

THREE NEW SPECIES OF THE SPIDER GENUS *PHRUROLITHUS* FROM CHINA (ARANEAE, CORINNIDAE)

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ABSTRACT. Three new species of the genus *Phrurolithus* are described from the Gaoligong Mountain Region of Yunnan Province, China: *Phrurolithus bifidus*, *P. qiqiensis* and *P. revolutus*.

Keywords: Taxonomy, Asia, Yunnan, Gaoligong Mountains

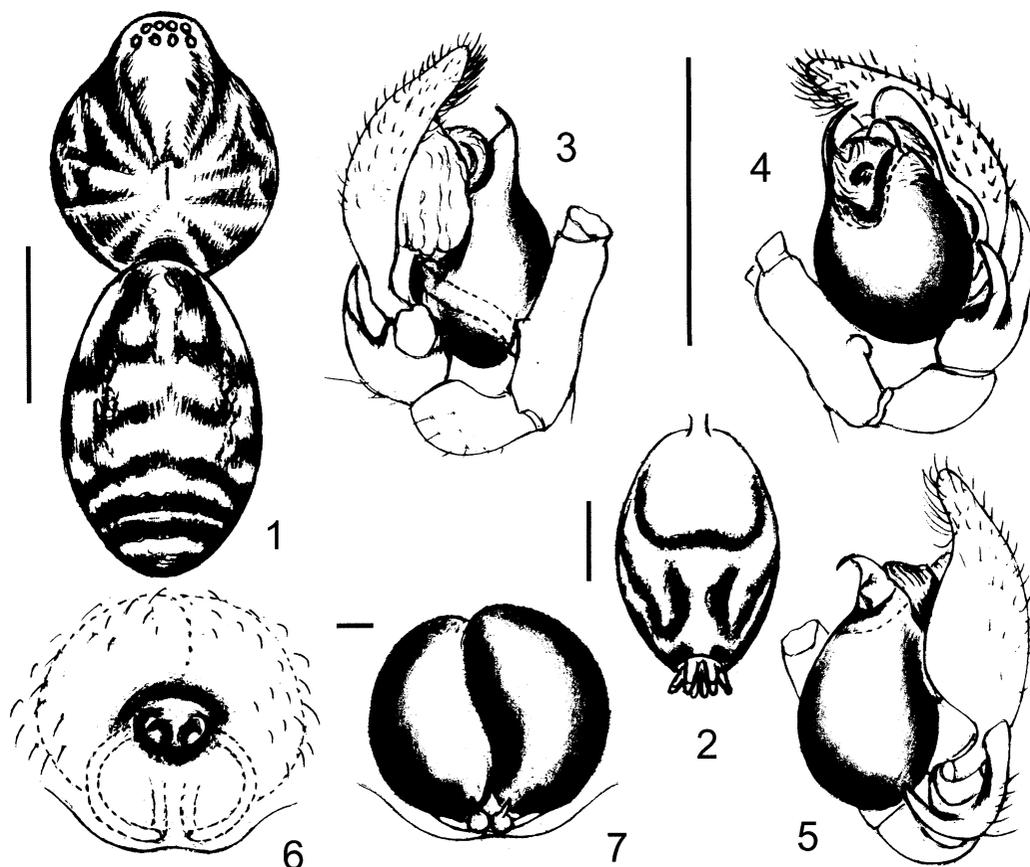
The genus *Phrurolithus* C.L. Koch 1839, with some 70 described species, is currently the largest phrurolithine genus in the northern hemisphere (Platnick 2002). This richness, however, is deceptive as most of the species are probably not closely related to the type species, *P. festivus* (C.L. Koch 1835). For instance, the New World species currently in *Phrurolithus*, and representing over half of the taxa, are most probably all misplaced; some have already been formally reassigned to *Scotinella* Banks (Dondale & Redner 1982) and the others will no doubt follow. Additionally, some of the European species have recently been removed to *Liophrurillus* Wunderlich 1992 and *Phrurolinillus* Wunderlich 1995 (Wunderlich 1992, 1995) and some Asian ones to *Otacilia* Thorell 1897 (Deeleman-Reinhold 2001) and what remains is probably still far from being monophyletic. For example, the 14 species currently recorded from China exhibit a wide spectrum of genitalic forms (Song, Zhu & Chen 1999). Males range in having the palpal tibial apophysis represented by a single large process, similar to that in *P. festivus* (see figs. 240I–J in Song, Zhu & Chen 1999), to being polyfurcate (*P. liaoningensis* Song, Zhu & Chen 1999; see figs. 240M–N, in Song, Zhu & Chen 1999), to having one strongly reduced process (*P. splendidus* Song & Zheng 1992; see figs. 241C–D, in Song, Zhu & Chen 1999), to completely lacking a process (*P. daoxianensis* Yin, Peng,

