

AMERICAN MUSEUM
Novitates

PUBLISHED BY
THE AMERICAN MUSEUM
OF NATURAL HISTORY

CENTRAL PARK WEST AT 79TH STREET
NEW YORK, N.Y. 10024 U.S.A.

NUMBER 2633

OCTOBER 4, 1977

NORMAN I. PLATNICK AND MOHAMMAD U. SHADAB
On Amazonian *Cryptocellus*
(Arachnida, Ricinulei)

AMERICAN MUSEUM *Novitates*

PUBLISHED BY THE AMERICAN MUSEUM OF NATURAL HISTORY
CENTRAL PARK WEST AT 79TH STREET, NEW YORK, N.Y. 10024

Number 2633, pp. 1-17, figs. 1-58

October 4, 1977

On Amazonian *Cryptocellus* (Arachnida, Ricinulei)

NORMAN I. PLATNICK¹ AND MOHAMMAD U. SHADAB²

ABSTRACT

A key is provided to the 10 known South American ricinuleid species. The synonymy of *Cryptocellus simonis* Hansen and Sørensen with *C. foedus* Westwood is disclaimed. These two species and *C. pseudocellatus* Roewer are redescribed; illustrations of the spermathecae of *C. albosquamatus* Cooke and *C. lampeli* Cooke are

provided. Three new species are described: *C. whitticki* from Guyana, *C. becki* from Brazil, and *C. peckorum* from Colombia. In a supplement, the recently proposed genus *Heteroricinoides* Dumitrescu and Juvara-Bals is newly synonymized with *Cryptocellus*.

INTRODUCTION

This paper, the second in a series on the arachnid order Ricinulei, reviews the known South American members of the group. Because of their extreme rarity in collections, previous authors who have reported on South American Ricinulei have seldom been able to examine more than one or two species at a time, with the result that some specimens representing undescribed species have been misidentified and that some named species have been erroneously synonymized. We have made a concerted effort to examine all previously reported South American specimens as well as newly available material; the few localities from which specimens are known are shown in figure 58.

Westwood (1874) described the first known American ricinuleid, *Cryptocellus foedus*, on the basis of a single female taken by Bates in the Amazonian region of Brazil, and Hansen and Sørensen (1904), in their monograph on the

order, established a second species, *Cryptocellus simonis*, for a single male collected in Pará, Brazil. Since that time six additional South American species have been described, although one of these (*Cryptocellus manni* Ewing) has subsequently been placed in synonymy (Platnick and Shadab, 1976). Beck and Schubart (1968) obtained pairs of specimens from both Pará and Amazonas, Brazil, and observed one of these pairs in copula; without consulting the original material of *C. foedus* and *C. simonis* (or the male from Guyana attributed to *C. simonis* by Whittick, 1938), they identified the females from both Brazilian areas as the former species, the males from both areas as the latter species, and synonymized the two. Brignoli (1974), without having seen any specimens, objected strongly to this synonymy on the grounds that the behavioral observations support only a hypothesis of conspecificity in one of the populations and that

¹Associate Curator, Department of Entomology, the American Museum of Natural History.

²Scientific Assistant, Department of Entomology, the American Museum of Natural History.

the resulting distribution of the species is untenable in view of the extremely restricted distributions presently known for all other members of the genus. Although these arguments are not convincing in themselves, direct observation of the relevant material indicates that Brignoli is correct. The male from Guyana noted by Whittick is very different from the Brazilian males, the Pará and Amazonas specimens are distinguishable in both sexes, and females from both populations are separable from the holotype of *C. foedus* (from an indeterminate Amazonian locality); all these forms are redescribed below.

Restudy of the available South American material has also allowed us to investigate the value of the female spermathecae, first noted by Brignoli (1974), as a taxonomic character. Differences in these structures can be detected in all eight species of which females are known; in some cases, such as *Cryptocellus albosquamatus* Cooke (fig. 52), they are very distinctive; in other cases, such as the complex including *C. foedus*, *C. simonis*, and *C. becki*, the differences are slight and somatic morphology provides more readily usable characters. Illustrations of the spermathecae of all species other than the two Colombian ones already treated by Platnick and Shadab (1976) are provided below. In addition, the one remaining species without a detailed modern description, *Cryptocellus pseudocellatus* Roewer, is redescribed below.

Enough material of two species, *Cryptocellus lampeli* Cooke and *C. albosquamatus*, has been available to allow some observation by scanning electron microscopy. One frequently cited character, the presence or absence of a notch in the posterior dorsal margin of the basal pygidial segment, must be used carefully as some species have only slight notches (compare figs. 14, 20, and 42); only when the notch is complete is the character conspicuous (fig. 1). At least three types of tubercles can be found on *C. lampeli*; the carapace bears flat tubercles like those found in the cuticular pits of *Cryptocellus magnus* Ewing (compare fig. 3 with Platnick and Shadab, 1976, fig. 5), the palpal trochanter bears low conical tubercles (fig. 2) like those found in *Cryptocellus pelaezi* Coronado (see Pittard and Mitchell, 1972, fig. 18), and the first metatarsus bears tall conical tubercles (fig. 4). Examination of the distal tarsomere of legs I and II of *C.*

lampeli reveals many of the same modifications found by Pittard and Mitchell (1972) in *C. pelaezi*: a large treelike seta and numerous bent setae (fig. 5) and a peg seta and shallow oval pits bearing peripheral setae (fig. 6). The entire body of *C. albosquamatus* is coated with large boat-shaped setae (figs. 7, 8) that seem structurally identical with the navicular setae described by Legg (1976, pl. 1) in African *Ricinoides*.

Any serious attempt to investigate the phylogeny of the Ricinulei must await a review of the numerous Central American and Mexican forms, but some preliminary observations can be made. There is, of course, no doubt as to the monophyly of at least the Recent Ricinulei; the cucullus, the abdominal coupling mechanism, and the male copulatory apparatus are all unique to the group, and Hansen and Sørensen (1904) noted numerous other autapomorphic characters of the order. The division of the group into two genera, *Ricinoides* (in tropical West Africa) and *Cryptocellus* (in tropical America) has not been investigated or seriously questioned since Hansen and Sørensen presented a list of about a dozen distinguishing characters of the two. Those authors knew only two very closely related and relatively atypical species of *Cryptocellus*, so it is not surprising that some of their suggested characters (such as the relative widths of coxae II and III and the shape of the movable finger of the chelicerae) are no longer valid, particularly for the troglobitic species. Of the basic structural (rather than proportional) characters, most (an anterior tooth on the chelicerae, a separate dorsal groove for the metatarsal process on the male metatarsus III, a lamina cyathiformis that adducts completely against the metatarsal process and encloses the male tarsal process, and a wide lateral flange on the body of the tarsal process) are restricted to *Ricinoides*; *Cryptocellus* is generally recognized by the absence of these characters. The question thus arises as to whether there are any characters that can be considered synapomorphic for *Cryptocellus*. Of course the genera are geographically disjunct and it is therefore convenient to think of them as sister groups, but the South America-Africa vicariance event need not be correlated with the earliest dichotomy in the history of the Recent Ricinulei. If no derived characters shared uniquely by all the *Cryptocellus* species can be found, it is possible that the

group is paraphyletic and that some of its members are more closely related to *Ricinoidea* than to each other. The navicular setae of *C. albosquamatus*, for example, might be regarded as evidence of such a (more recent) transatlantic relationship. There is at least one character, however, that might be considered synapomorphic for *Cryptocellus*: the presence of distinct invaginations of the dorsodistal margins of the final tarsomeres of legs III and IV. Similar invaginations are found in some other arachnids (such as oncopodid opilionids; Suzuki, 1976, fig. 2), however, so serious consideration of this question requires an analysis of the arachnid orders to determine what the closest relatives of the Ricinulei may be; Kraus (1976) has commented aptly on the difficulty of such an analysis. It is worth noting that if the presence of a pedicel is regarded as a synapomorphic character, as suggested by Kraus, the Ricinulei will have to be included in the group thus formed; the fact that the pedicel is normally externally invisible because of the abdominal coupling mechanism does not justify consideration of the order as non-pedicellate.

