

Cryptocellus hanseni Cooke & Shadab 1973 (Nicaragua and Honduras), known from male and female.

Cryptocellus isthmus Cooke & Shadab 1973 (Panama, Canal Zone, Gatun), known from male and female.

Cryptocellus luisedieri Botero-Trujillo & Pérez, 2009 (Colombia, Ipiales Municipality, Nariño Department), known only from male.

Cryptocellus osa Platnick & Shadab 1981 (Costa Rica, Puntarenas, Peninsula of Osa), known from male and female.

Cryptocellus platnicki Botero-Trujillo & Pérez 2008 (Colombia, Department of Chocó) – **dubious position** (Botero-Trujillo & Pérez 2008), known from male and female.

Cryptocellus striatipes Cooke & Shadab 1973 (Costa Rica, Limón, Colombiana), known from male and female.

Foedus group (Platnick & Shadab 1977)

Cryptocellus abaporu Bonaldo & Pinto-da-Rocha 2003 (Brazil, Rondônia, Ji-Paraná), known from male and female.

Cryptocellus becki Platnick & Shadab 1977 (Brazil, Amazonas, near Manaus, Reserva Ducke), known from male and female.

Cryptocellus foedus Westwood 1874 (Brazil, Amazon, somewhere between Belém in Pará and São Paulo de Olivença, in Amazonas), known only from female.

Cryptocellus icamiabas Tourinho & Azevedo 2007 (Brazil, Amazonas, Presidente Figueiredo, Balbina), known only from male.

Cryptocellus simonis Hansen & Sørensen 1904 (Brazil, Pará, Belém), known from male and female.

Cryptocellus whitticki Platnick & Shadab 1977 (Guyana, Rupununi, New River district), known only from male.

Magnus group (Platnick & Paz 1979)

Cryptocellus bordonii Dumitrescu & Juvara-Bals 1977 (Venezuela, Zulia), known from male and female.

Cryptocellus brignolii Cokendolpher 2000 (Suriname, Paramaribo), known only from male.

Cryptocellus magnus Ewing 1929 (Colombia, Magdalena), known only from female.

Cryptocellus narino Platnick & Paz 1979 (Colombia, Antioquia), known from male and female.

Cryptocellus pseudocellatus Roewer 1952 (Peru, Cajamarca), known only from female.

Peckorum group

Cryptocellus conori new species (Brazil, Amazonas, Carreiro), known from male and female.

Cryptocellus lampeli Cooke 1967 (British Guiana, Amatum), known from male and female.

Cryptocellus peckorum Platnick & Shadab 1977 (Colombia, Amazonas, Leticia), known from male and female.

Cryptocellus tarsilae Pinto-da-Rocha & Bonaldo 2007 (Brazil, Pará, National Forest (FLONA) of Carajás), known from male and female.

Nomina dubia

Cryptocellus leleupi Cooreman 1977 (Platnick & Paz 1979) (Ecuador, Oriente, Rio Negro), known only from nymph.

Cryptocellus emarginatus Ewing 1929 (Platnick & Shadab 1981) (Costa Rica, Cartago, Navarro farms), known only from nymph.

Remaining species

Cryptocellus albosquamatus Cooke 1967 (British Guiana, Amatum), known only from female.

Cryptocellus bocas Platnick & Shadab 1981 (Panama, Quebrada Alicia), known only from female.

Cryptocellus verde Platnick & Shadab 1981 (Costa Rica, Puntarenas, Monteverde), known only from female.

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