Gong & Kim. 1997; see figs. 240G–H, Song, Zhu & Chen 1999). Similarly, and as would be expected, the female genitalia are equally diverse, with extreme variation in spermathecal size, the form of accessory bursae, and length and coiling of copulatory ducts. Given this morphological diversity, it is with some hesitation that we are placing the three new species in *Phrurolithus*. Whereas the three species do all have a pair of large spermathecae, as in *P. festivus*, the tibial apophysis of *P. bifidus*, the only male here described, is bifurcate and deviates significantly from that of the type species. Although this degree of intrageneric genitalic variation was accepted for *Otacilia* by Deeleman-Reinhold (2001), it remains to be seen if future studies will reveal a similar trend in *Phrurolithus*.

The new species here described were collected in the Gaoligong Mountains by the first and second Sino-American expeditions. The type specimens are deposited in the College of Life Science at the Hunan Normal University and some paratypes at the California Academy of Sciences. This is Scientific Contribution no. 27 from the California Academy of Sciences Center for Biodiversity Research and Information and contribution no. 20 from the China Natural History Project.

METHODS

Specimens were killed in 75% ethanol and after 24 hours transferred to 85% ethanol for



Figures 1–7.—*Phrurolithus bifidus*, new species. 1–5. Male. 1. Body, dorsal view. 2. Abdomen, ventral view. 3–5. Palpus. 3. Prolateral view. 4. Retrolateral, subventral view. 5. Retrolateral, subdorsal view. 6–7. Female. 6. Epigynum. 7. Vulva. Scale lines: 1–5 = 1.00mm; 6, 7 = 0.10mm.

preservation. Epigyna were cleared in lactic acid for examination and stored in microvials with the specimen. Examination was with an Olympus Tokyo BH-2 stereo dissecting microscope. Leg and palpus lengths are given as: total length (femur, patella + tibia, metatarsus, tarsus). All measurements are in mm.

Abbreviations: AER = anterior eye row; AL = abdomen length, ALE = anterior lateral eye, AME = anterior median eye, AME—ALE = distance between AME and ALE, AME—AME = distance between AMEs, AW = abdomen width, CH = clypeus height, CL = carapace length, CW = carapace width, MOQ = median ocular quadrangle, MOQA = MOQ anterior width, MOQL = length of MOQ, MOQP = MOQ posterior width, PER = posterior eye row, PLE = posterior lateral eye, PME = posterior median eye, PME—PLE = distance between PME and PLE,

PME—PME = distance between PMEs, RTA = retrolateral tibial apophysis, TL = total length.

Phrurolithus bifidus new species

Figs. 1–7

Type material.—Male holotype from sifted leaf litter in native forest on pass over Gaoiligongshan, Nankang, 36 air km SE Tengchong (24°50'N, 98°47'E, 2100m), Baoshan Prefecture, Yunnan Province, China, 4–7 November 1998, C. Griswold and D. Kavanaugh (deposited in Hunan Normal University, type number 98-NK-48). *Paratypes*: China: *Yunnan Province*: 1 male and 1 female collected with the holotype (female deposited at the Hunan Normal University, male at the California Academy of Sciences).

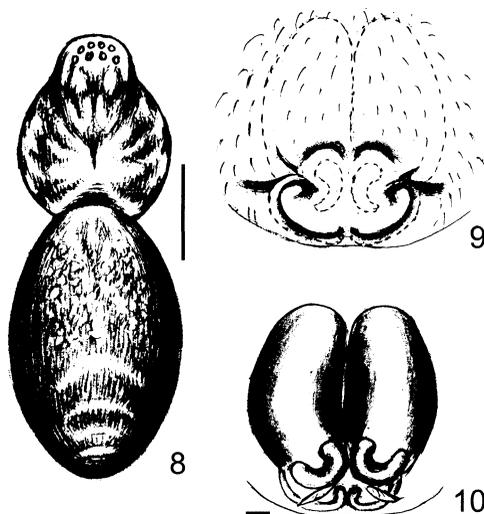
Etymology.—The specific name refers to the bifid tibial apophysis of the male palpus.