Some preliminary hypotheses on the interrelationships of the South American Ricinulei can be offered. The "pseudocelli" described by Roewer (1952) in the Peruvian *C. pseudocellatus* are not the two translucent areas on the margins of the carapace between legs I and II, but eight (out of many) deep pits of the same type found in the Colombian *C. magnus* (Platnick and Shadab, 1976, figs. 1, 2, 4, and 5). The presence of these pits is probably synapomorphic and the two species are probably sister taxa; the unusual straight and massive accessory piece of the male tarsal process in *C. magnus* and the Colombian *Cryptocellus glenoides* Cooke and Shadab may indicate that the latter species is the plesiomorphic sister group of *C. magnus* plus *C. pseudocellatus*. If this is the case, the male of *C. pseudocellatus*, when discovered, should also prove to have a straight and massive accessory piece. Four other species (*C. foedus*, *C. simonis*, *C. becki*, and *C. whitticki*) form a monophyletic group with the following unique characters: the male cucullus has a strong depression below its dorsal margin (fig. 22), the male metatarsus III is greatly expanded (fig. 24), the male trochanters on legs III and IV bear apophyses (fig. 23), and

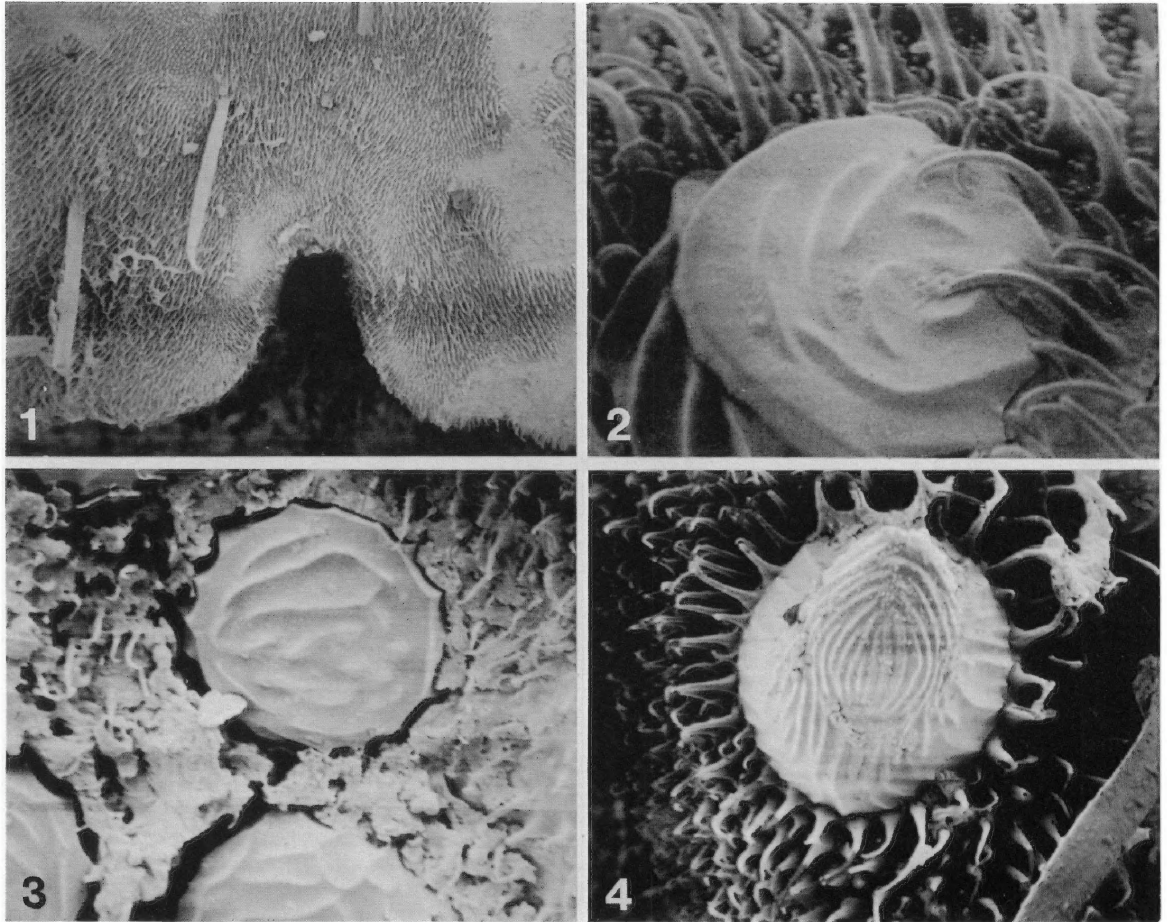
the female spermathecae are short and wide (fig. 12); relationships within this group will probably remain obscure until the male of *C. foedus* and the female of *C. whitticki* are discovered. The three remaining species (*C. peckorum*, *C. lampeli*, and *C. albosquamatus*) do not appear to be closely related to each other; the first of these may be the plesiomorphic sister taxon of the *foedus* group, judging by its slightly expanded metatarsus III (fig. 54).

As in our previous collaborations, the senior author has been responsible for the taxonomic analysis and the preparation of the text and the junior author for the preparation of the illustrations; the scanning electron micrographs were obtained with the assistance of Mr. Robert J. Koestler. We are grateful to the following curators and institutions for supplying material: Drs. R. E. Crabill, Jr., National Museum of Natural History, Smithsonian Institution; H. Dybas, Field Museum of Natural History (FMNH); M. Grasshoff, Natur-Museum Senckenberg (NMS); M. Hubert, Muséum National d'Histoire Naturelle (MNHN); H. W. Levi, Museum of Comparative Zoology, Harvard University (MCZ); E. Taylor and M. W. R. de V. Graham, Hope Department of Entomology, Oxford University (HDO); and F. Wanless, British Museum (Natural History) (BMNH).

All measurements cited below are in millimeters.

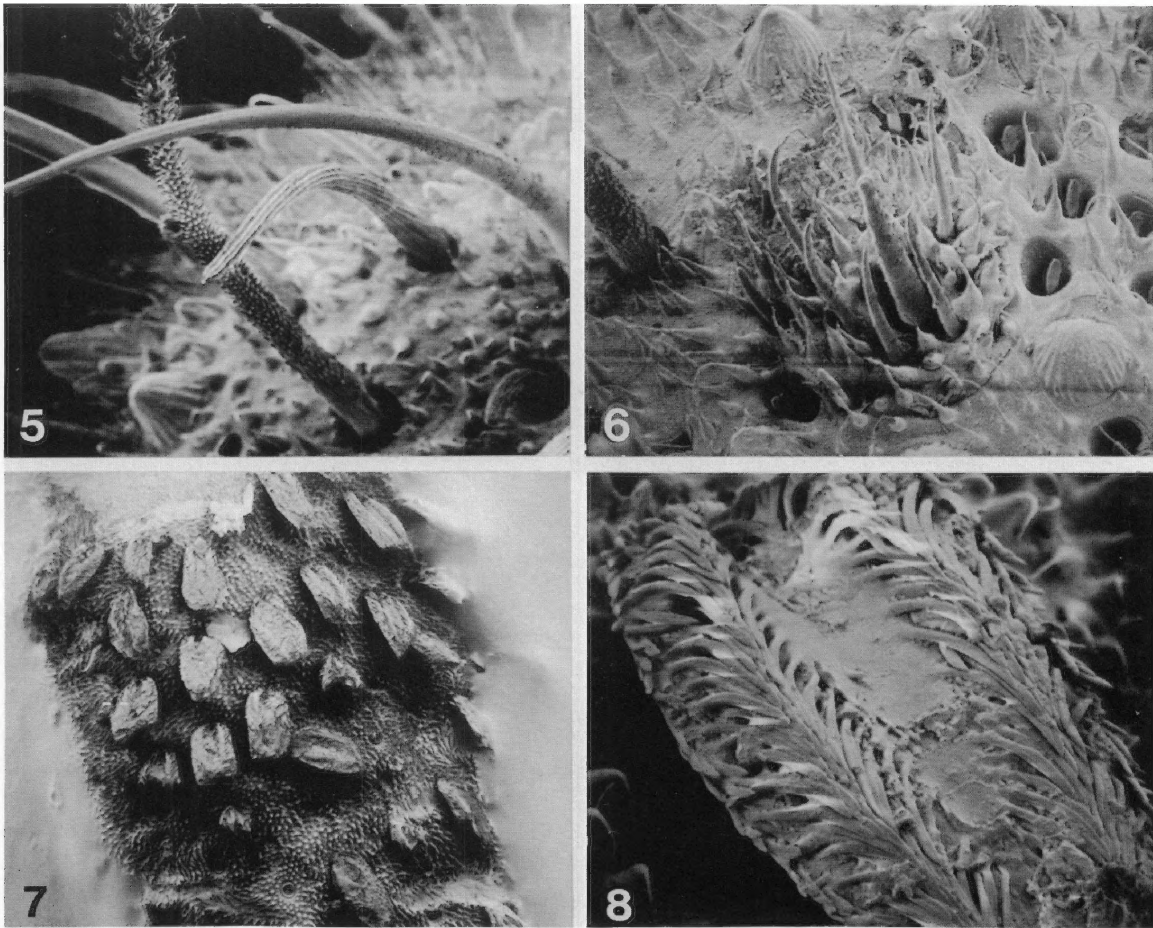
KEY TO SOUTH AMERICAN SPECIES OF *CRYPTOCELLUS*

1. Body and legs covered with large navicular setae (figs. 7, 8); spermathecae triangular (fig. 52); Guyana. . . *albosquamatus* Cooke
Body and legs without navicular setae; spermathecae not triangular. 2
2. Carapace with deep pits containing tubercles (Platnick and Shadab, 1976, figs. 1, 2, 4, 5). 3
Carapace without deep pits. 4
3. Accessory piece of male tarsal process trifold (Platnick and Shadab, 1976, fig. 13); dorsal margin of spermathecae smooth (Platnick and Shadab, 1976, fig. 14); Magdalena, Colombia. . . . *magnus* Ewing
Males unknown; dorsal margin of spermathecae invaginated (fig. 51); Cajamarca, Peru *pseudocellatus* Roewer
4. Males 5



FIGS. 1-4. Scanning electron micrographs, *Cryptocellus lampeli*, female. 1. Basal segment of pygidium, showing notch, dorsal view, 500X. 2. Tubercle from palpal trochanter, ventral view, 5000X. 3. Tubercles from carapace, dorsal view, 2000X. 4. Tubercle from dorsal ridge of metatarsus I, 2000X.

- | | |
|---|---|
| <p>Females. 10</p> <p>5. Femur I with proximal and distal prolatero-ventral knobs (Hansen and Sørensen, 1904, fig. 3g); trochanters III and IV with apophyses (as in fig. 23); cucullus with a proximal depression (as in fig. 22)6</p> <p>Femur I without knobs; trochanters III and IV without apophyses; cucullus without proximal depression. 8</p> <p>6. Apophyses on trochanters III and IV rounded (fig. 31); Guyana.</p> <p>. <i>whitticki</i>, new species</p> <p>Apophyses on trochanters III and IV pointed (figs. 23, 45); Brazil. 7</p> <p>7. Cucullus and median plate of tergite 11 with many tubercles (figs. 21, 22); femur III not elevated dorsally, with few prolateral</p> | <p>tubercles (fig. 25); Pará, Brazil</p> <p>. <i>simonis</i> Hansen and Sørensen</p> <p>Cucullus and median plate of tergite 11 with few tubercles (figs. 43, 44); femur III elevated dorsally, with many tubercles (fig. 47); Amazonas, Brazil</p> <p>. <i>becki</i>, new species</p> <p>8. Accessory piece of male tarsal process thick and straight (Cooke and Shadab, 1973, fig. 37); Valle, Colombia.</p> <p>. <i>glenoides</i> Cooke and Shadab</p> <p>Accessory piece of male tarsal process thin and curved (as in fig. 55). 9</p> <p>9. Carapace almost devoid of tubercles; Guyana</p> <p>. <i>lampeli</i> Cooke</p> <p>Carapace almost completely covered with tubercles; Amazonas, Colombia</p> |
|---|---|



FIGS. 5-8. Scanning electron micrographs. 5, 6. *Cryptocellus lampeli*, female. 5. Tarsus I, dorsal view, 1000X. 6. Tarsus II, dorsal view, 1000X. 7, 8. *C. albosquamatus*, nymph. 7. Femur I, showing navicular setae, 250X. 8. Single navicular seta, 2500X.

- *peckorum*, new species
- 10. Spermathecae longer than wide (Platnick and Shadab, 1976, fig. 17); Valle, Colombia. . . *glenoides* Cooke and Shadab
Spermathecae wider than long (as in fig. 53).....11
- 11. Spermathecae wider laterally than medially (fig. 53); Guyana. *lampeli* Cooke
Spermathecae wider medially than laterally (figs. 12, 18, 40) 12
- 12. Carapace and median plate of tergite 11 almost completely covered with tubercles (figs. 9, 11) *foedus* Westwood
Carapace and median plate of tergite 11 with scattered tubercles only 13
- 13. Carapace and median plate of tergite 11 with numerous scattered tubercles (figs. 15,

- 17); femur I not expanded dorsally (fig. 19); pygidium unnotched (fig. 20); Pará, Brazil *simonis* Hansen and Sørensen
- Carapace and median plate of tergite 11 with few scattered tubercles (figs. 37, 39); femur I expanded dorsally (fig. 41); pygidium notched (fig. 42); Amazonas, Brazil *becki*, new species

Cryptocellus foedus Westwood
Figures 9-14

Cryptocellus foedus Westwood, 1874, p. 201, pl. 37, figs. 5, 5a-5c (female holotype from "Amazonia," somewhere between Belém in Pará and São Paulo de Olivença in Amazonas,

Brazil, in HDO, examined). Hansen and Sørensen, 1904, p. 155, pl. 9, figs. 2a-2e.

Diagnosis. Males of *C. foedus* are unknown; females may be distinguished from those of *C. simonis* and *C. becki* by the much larger number of tubercles on the carapace, cucullus, and median plate of tergite 11 (figs. 9-11), the ventrally but not dorsally expanded femur I (fig. 13), and the shallowly notched pygidium (fig. 14).

Female. Total length 4.64. Carapace 1.85 long, 1.83 wide between legs II and III, where widest, dark red with distinctly darkened borders, with translucent pale yellow areas near margins between legs I and II; surface, except for margins, rather evenly and completely covered with tubercles (fig. 9). Cucullus 0.90 long, 1.13 wide, dark red, with long setae and numerous scattered tubercles most densely packed below dorsal margin; lateral lobes slightly protuberant (fig. 10). Left chelicera: movable finger laterally thin, flattened posteriorly, slightly widened transversely, armed with seven teeth increasing in length distally; fixed finger armed with four teeth of which most distal is much the largest. Sternal region with coxae I not meeting tritosternum; coxae II meeting along their posterior four-fifths, their suture line only slightly longer than that of coxae III; coxae IV almost meeting distally. Abdomen 2.99 long, 2.63 wide near front of tergite 12, where widest, coloration as in carapace except for brown articular membranes, with numerous tubercles evenly coating all tergal plates (fig. 11) and U-shaped area covering all of sternite 13 and lateral areas of sternite 12; median plates of tergites 11-13 and corresponding sternites with paired lateral depressions, depressions of sternite 11 triangular, filled with tubercles; median plates of all tergites wider than long. Pygidium with shallow notch in posterior dorsal margin of basal segment (fig. 14). Pedipalp coxae light red, distal segments orange; coxae and trochanters with scattered ventral and dorsal tubercles, femora with few proximal tubercles. Leg formula 2431. Legs dark red, lighter distally, coated with short setae; coxae with few small tubercles at margins; femur I expanded ventrally but not dorsally (fig. 13); distal leg segments with relatively few scattered tubercles.

	I	II	III	IV	Palp
Coxa	0.82	1.04	0.94	0.86	0.40
Trochanter I	0.58	0.65	0.47	0.61	0.50
Trochanter II	—	—	0.54	0.65	0.39
Femur	1.12	1.62	1.09	1.22	0.86
Patella	0.73	0.94	0.81	0.77	—
Tibia	0.97	1.37	0.88	0.94	1.40
Metatarsus	1.06	1.53	0.95	0.96	—
Tarsus	0.49	1.51	0.83	0.86	0.14
Total	5.78	8.66	6.51	6.87	3.69

Second legs not greatly widened; femur I about twice, femur II about three times as long as wide. Tarsal claws stout, evenly curved. Spermathecae wide, short (fig. 12).

Male. Unknown.

Material Examined. Only the holotype.

Distribution. The type specimen was collected by H. W. Bates in the Amazon basin. A label with the specimen gives the date 1861, which was thus reported by Hansen and Sørensen (1904) as the date of collection. Edward Clodd's memoir of Bates (in Bates, 1892) indicates that Bates returned to England by at least 1860, having departed from Brazil in June 1859. We have been unable to find any reference to the specimen in Bates's narrative of his expedition, so it would appear that the type locality of this species can only be said to be somewhere along the Amazon, with limits set only by the extent of Bates's itinerary, cited above.

Cryptocellus simonis Hansen and Sørensen
Figures 15-28

Cryptocellus simonis Hansen and Sørensen, 1904, p. 156, pl. 9, figs. 3a-3i (male holotype from Le Pará [=Belém], Pará, Brazil, in MNHN, examined).

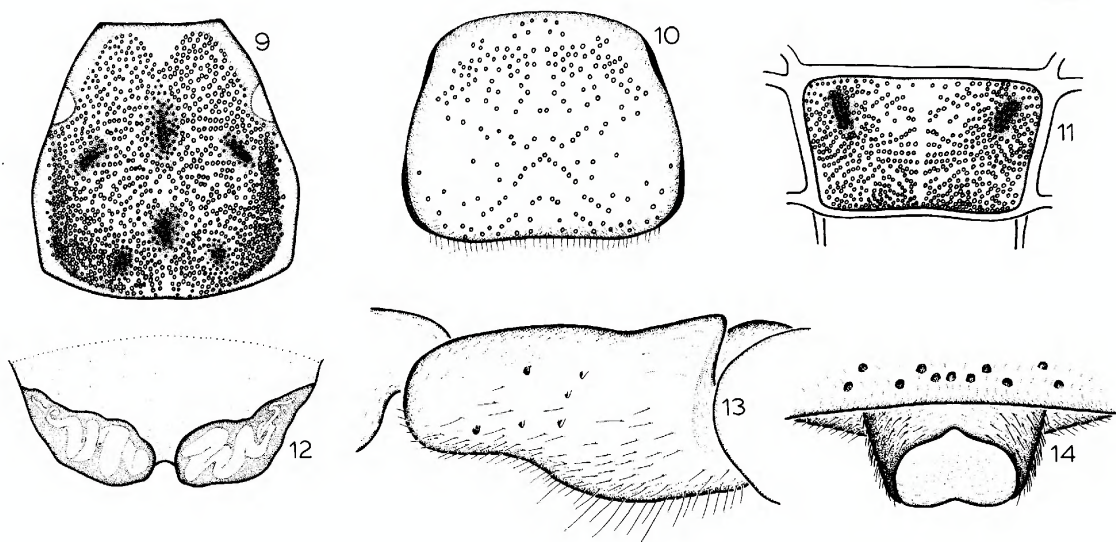
Cryptocellus foedus (misidentification): Beck and Schubart, 1968, p. 75 (in part; specimens from Pará only).