Diagnosis.—The male of this species differs from most other east Asian *Phrurolithus*, except *P. vulpes* Kamura 2001 and *P. pennatus* Yaginuma 1967, in having a bifid tibial apophysis on the palpus. From *P. vulpes* (see Kamura 2001, figs. 1–5) and *P. pennatus* (see Paik 1991, figs. 51–54 and Danilov 1999, fig. 3E–F) it differs in having the retrolateral prong of the RTA almost as long as the dorsal prong (as opposed to less than one third the length of the dorsal prong in the other species), and the dorsal prong apically spatulate (with subapical notch in *P. vulpes* and apically attenuated in *P. pennatus*). The female differs from most Asian *Phrurolithus* in having very large spermathecae and appears most similar to *P. hamdeokensis* Seo 1988 (see Paik 1991, figs. 29–38) as both species have an epigynum with a single central atrium bearing the copulatory openings and spermathecae which are asymmetrical. It differs from *P. hamdeokensis* in having a larger epigynal atrium and larger spermathecae that overlap along their anterior margins.

Description.—Male: Carapace pear-shaped, brown with pale gray pattern. AER and PER straight in dorsal view. Cervical groove distinct, head region slightly elevated. Fovea short, longitudinal, anteriorly with bilobed pale mark, laterally with radiating markings along radial grooves. Sternum yellow brown, margins darker with gray radial striae inwards. Chelicera weak, grayish brown, with 1 retromarginal and 3 promarginal teeth. Endites and labium grayish brown. Palpus and leg segments yellow-brown, distal end of leg femur having grayish black annulus, tibia and metatarsus with one dark stria. Anterior leg spines: 4 on prolateral surface of femur, 7 pairs ventrally on tibiae, and 4 pairs ventrally on metatarsi. Abdomen with dorsum grayish black patterned with yellowish gray, anteriorly with pale cardiac mark and lateral spots, posteriorly with five chevrons (Fig. 1); venter yellow gray with dark markings (Fig. 2).

Palpus with large, spherical genital bulb bearing short, curved embolus apically; tibial apophysis large, deeply bifid, with spatulate dorsal and pointed retrolateral prong; femur with small ventral knob about 2/3 the distance from its basal margin (Figs. 3–5).

Female: Coloration and markings as in male, except carapace reddish brown; eye arrangement as male. Epigynum with small sub-



Figures 8–10.—*Phrurolithus qiqiensis*, new species, female. 8. Body, dorsal view. 9. Epigynum. 10. Vulva. Scale line: 8 = 1.00mm; 9, 10 = 0.10mm.

circular atrium (Fig. 6); vulva with two large spermathecae from which thin copulatory ducts extend along semicircular arc to atrium. (Figs. 6–7)

Measurements: Male (holotype): TL 3.90, CL 1.70, CW 1.50; AL 2.10, AW 1.30. Eye sizes and interdistances: AME 0.10, ALE 0.10, PME 0.09, PLE 0.13, AME-AME 0.05, AME-ALE 0.025, PME-PME 0.40, PME-PLE 0.03; MOQL 0.25, MOQA 0.24, MOQP 0.27; CH 0.14, longer than AME diameter. Appendage lengths: palpus: 2.10 (0.50, 0.60, 0, 1.00); leg I: 5.94 (1.68, 2.50, 1.06, 0.70); leg II: 5.50 (1.50, 2.00, 1.30, 0.70); leg III: 4.30 (1.40, 1.50, 0.90, 0.50); leg IV: 6.62 (1.92, 2.00, 1.80, 0.90); leg formula: IV, I, II, III.

Female: TL 4.10, CL 1.60, CW 1.40; AL 2.40, AW 1.40. Appendage lengths: palpus: 1.42 (0.32, 0.60, 0, 0.50); leg I: 4.96 (1.40, 1.71, 1.25, 0.60); leg II: 4.85 (1.35, 1.80, 1.00, 0.70); leg III: 3.70 (1.10, 1.10, 1.00, 0.50); leg IV: 6.10 (1.65, 1.90, 1.70, 0.85); leg formula: IV, I, II, III.

Distribution.—Yunnan Province, China.

Phrurolithus qiqiensis new species
Figs. 8–10

Type material.—Female holotype collected in Qiqi He, 9.9 air km W of Gongshan (27°43' N, 98°34' E, 2000m), Mt. Gaoligong, Nujiang State Nature Reserve, Nujiang Pre-

fecture, Yunnan Province, China, 9–14 July 2000, H.M. Yan, D. Kavanaugh, C.E. Griswold, H.-B. Liang, D. Ubick, and D.-Z. Dong (deposited in Hunan Normal University, type number 00-QF-44). *Paratypes*: China: *Yunnan Province*: 3 females collected with holotype; Baoshan Prefecture: 1 female (No. 98-OP-15), pass over Gaoligongshan, Luoshuidong, 28 air km E TengChong, 24°57'N, 98°45'E, 2300m, flight trap in clearing of native forest, 26–31 October 1998, C. Griswold, D. Kavanaugh, and C.-L. Long (2 paratypes deposited at the California Academy of Sciences, the rest at Hunan Normal University).