Diagnosis. Females of *C. simonis* may be distinguished from those of *C. foedus* and *C. becki* by the moderate number of tubercles on the carapace, cucullus, and median plate of tergite 11 (figs. 15-17), the unexpanded femur I (fig. 19), and the unnotched pygidium (fig. 20). Males of *C. simonis* may be distinguished from those of *C. becki* by the larger number of tubercles on the

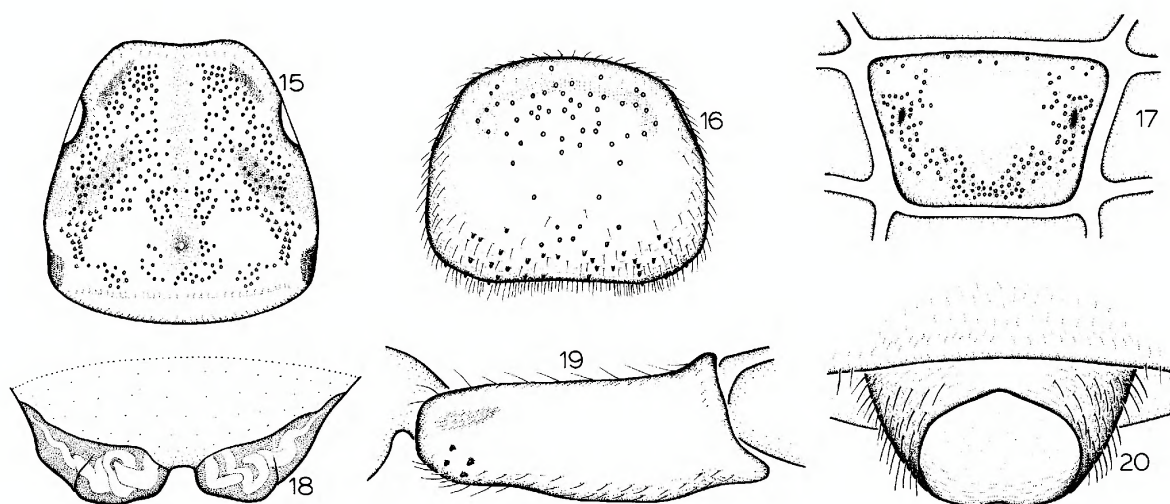
cucullus and median plate of tergite 11 (figs. 21, 22), the smaller number of prolateral tubercles on femur III (fig. 25), and the lack of a distinct widening below the tip of the tarsal process (fig. 26), and from those of *C. whitticki* by the much longer apophyses on trochanters III and IV (fig. 23).

Female. Total length 4.57. Carapace 1.80 long, 1.67 wide at front of leg III, where widest, dark red laterally and posteriorly, lighter medially and anteriorly, with very small translucent yellow areas near margins between legs I and II; surface, except for midline, with scattered large tubercles (fig. 15) and short recumbent white setae. Cucullus 0.83 long, 0.97 wide, dark red proximally, lighter distally, evenly coated with large tubercles and white setae becoming longer distally; lateral lobes only slightly protuberant (fig. 16). Left chelicera: movable finger laterally thin, flattened posteriorly, slightly widened transversely, armed with seven teeth of which most proximal is smallest, others subequal in length; fixed finger armed with four teeth of which most distal is much the largest. Sternal region with coxae I not meeting tritosternum; coxae II meeting along their posterior two-thirds,

their suture line about one and one-third times as long as that of coxae III; coxae IV not meeting. Abdomen 3.02 long, 2.54 wide near middle of tergite 12, where widest; coloration, setation, and ornamentation as in carapace except for brownish orange articular membranes, with numerous tubercles evenly distributed except on bare patch anteromedially on median plate of tergite 11 (fig. 17); median plates of tergites 11-13 with paired lateral glabrous depressions, corresponding sternites with similar tuberculate depressions, with numerous tubercles on dark U-shaped band covering all of sternite 13 and lateral areas of sternites 11 and 12, surrounding lighter smooth median areas of those sternites; median plates of all tergites wider than long. Pygidium with narrowed dorsal margin of basal segment but without distinct notch (fig. 20). Pedipalps orange; coxae and trochanters with ventral tubercles, femora with proximal dorsal and ventral tubercles. Leg formula 2431. Legs dark red proximally, lighter distally, coated with fine white setae; femur I not expanded dorsally or ventrally (fig. 19); segments with relatively few scattered tubercles except on dorsal ridges and sides of metatarsi, where numerous.



FIGS. 9-14. *Cryptocellus foedus*, female. 9. Carapace, dorsal view. 10. Cucullus, anterior view. 11. Median plate of tergite 11, dorsal view. 12. Spermathecae, posterior view. 13. Femur I, prolateral view. 14. Pygidium, dorsal view.



FIGS. 15-20. *Cryptocellus simonis*, female. 15. Carapace, dorsal view. 16. Cucullus, anterior view. 17. Median plate of tergite 11, dorsal view. 18. Spermathecae, posterior view. 19. Femur I, prolateral view. 20. Pygidium, dorsal view.

	I	II	III	IV	Palp
Coxa	0.72	1.10	0.88	0.81	0.43
Trochanter I	0.47	0.61	0.50	0.63	0.50
Trochanter II	—	—	0.47	0.57	0.36
Femur	1.10	1.73	1.14	1.19	0.86
Patella	0.70	0.83	0.65	0.78	—
Tibia	0.90	1.32	0.90	0.94	1.22
Metatarsus	0.94	1.58	0.83	0.99	—
Tarsus	0.47	1.30	0.79	0.90	0.14
Total	5.30	8.47	6.16	6.81	3.51

Second legs not noticeably widened; femur I three times, femur II five times as long as wide. Tarsal claws thin, evenly curved. Spermathecae wide, short (fig. 18).

Male. Total length 5.08. Carapace 2.05 long, 1.69 wide at back of leg II, where widest, dark red anteriorly and laterally, lighter medially and posteriorly, with very small translucent yellow areas at margins between legs I and II; surface, except for anterior end, almost completely covered with numerous tubercles, with fine white setae clustered toward margins. Cucullus 0.76 long, 1.19 wide, dark red proximally, grading to yellow distally; distal half with scattered tubercles; surface with long fine setae; lateral lobes strongly protuberant, distal margin invaginated between lobes; proximal margin curved, followed by deep depression (fig. 22). Left chelicera: mov-

able finger laterally thick, flattened posteriorly, greatly widened transversely, armed with seven teeth of which most proximal is smallest, others becoming longer distally, last four grouped in two pairs; fixed finger armed with four teeth of which most distal is much the largest. Sternal region with coxae I not meeting tritosternum; coxae II meeting along their posterior eighth-ninths, their suture line almost twice as long as that of coxae III; coxae IV meeting. Abdomen 3.35 long, 2.38 wide near middle of tergite 12, where widest, coloration lighter than carapace, all tergites with numerous tubercles most densely packed on median plates and on tergite 11 (fig. 21); setation sparse; articular membranes beige; median plates of tergites 11-13 with paired tuberculate lateral depressions, corresponding sternites with similar depressions, with numerous tubercles on U-shaped band covering all of sternite 13 and posterior one-third of sternite 12 and sides of sternites 11 and 12; additional tubercles along anterior and posterior margins of sternite 11; median plates of all tergites wider than long. Pygidium with narrowed dorsal margin of basal segment but without distinct notch. Pedipalps orange; coxae, trochanters, and ventroproximal edge of femora with scattered tubercles. Leg formula 2341. Legs light red proximally, lighter distally, sparsely coated with fine white setae;

segments with relatively few scattered tubercles except ventrally on metatarsus I and prolaterally on femur III (fig. 25), where numerous.

	I	II	III	IV	Palp
Coxa	0.58	1.24	1.01	0.78	0.42
Trochanter I	0.83	0.79	0.47	0.71	0.47
Trochanter II	—	—	0.73	0.61	0.40
Femur	1.24	1.74	1.55	1.58	0.89
Patella	0.83	0.97	0.79	0.83	—
Tibia	1.01	1.48	1.01	1.06	1.30
Metatarsus	1.30	1.84	1.19	1.01	—
Tarsus	0.47	1.62	1.37	1.19	0.16
Total	6.26	9.68	8.12	7.77	3.64

Legs with numerous sexual modifications: femur I with ventral spur at proximal end and two connected spurs at distal end on prolateral side of venter; tibia and metatarsus I each with prolateroventral rounded knob; femur II with slight prolateroventral knob at proximal end; second

trochanter of leg III with prolateroventral spur, first trochanter of leg IV with retrolateroventral spur (fig. 23). Second legs not noticeably widened; femur I two and one-half, femur II four times as long as wide. Tarsal claws thin, evenly curved. Copulatory apparatus as in figures 24, 26-28.

Material Examined. The holotype male (described above) and a male and female from Utinga, near Belém, Pará, Brazil (L. Beck, 1966, NMS).

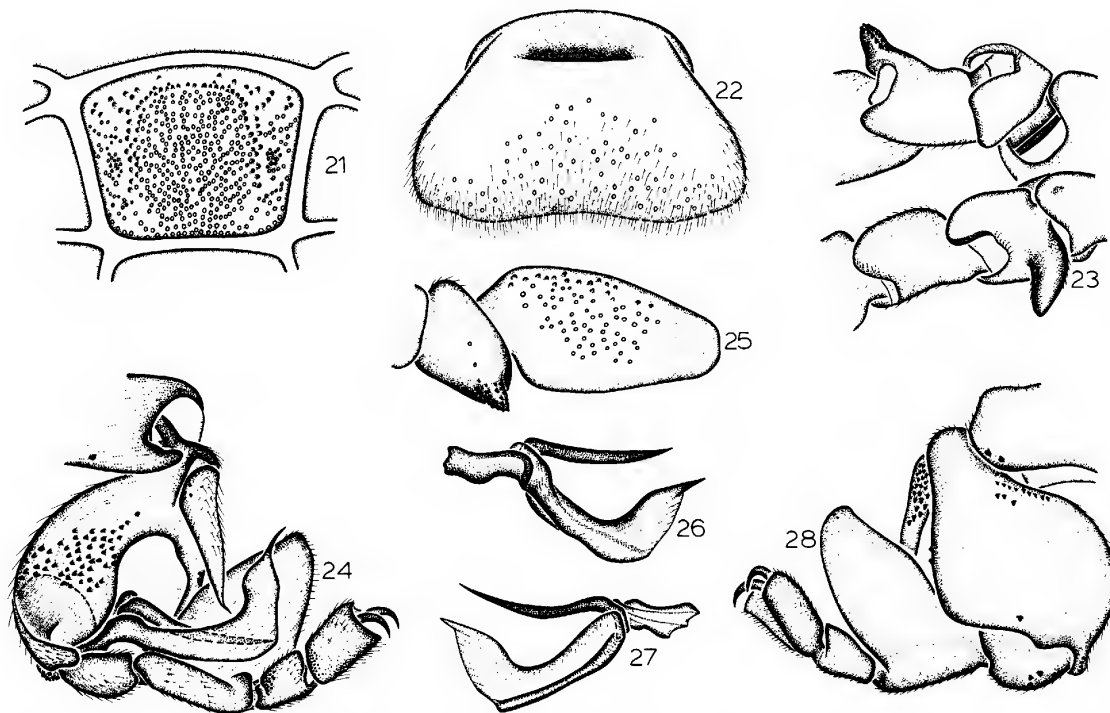
Variation. The male from Utinga has slightly fewer tubercles on the carapace and abdomen and slightly more tubercles on the prolateral surface of tibia III.

Distribution. Known only from Pará, Brazil.

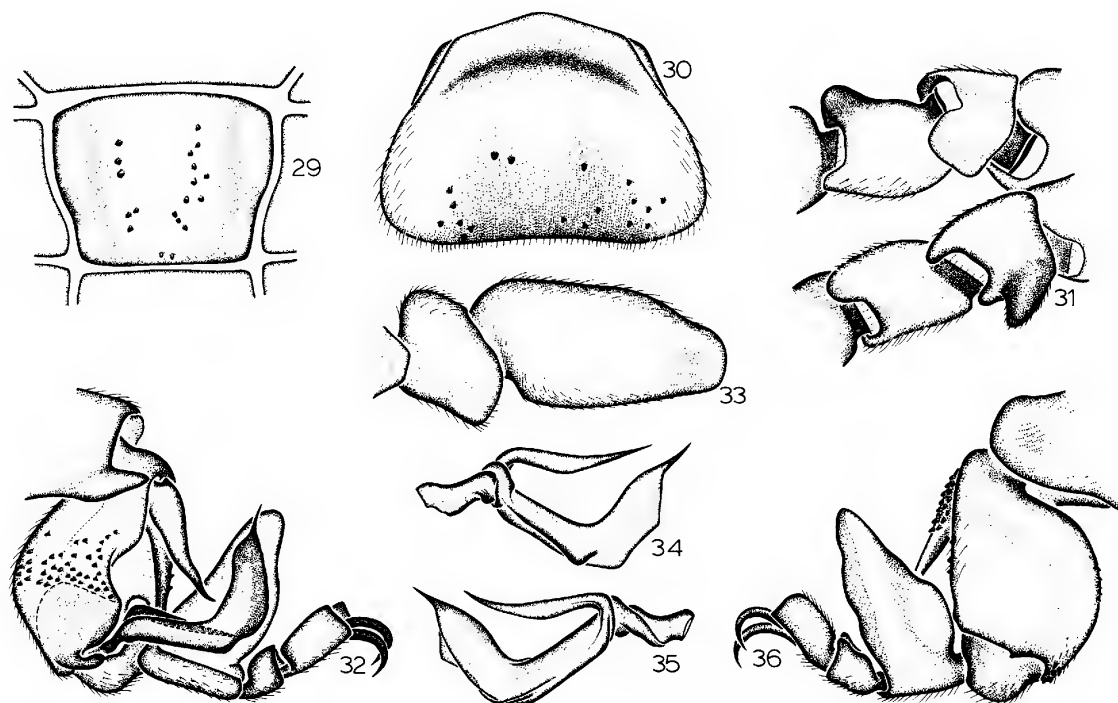
Cryptocellus whitticki, new species

Figures 29-36

Cryptocellus simonis (misidentification): Whittick, 1938, p. 479.



FIGS. 21-28. *Cryptocellus simonis*, male. 21. Median plate of tergite 11, dorsal view. 22. Cucullus, anterior view. 23. Trochanters III and IV, ventral view. 24. Leg III, anterior view. 25. Femur III, prolateral view. 26. Tarsal process, anterior view. 27. Tarsal process, posterior view. 28. Leg III, posterior view.



FIGS. 29-36. *Cryptocellus whitticki*, male. 29. Median plate of tergite 11, dorsal view. 30. Cucullus, anterior view. 31. Trochanters III and IV, ventral view. 32. Leg III, anterior view. 33. Femur III, prolateral view. 34. Tarsal process, anterior view. 35. Tarsal process, posterior view. 36. Leg III, posterior view.

Type. Male holotype from New River district, elevation 750 feet, Rupununi, Guyana (January-March 1938; C. A. Hudson), deposited in BMNH.

Etymology. The specific name is a patronym in honor of R. J. Whittick, who first reported on the holotype.

Diagnosis. Females of *C. whitticki* are unknown; males may be distinguished from those of *C. simonis* and *C. becki* by the shorter and more rounded apophyses on trochanters III and IV (fig. 31), the smaller number of tubercles on the cucullus and median plate of tergite 11 (figs. 29, 30), and the absence of prolateral tubercles on femur III (fig. 33).

Female. Unknown.

Male. Total length 5.40. Carapace 2.19 long, 1.91 wide at middle of leg III, where widest, dark red around margins, lighter medially, with small translucent pale areas at margins between legs I and II; surface almost devoid of tubercles, with short white setae. Cucullus 0.76 long, 1.19 wide, dark red proximally, grading to yellow distally;

distal half with few scattered tubercles, margins with long white setae; lateral lobes protuberant, distal margin slightly invaginated between lobes; proximal margin followed by deep depression (fig. 30). Left chelicera: movable finger laterally thick, widened transversely, armed with 10 teeth of which two most proximal are reduced and two most distal are largest; fixed finger armed with four teeth of which most distal is much the longest and two most distal are bifid. Sternal region with coxae I not meeting tritosternum; coxae II meeting along their entire length, their suture line only slightly longer than that of coxae III; coxae IV meeting anteriorly. Abdomen 3.49 long, 2.45 wide near middle of tergite 12, where widest; coloration lighter than carapace, tergites with few tubercles (fig. 29); scattered long thin white setae; articular membranes light yellow; median plates of tergites 11-13 with paired lateral depressions and greatly elevated median areas, corresponding sternites with similar depressions, with only a few scattered tubercles poste-

riorly; median plates of all tergites wider than long. Pygidium with narrowed dorsal margin of basal segment but without distinct notch. Pedipalp coxae light red, other segments orange, without tubercles; coxae with pair of short thick white setae along inner margin. Leg formula 2341. Legs light red proximally, lighter distally, sparsely coated with long white setae; distal segments with few scattered tubercles except under metatarsus I, where numerous.

	I	II	III	IV	Palp
Coxa	0.83	1.19	1.06	0.86	0.36
Trochanter I	0.76	0.83	0.74	0.67	0.50
Trochanter II	—	—	0.72	0.61	0.47
Femur	1.44	2.02	1.62	1.69	0.86
Patella	0.94	1.12	0.86	0.86	—
Tibia	0.97	1.58	0.94	1.10	1.30
Metatarsus	1.18	1.69	1.19	1.12	—
Tarsus	<u>0.47</u>	<u>1.63</u>	<u>1.33</u>	<u>1.08</u>	<u>0.18</u>
Total	6.59	10.06	8.46	6.87	3.67

Legs with sexual modifications as in *C. simonis* except femur II prolateroventral knob absent and apophyses of trochanters shorter, rounded (fig. 33). Second legs not noticeably widened; femur I three times, femur II four times as long as wide. Tarsal claws thin, evenly curved. Copulatory apparatus as in figures 32, 34-36.

Material Examined. Only the holotype; the BMNH houses a tritonymph male taken by the same collector in Guyana (no specific locality) in June 1938, that may well belong to this species.

Distribution. Known only from Guyana.