Etymology.—The specific name is an adjective derived from the type locality.

Diagnosis.—This species is similar to *Phrurolithus taiwanicus* Hayashi & Yoshida 1993 (see Kamura 2001, figs. 14–19) in having large spermathecae with separate copulatory openings and large, curved fertilization ducts, but differs in having larger spermathecae which reach the epigastric furrow.

Description.—Female: (Fig. 8): Carapace pear-shaped, brown-black. AER slightly recurved, PER straight in dorsal view. Cervical groove distinct and deep, head region somewhat elevated. Fovea short, longitudinal, surrounded by radiating pale pattern. Sternum heart-shaped, grayish black, paler in center, margins red brown. Chelicera weak, yellow-brown with grayish black mark dorsally, teeth small, 3 promarginal and 2 retromarginal. Palpus grayish black interrupted by grayish brown. Endites and labium grayish black, distal end pale yellow, labium longer than wide. Leg grayish brown, with paired ventral spines, Leg I, tibia with 8, metatarsus with 4, Leg II, tibia with 7, metatarsus with 3. Abdomen dorsum slightly paler than carapace, pattern yellowish gray, cardiac mark not distinct; anterior half with 3 pairs markings and 3 chevrons posteriorly; venter with gray markings: 1 pair of longitudinal striae and 2 pairs of patches. Spinnerets pale brown.

Epigynum with large ovoid atrium in posterior portion; vulva with two large spermathecae and twisted copulatory ducts with thicker anterior and thinner posterior sections (Figs. 9, 10).

Male: Unknown.

Measurements: Female (holotype): TL 4.90, CL 1.80, CW 1.50; AL 3.00, AW 2.40. Eye sizes and interdistances: AME = ALE =

PME 0.09, PLE 0.10; AME–AME 0.05, AME–ALE 0.03; PME–PME 0.10, PME–PLE 0.07. MOQ L 0.29 MOQA W 0.20, MOQP W 0.30; CH 0.15, longer than AME diameter. Appendage lengths: palpus: 2.23 (0.78, 1.05, 0, 0.40); leg I: 6.46 (1.70, 2.50, 1.51, 0.75); leg II: 5.35 (1.40, 2.00, 1.20, 0.75); leg III: 4.41 (1.20, 1.51, 1.00, 0.70); leg IV: 6.60 (1.70, 2.20, 1.80, 0.90); leg formula: IV, I, II, III.

Distribution.—Yunnan Province, China.

Phrurolithus revolutus new species
Figs. 11–16

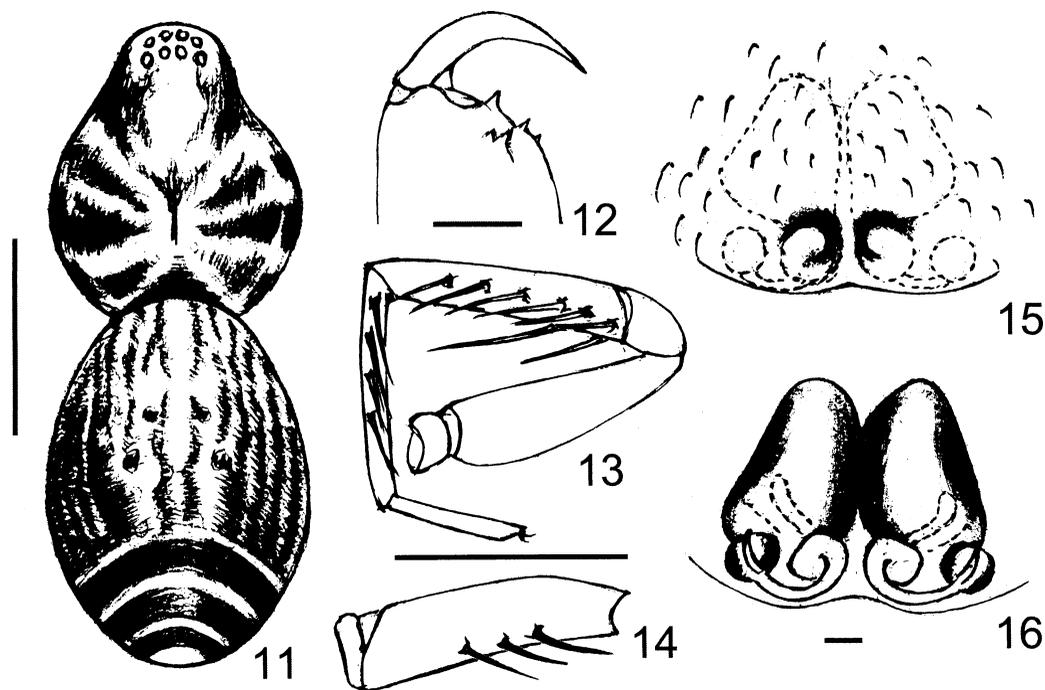
Type material.—Female holotype collected at 9 km ESE of Pianma (25°36' N, 98°24' E), Mt. Gaoligong, Yunnan Province, China, 13–18 October 1998, C. Griswold, D. Kavanaugh, and C.-L. Long (deposited in Hunan Normal University, type number 98-EP-15).