Cryptocellus becki, new species

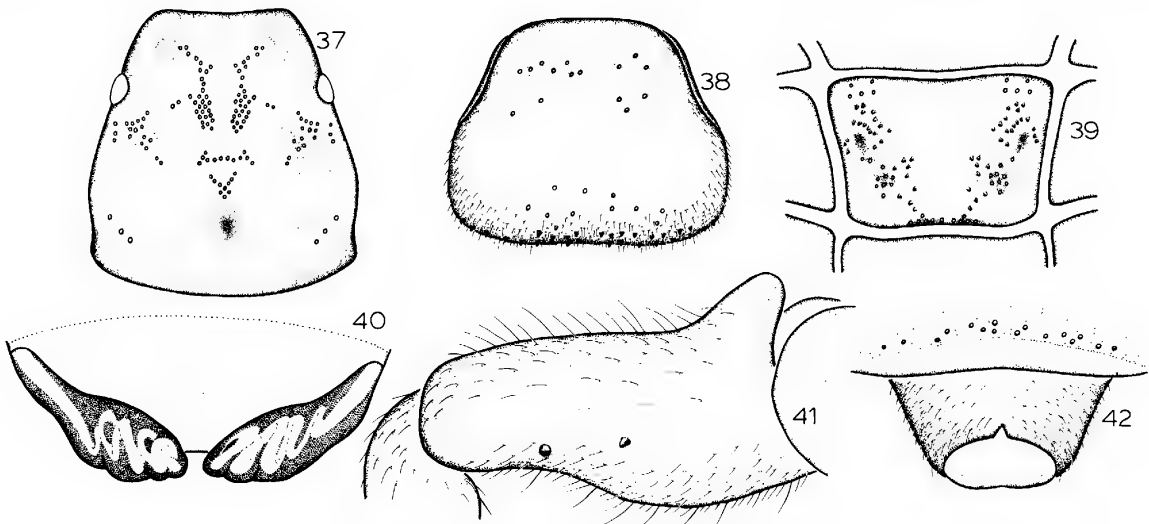
Figures 37-50

Cryptocellus foedus (misidentification): Beck and Schubart, 1968, p. 75 (in part; specimens from Amazonas only).

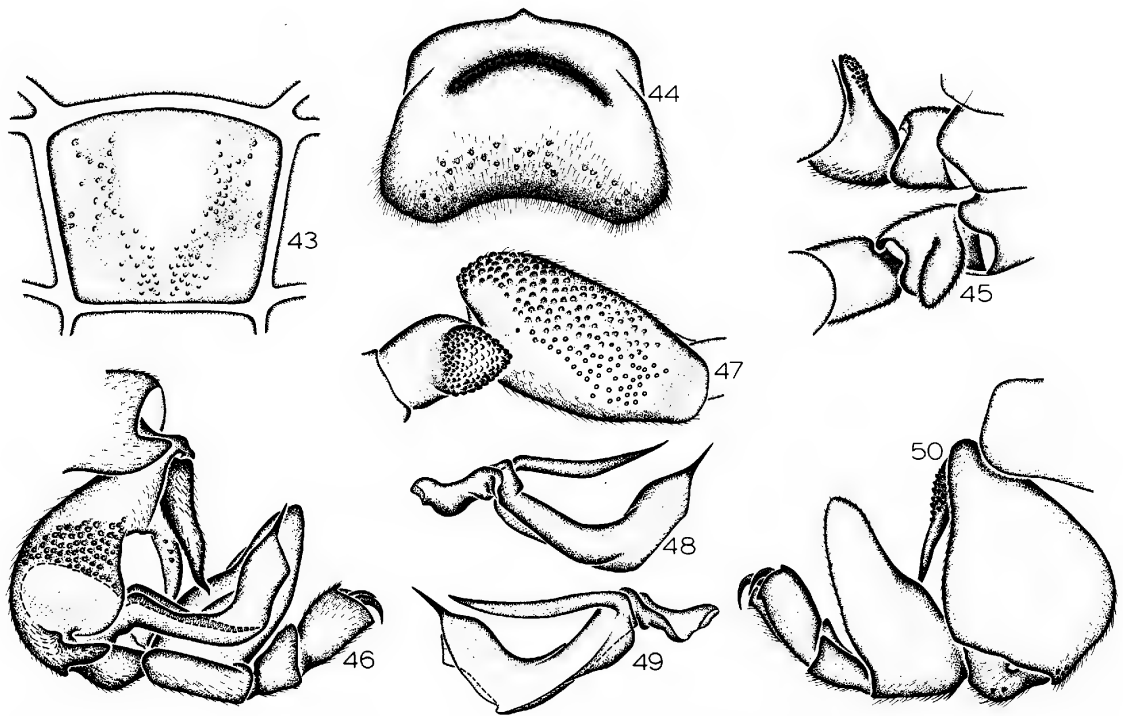
Types. Male holotype and female paratype from Reserva Ducke, near Manaus, Amazonas, Brazil (1966; L. Beck), deposited in NMS.

Etymology. The specific name is a patronym in honor of the collector of the type specimens.

Diagnosis. Females of *C. becki* may be distinguished from those of *C. foedus* and *C. simonis* by the small number of tubercles on the carapace, cucullus, and median plate of tergite 11 (figs. 37-39), the dorsally and ventrally expanded femur I (fig. 41), and the distinctly notched pygidium (fig. 42). Males of *C. becki* may be distinguished from those of *C. simonis* by the smaller number of tubercles on the cucullus and median plate of tergite 11 (figs. 43, 44), the larger number of prolateral tubercles on femur



FIGS. 37-42. *Cryptocellus becki*, female. 37. Carapace, dorsal view. 38. Cucullus, anterior view. 39. Median plate of tergite 11, dorsal view. 40. Spermathecae, posterior view. 41. Femur I, prolateral view. 42. Pygidium, dorsal view.



FIGS. 43-50. *Cryptocellus becki*, male. 43. Median plate of tergite 11, dorsal view. 44. Cucullus, anterior view. 45. Trochanters III and IV, ventral view. 46. Leg III, anterior view. 47. Femur III, prolateral view. 48. Tarsal process, anterior view. 49. Tarsal process, posterior view. 50. Leg III, posterior view.

III (fig. 47), and the presence of a distinct widening below the tip of the tarsal process (figs. 46, 48), and from those of *C. whitticki* by the much longer apophyses on trochanters III and IV (fig. 45).

Female. Total length 5.00. Carapace 1.84 long, 1.69 wide between legs II and III, where widest, dark red along margins, lighter medially, with round white translucent area at margins behind leg I; surface with few scattered tubercles (fig. 37). Cucullus 0.83 long, 1.14 wide, dark red, with long setae and few tubercles; lateral lobes protuberant (fig. 38). Chelicerae missing but as indicated by Beck and Schubart (1968) movable finger slightly widened transversely, armed with seven teeth slightly increasing in length distally; fixed finger armed with four teeth of which most distal is much the largest and most proximal is reduced to a low lobe. Sternal region with coxae I not meeting tritosternum; coxae II meeting along their

posterior two-thirds, their suture line slightly longer than that of coxae III; coxae IV meeting anteriorly. Abdomen 3.56 long, 2.63 wide behind middle of tergite 12, where widest, coloration as in carapace except for beige articular membranes, with scattered tubercles sparse anteriorly (fig. 39), becoming quite dense posteriorly and on U-shaped area covering all of sternite 13 and lateral areas of sternite 12; median plates of tergites 11-13 and corresponding sternites with paired lateral depressions; median plates of all tergites wider than long. Pygidium with distinct notch in posterior dorsal margin of basal segment (fig. 42). Palpi missing but indicated by Beck and Schubart (1968) as bearing a few tubercles on trochanters only. Leg formula 2431. Legs dark red proximally, lighter distally, with sparse short white setae and relatively few evenly scattered tubercles; femur I greatly expanded dorsally and ventrally (fig. 41).

	I	II	III	IV	Palp
Coxa	0.50	0.96	0.83	0.81	0.47
Trochanter I	0.46	0.81	0.58	0.73	—
Trochanter II	—	—	0.54	0.61	—
Femur	1.12	1.82	1.15	1.30	—
Patella	0.61	1.01	0.68	0.73	—
Tibia	0.97	1.26	1.02	1.08	—
Metatarsus	1.03	1.73	0.92	1.01	—
Tarsus	0.49	1.58	0.88	0.99	—
Total	5.18	9.17	6.60	7.26	—

Second legs not greatly widened; femur I about two and one-half, femur II four times as long as wide. Tarsal claws thin, evenly curved. Spermathecae wide, short (fig. 40).

Male. Total length 5.08. Carapace 2.05 long, 1.87 wide at back of leg II, where widest, dark red around margins, lighter medially, with small translucent yellow areas at margins between legs I and II, with scattered tubercles concentrated at sides and short white setae. Cucullus 0.79 long, 1.15 wide, dark red proximally, grading to orange distally, with scattered tubercles concentrated distally; distal margin with long white setae, slightly invaginated and depressed between protuberant lateral lobes; proximal margin followed by deep depression (fig. 44). Left chelicera: movable finger tremendously widened, sickle-shaped, armed with eight teeth of which two most proximal are greatly reduced and others increase in length distally; fixed finger armed with five teeth of which most distal is much the largest. Sternal region with coxae I not meeting tritosternum; coxae II meeting along their entire length, their suture line about one-third longer than that of coxae III; coxae IV meeting anteriorly. Abdomen 3.25 long, 2.29 wide near middle of tergite 12, where widest; coloration as in carapace except for orange articular membranes; tergites with scattered tubercles (fig. 43) and short white setae; median plates of tergites 11-13 raised medially between paired lateral depressions, corresponding sternites with depressions and scattered posterior tubercles; median plates of all tergites wider than long. Pygidium with shallow notch in dorsal margin of basal segment. Pedipalp coxae light red, other segments orange; coxae and trochanters with few scattered tubercles. Leg formula 2341. Legs light red proximally, lighter distally, sparsely coated

with short white setae, with few scattered tubercles on anterior legs, more on posterior legs, especially on femur III (fig. 47).

	I	II	III	IV	Palp
Coxa	0.70	1.28	1.08	0.81	0.43
Trochanter I	0.86	0.92	0.50	0.65	0.54
Trochanter II	—	—	0.79	0.86	0.36
Femur	1.40	2.02	1.62	1.62	0.86
Patella	0.77	1.04	0.78	0.76	—
Tibia	0.96	1.80	0.94	0.97	1.40
Metatarsus	1.11	1.80	1.08	1.08	—
Tarsus	0.50	1.72	1.37	1.10	0.14
Total	6.30	10.58	8.16	7.85	3.73

Legs with sexual modifications as in *C. simonis* except femur II prolateroventral knob absent and apophyses on trochanters longer, more pointed (fig. 45). Second legs not noticeably widened; femur I three times, femur II five times as long as wide. Tarsal claws thin, evenly curved. Copulatory apparatus as in figures 46, 48-50.

Material Examined. Only the types.

Distribution. Known only from Amazonas, Brazil.

Cryptocellus peckorum, new species

Figures 54-57

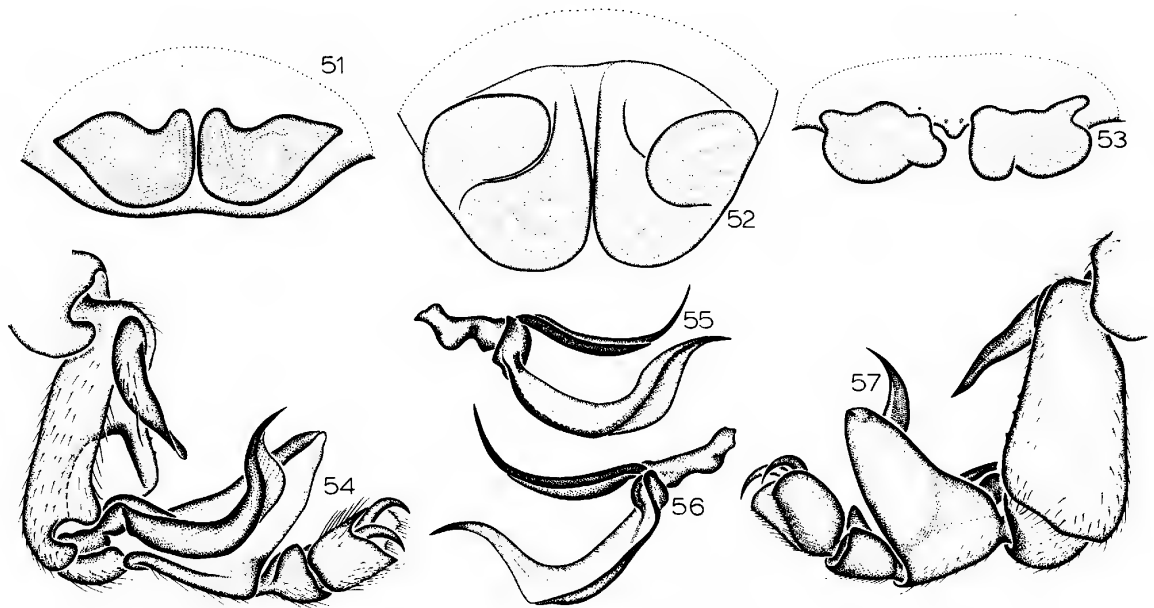
Type. Male holotype from Berlese sample of forest litter at Leticia, Amazonas, Colombia (February 24-28, 1974; S. and J. Peck), deposited in MCZ.

Etymology. The specific name is a patronym in honor of the collectors of the type.

Diagnosis. Females of *C. peckorum* are unknown; the moderately expanded metatarsus III (fig. 54) is diagnostic of the males, which may also be distinguished from those of *C. simonis*, *C. becki*, and *C. whitticki* by the lack of apophyses on trochanters III and IV, from those of *C. magnus* and *C. glenoides* by the thin, curved accessory piece of the male tarsal process (fig. 55), and from those of *C. lampeli* by the carapace being almost completely covered with tubercles (as in fig. 9).

Female. Unknown.

Male. Total length 3.58. Carapace 1.31 long, 1.44 wide near middle of leg III, where widest, dark red, with small white translucent areas at



FIGS. 51-57. 51-53. Spermathecae, posterior views. 51. *Cryptocellus pseudocellatus*. 52. *C. albosquamatus*. 53. *C. lampeli*. 54-57. *C. peckorum*, male. 54. Leg III, anterior view. 55. Tarsal process, anterior view. 56. Tarsal process, posterior view. 57. Leg III, posterior view.

margins between legs I and II; surface almost completely covered with tubercles, with few setae. Cucullus 0.56 long, 0.81 wide, light red, with scattered tubercles near distal margin and short setae; lateral lobes only slightly protuberant; depression below proximal margin lacking. Left chelicera: movable finger laterally thick but not transversely widened, armed with seven teeth increasing in length distally; fixed finger armed with four teeth of which most distal is much the largest. Sternal region with coxae I not meeting tritosternum; coxae II meeting along their posterior two-thirds, their suture line almost as long as that of coxae III; coxae IV meeting anteriorly. Abdomen 2.23 long, 1.69 wide near middle of tergite 12, where widest; coloration as in carapace except for white articular membranes; tergites almost completely covered with tubercles, with few setae; median plates of tergites 11-13 with lateral depressions and median elevations, corresponding sternites with numerous tubercles and setae; median plates of all tergites wider than long. Pygidium with notch in dorsal margin of basal segment. Pedipalp coxae light red, other segments orange; coxae and trochanters with tu-

bercles. Leg formula 2341. Legs dark red proximally, grading to orange distally, with numerous scattered tubercles and long white setae.

	I	II	III	IV	Palp
Coxa	0.47	0.83	0.61	0.54	0.34
Trochanter I	0.32	0.54	0.47	0.50	0.36
Trochanter II	—	—	0.49	0.43	0.22
Femur	0.79	1.33	0.95	1.08	0.61
Patella	0.50	0.83	0.59	0.58	—
Tibia	0.73	1.03	0.71	0.74	0.92
Metatarsus	0.79	1.15	0.74	0.72	—
Tarsus	0.29	1.19	0.90	0.63	0.13
Total	3.89	6.90	5.46	5.22	2.58

Legs without sexual modifications. Second legs noticeably widened; femur I two and one-half, femur II three and one-half times as long as wide. Tarsal claws thin, evenly curved. Copulatory apparatus as in figures 54-57.

Material Examined. One protonymph, one deutonymph, one tritonymph female, and two adult males taken with the holotype (MCZ) and one protonymph taken in a Berlese sample of tropical forest litter 18 km. north of the type

locality (same dates, S. Peck; FMNH) probably belonging to this species.

Distribution. Known only from Amazonas, Colombia.

Cryptocellus pseudocellatus Roewer

Figure 51

Cryptocellus pseudocellatus Roewer, 1952, p. 39, figs. 4, 4a-4c (female holotype from Santa Rosa, Río Chinchipe, Cajamarca, Peru, in NMS, examined). Beck and Schubart, 1968, p. 77, figs. 5, 12, 17, 22.

Diagnosis. Males of *C. pseudocellatus* are unknown; females may be distinguished from those of *C. magnus* (the only other species with deep cuticular pits on the carapace) by the invaginated dorsal margin of the spermathecae (fig. 51).

Female. Total length 5.87. Carapace 1.91 long, 1.90 wide between legs II and III, where widest, dark red posteriorly, lighter anteriorly, with translucent yellow areas at margins between legs I and II; surface with short white setae, longer at margins, with tubercles in transverse row along posterior margin and deep pits arranged as follows: median longitudinal row of about six commencing at level of translucent areas, becoming deeper posteriorly but not reaching posterior margin; about 10 procurved rows arranged concentrically, occupying increasing

portion of carapace width posteriorly, rows each with from one to seven pits; four or five in longitudinal row along anterior lateral margins. Cucullus 0.97 long, 1.47 wide, light red, with long white setae and four transverse rows of about 10 tubercles each distally, without pits, with moderately protuberant lateral lobes. Left chelicera: movable finger laterally thin, slightly widened transversely, armed with seven teeth of which most proximal is greatly enlarged; fixed finger armed with six teeth of which most proximal is shortest and most distal longest. Sternal region with coxae I meeting tritosternum with point rather than median edge; coxae II meeting along their posterior five-sixths, their suture line more than twice as long as that of coxae III; coxae IV meeting anteriorly. Abdomen 3.85 long, 2.95 wide near middle of tergite 12, where widest, coloration and setation as in carapace except for brownish orange articular membranes, with tubercles along anterior margins of tergite and sternite 10 and deep pits arranged as follows: tergite 10, median plate none, lateral plates one at middle of inner margin; tergite 11, median plate 10 along anterior margin, 11 along posterior margin, median longitudinal row of three, lateral plates five along inner margin, two along posterior margin; tergite 12, median plate eight along anterior margin, 10 along posterior margin, median longitudinal row of three, lateral plates five along inner margin, two along posterior margin; tergite 13, median plate seven along anterior margin, numerous scattered over posterior half, lateral plate about six along inner margin; median plates of tergites 11-13 with paired lateral depressions, corresponding sternites with similar depressions and lateral longitudinal rows of four, three, and two deep pits, respectively; median plate of all tergites wider than long. Pygidium without notch in posterior dorsal margin of basal segment. Pedipalp very light red; coxae and trochanters with scattered tubercles; coxae each with two thick white setae posteriorly along inner margin; tibia with two rows of ventral tubercles at distal end. Leg formula 2431. Leg light red, lightest distally, coated with long white setae; segments with relatively few scattered tubercles except under metatarsi II, where numerous.