Etymology.—The specific name refers to the curved copulatory ducts.

Diagnosis.—This species is similar to *Phrurolithus vulpes* (see Kamura 2001, figs. 1–7) in having large spermathecae and paired, crescent shaped copulatory openings but differs in having: 1) larger spermathecae which reach the epigastric furrow and 2) the copulatory openings more posteriorly placed.

Description.—Female: Carapace pale black brown, patterned with black brown. AER and PER recurved in dorsal view. Cervical groove distinct, head region slightly elevated. Carapace with distinct radial grooves, interspersed with shorter lines; fovea short, longitudinal. Sternum heart-like, grayish brown, paler in center, margins red brown. Chelicera weak, yellow-brown, with grayish brown mark dorsally, with 3 promarginal and 2 retromarginal teeth (Fig. 12.). Palpi, endites, and legs yellow-brown, femur with one grayish brown band on distal end. Tibiae I, II dark in color, with 6 pairs of ventral spines; metatarsi I, II with 4 pairs of ventral spines (Fig. 13); anterior femora with 3 prolateral spines (Fig. 14).

Abdomen dorsum iridescent with grayish black and yellow and gray patterns; cardiac mark large, pale grayish black, lined with yellow-gray margins; sides with fine longitudinal lines; posterior with 2–3 transverse bands and 1 small ellipsoid, white marking; venter median grayish black, laterally with yellow gray oblique striae; spinnerets short, yellow brown.



Figures 11–16.—*Phrurolithus revolutus*, new species, female. 11. Body, dorsal view. 12. Chelicera, retrolateral view. 13. Leg I prolateral view, showing paired ventral spines. 4. Femur II, prolateral view showing spines. 15. Epigynum. 16. Vulva. Scale bars: 11, 13, 14 = 1.00mm; 12, 15, 16 = 0.10mm.

Epigynum with atrium consisting of two small round pits near posterior margin; vulva with 2 large spermathecae and spiraled copulatory ducts (Figs. 15, 16).

Male: Unknown.

Measurements: Female (holotype): TL 3.35, CL 1.45, CW 1.05; AL 1.90, AW 1.15. Eye sizes and interdistances: AME 0.07, ALE = PLE 0.08, PME 0.55, AME–AME 0.025, AME–ALE 0.028; PME–PME 0.075, PME–PLE 0.05; MOQL 0.20, MOQA 0.14, MOQP 0.18; CH 0.075, almost equal to AME diameter. Appendage lengths: palpus: 1.50 (0.60, 0.45, 0, 0.45); leg I: 5.30 (1.35, 2.00, 1.45, 0.50); leg II: 4.42 (1.12, 1.50, 1.10, 0.70); leg III: 3.72 (1.12, 1.20, 0.90, 0.50); leg IV: 5.15 (1.50, 1.60, 1.30, 0.75); leg formula: I, IV, II, III.

Distribution.—Yunnan Province, China.

ACKNOWLEDGMENTS

Thanks go to Prof. Li Heng and Dr. Long Chun-Lin for support for the 1998 and 2000 Sino-American expedition to the Gaoligong Mountains, Drs. Charles Griswold, Jan Bos-selaers, Robert Raven and Mark Harvey for

reviewing this manuscript, and Mr. Larrie Currie and the CAS library staff for providing obscure references and citations. This research work was sponsored by the California Academy of Sciences Center for Biodiversity Research and Information, the China Natural History Project, and the Foundation of Nature Sciences of Education Department of Hunan Province.

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Manuscript received 13 December 2002, revised 6 May 2003.