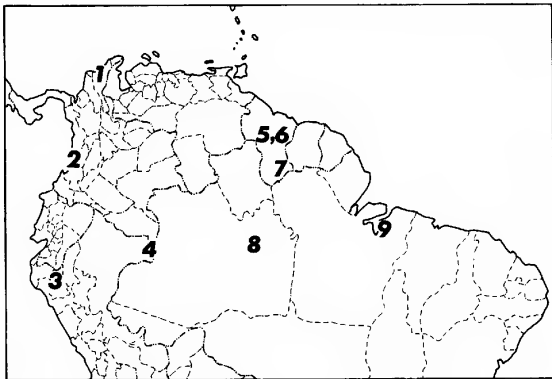


FIG. 58. Map of northern South America, showing known localities of *Cryptocellus magnus* (1), *C. glenoides* (2), *C. pseudocellatus* (3), *C. peckorum* (4), *C. lampeli* (5), *C. albosquamatus* (6), *C. whitticki* (7), *C. becki* (8), and *C. simonis* (9).

	I	II	III	IV	Palp
Coxa	0.83	1.11	0.95	0.88	0.40
Trochanter I	0.49	0.72	0.50	0.50	0.36
Trochanter II	—	—	0.59	0.58	0.40
Femur	1.15	1.98	1.24	1.44	0.99
Patella	0.71	1.00	0.78	0.72	—
Tibia	0.86	1.48	0.95	1.04	1.58
Metatarsus	1.01	1.55	0.99	1.08	—
Tarsus	0.50	1.69	0.94	1.01	0.14
Total	5.55	9.53	6.94	7.25	3.87

Second legs not greatly widened; femur I slightly more than three times, femur II almost four times as long as wide. Tarsal claws thin, evenly curved. Spermathecae with invaginated dorsal margin (fig. 51).

Male. Unknown.

Material Examined. Only the holotype.

Distribution. Known only from Cajamarca, Peru.

SUPPLEMENT

After the manuscript of the present paper had been set in type, a paper by Dumitrescu and Juvara-Bals (1977) appeared in which a new genus and species of ricinuleid (*Heteroricinoides bordoni*) are described on the basis of one male and three female specimens collected in the Cueva de Cerro Verde, Río Guasare, Maracaibo, Estado Zulia, Venezuela. Those authors present an extremely detailed description, and we agree with their conclusions that the Venezuelan specimens represent a new species most closely related to *Cryptocellus magnus* Ewing (and *C. manni* Ewing, our synonymy of which with *C. magnus* they were unaware). However, it is our judgment that both the lack of sufficient comparative material (their having seen specimens of only one other species of *Cryptocellus*, *C. cubanicus* Dumitrescu and Juvara-Bals, 1973) and the uncritical acceptance of erroneous statements and poor descriptions in the literature (such as Ewing's mistaken indication that *C. magnus* has no tubercles on the carapace, Roewer's inadequate description of the cuticular pits of *C. pseudocellatus*, and Ewing's failure to note the deutonymph rather than tritonymph tarsomere formula of *C. manni*) have led Dumitrescu and Juvara-Bals to an erroneous conclusion in their erection of a new genus for *H. bordoni*.

Those authors quite properly regard genitalic characters as being of great significance, and justify the establishment of *Heteroricinoides* primarily on features of the female spermathecae. They note that the spermathecae of *H. bordoni* differ from those of *C. cubanicus* and the three Mexican species illustrated by Brignoli (1974) in being globose and undivided rather than tubular and bifurcated. As we have shown above and elsewhere (Platnick and Shadab, 1976), however, all known South American females, including those of the type species of *Cryptocellus*, resemble *H. bordoni* in having globose and undivided spermathecae. Thus, even if one accepts the structure of the spermathecae as a valid generic character, *H. bordoni* would belong to the group including the type species of *Cryptocellus* and it is the other group, including *C. cubanicus* and the Mexican species, that would require a new generic name. We therefore consider *Heteroricinoides* to be a synonym of *Cryptocellus* (NEW SYNONYMY).

Cryptocellus bordoni (Dumitrescu and Juvara-Bals) will key out to couplet three in the key given above, but may be distinguished from both *C. magnus* and *C. pseudocellatus* by the presence of a deep ventral notch in the posterior border of the basal pygidial segment and by details of the genitalia (Dumitrescu and Juvara-Bals, 1977, figs. 1D, 6, and 9). The ventral pygidial notch was claimed as unique to *C. bordoni* by its describers; it is most strongly developed in that species but does occur as a shallower invagination in other Neotropical species (figs. 14, 20). Other characters of *C. bordoni* cited by Dumitrescu and Juvara-Bals are also shared with various species of *Cryptocellus*: the enlarged cylindrical processes of the male copulatory apparatus with both *C. magnus* and *C. glenoides*, and the elongated tubercles on the distal half of the palpal tibia and the relative lengths of the tarsomeres of leg II with *C. magnus*.

The presence of deep cuticular pits in *C. bordoni*, *C. magnus*, and *C. pseudocellatus* indicates that these three species probably form a monophyletic group, and the presence of elevated tubercles on the distal half of the palpal tibia in *C. magnus* and *C. bordoni* indicates that they are probably sister species (which is consistent with their close geographical proximity). Thus, one could consider the latter two species,

all three species, or (if the arguments presented in the Introduction about the relationships of *C. glenoides* are correct) these three species plus *C. glenoides* as the only members of a valid genus. However, such a decision might (and probably would) result in a paraphyletic group containing the remaining species of *Cryptocellus*, since it has not yet been demonstrated that those four species singly or together constitute the sister group of all other *Cryptocellus*. Thus, until a phylogeny of the species groups of *Cryptocellus* can be established on the basis of shared derived characters, we regard attempts to split the genus as premature. It should also be pointed out that if Dumitrescu and Juvara-Bals's indication that the male copulatory apparatus of *Ricinoides feae* lacks the circular loop of the "filament chitineux" of the male tarsal process proves to apply also to the other known species of *Ricinoides*, the presence of the loop may prove to be (along with the tarsal invaginations mentioned in the Introduction) a synapomorphy for *Cryptocellus*.

LITERATURE CITED

- Bates, Henry Walter
1892. The naturalist on the river Amazons, reprint of the unabridged edition with a memoir of the author by Edward Clodd. London, 395 pp.
- Beck, Ludwig, and Herbert Schubart
1968. Revision der Gattung *Cryptocellus* Westwood 1874 (Arachnida: Ricinulei). *Senckenbergiana Biol.*, vol. 49, pp. 67-78, figs. 1-22.
- Brignoli, Paolo M.
1974. On some Ricinulei of Mexico with notes of the morphology of the female genital apparatus (Arachnida, Ricinulei). *Accad. Naz. Lincei Quaderno*, no. 171, pp. 153-174, figs. 1-3.
- Cooke, John A. L., and Mohammad U. Shadab
1973. New and little known ricinuleids of the genus *Cryptocellus* (Arachnida, Ricinulei). *Amer. Mus. Novitates*, no. 2530, pp. 1-25, figs. 1-39.
- Dumitrescu, Margareta, and Ilinca Juvara-Bals
1973. *Cryptocellus cubanicus* n.sp. (Arachnida-Ricinulei). Premier représentant de la fam. Ricinuleidae de Cuba. In *Résultats des Expéditions Biospéologiques Cubana-Roumaines à Cuba*. Bucharest, pp. 259-278, figs. 1-9.
1977. Position systématique de *Heteroricinoides bordoni* n.g. n.sp. dans la famille Ricinuleidae (Arachnida). *Bol. Soc. Venezolana Espeleologia*, vol. 7, pp. 147-180, figs. 1-13.
- Hansen, H. J., and W. Sørensen
1904. On two orders of Arachnida. Cambridge, 182 pp., 9 pls.
- Kraus, Otto
1976. Zur phylogenetischen Stellung und Evolution der Chelicerata. *Ent. Germanica*, vol. 3, pp. 1-12, figs. 1-8.
- Legg, Gerald
1976. The external morphology of a new species of ricinuleid (Arachnida) from Sierra Leone. *Zool. Jour. Linnean Soc.*, vol. 59, pp. 1-58, figs. 1-43, pls. 1-6.
- Pittard, Kay, and Robert W. Mitchell
1972. Comparative morphology of the life stages of *Cryptocellus pelaezi* (Arachnida, Ricinulei). *Graduate Studies Texas Tech Univ.*, no. 1, pp. 1-77, figs. 1-130.
- Platnick, Norman I., and Mohammad U. Shadab
1976. On Colombian *Cryptocellus* (Arachnida, Ricinulei). *Amer. Mus. Novitates*, no. 2605, pp. 1-8, figs. 1-17.
- Roewer, Carl F.
1952. Neotropische Arachnida Arthrogasta, zumeist aus Peru. *Senckenbergiana*, vol. 33, pp. 37-58, figs. 1-26.
- Suzuki, Seisho
1976. Report on a collection of opilionids from Pasoh Forest Reserve, West Malaysia. *Nature and Life in Southeast Asia*, vol. 4, pp. 9-38, figs. 1-13.
- Westwood, J. O.
1874. *Thesaurus Entomologicus Oxoniensis*. Oxford, 205 pp., 40 pls.
- Whittick, R. J.
1938. On a second specimen of *Cryptocellus simonis* Hans. & Sør. [Arachnida]. *Ann. Mag. Nat. Hist.*, ser. 11, vol. 2, pp. 479-480, 1 fig.

