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A Revision of the Appalachian Spider Genus *Liocranoides* (Araneae: Tengellidae)

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ABSTRACT

The spider genus *Liocranoides* Keyserling is relimited to include only a small group of Appalachian spiders, and its suggested (albeit surprising) placement in the family Tengellidae is tentatively accepted. The closest relatives of the genus appear to be from California and adjacent areas (*Titiotus* Simon, *Anachemmis* Chamberlin, and an apparently undescribed genus) but previous hypotheses that some or all of those western taxa should be placed in *Liocranoides* are rejected. Because the type species of *Liocranoides* was based on a juvenile from Mammoth Cave, Kentucky, and no adults seem subsequently to have been collected from that area, the identity of *L. unicolor* remains uncertain. It has seemed best to use that name for the geographically closest species, so adult males (the first described for the genus) and females of a species known only from caves in north-central Tennessee are assigned to *L. unicolor*, and four new species are described: *L. tennesseensis* from central and eastern Tennessee, *L. coylei* from southwestern Virginia, western North Carolina, and eastern Tennessee, *L. archeri* from south-central Tennessee and northeastern Alabama, and *L. gertschi* from northern Alabama and northwestern Georgia. All five species have been taken in caves, and two (*L. unicolor* and *L. archeri*) are so far known only from that habitat.

INTRODUCTION

The spider genus *Liocranoides* Keyserling (1881) has long been one of the most puzzling components of the eastern North American spider fauna. It was originally described on the basis of a single juvenile specimen taken in Mammoth Cave (Edmondson County, Kentucky); over the ensuing century, both the identity and the relationships of this un-

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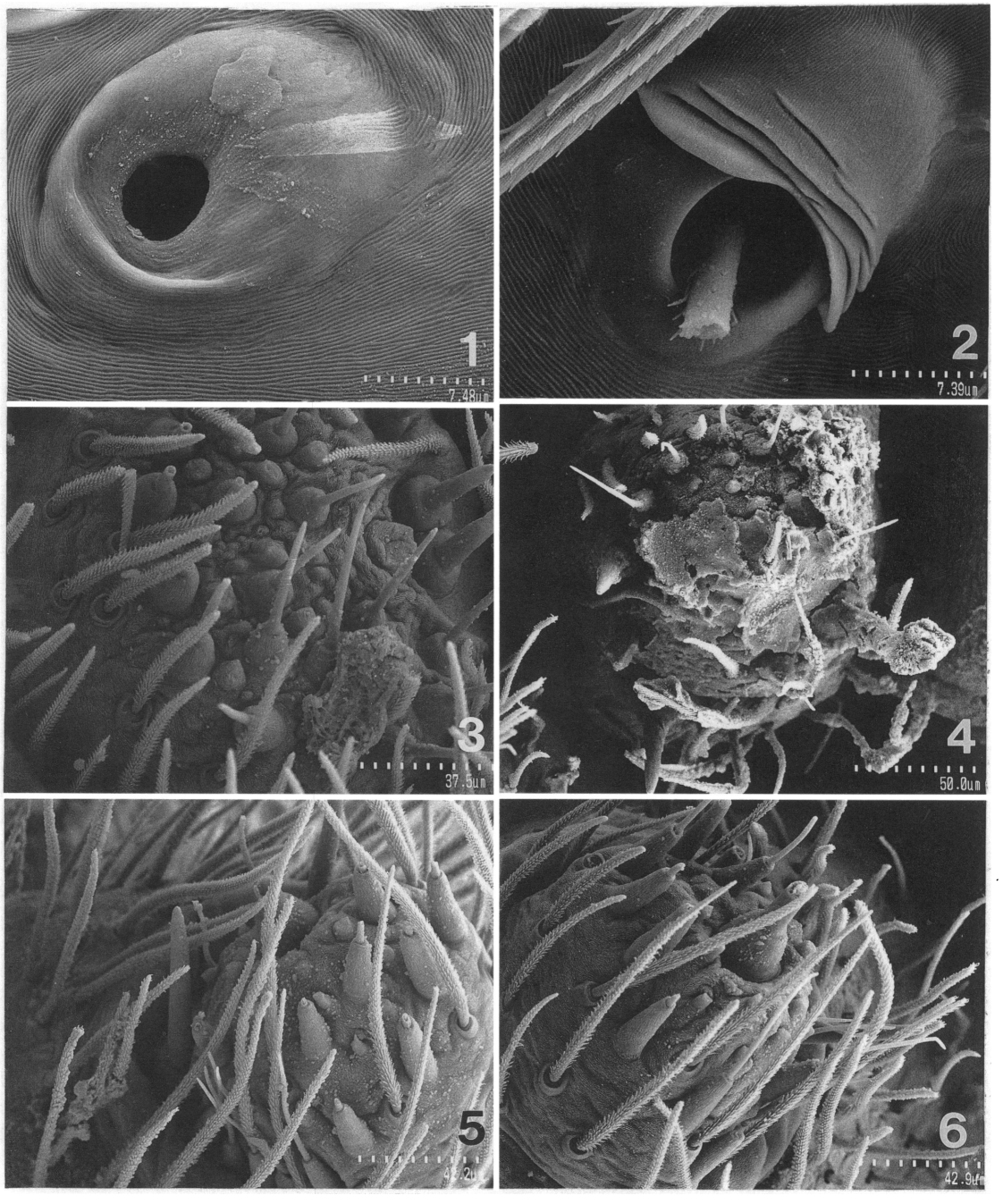
usual spider have remained enigmatic. Only one illustration of an adult specimen seems ever to have been published, by Barrows (1940), based on a female taken in the Great Smoky Mountains National Park, Tennessee. A catalog card for that specimen, kindly copied for me by Dr. Frederick A. Coyle, provides ample testimony of the difficulty Barrows had in trying to identify that female: it was initially placed in such varied genera as *Cryphoeca* Thorell, *Ctenus* Walckenaer, *Rhoicinus* Simon, or *Zora* C. L. Koch, each of which is currently placed in a different family (the Hahniidae, Ctenidae, Trechaleidae, and Zoridae, respectively)! Barrows also considered that his specimen might belong to a new genus, but eventually placed it in *Liocranoides* instead. He appears to have been correct, at the generic level, although it now seems unlikely that his specimen actually belongs to the type species, *Liocranoides unicolor* Keyserling.

In retrospect, it is easy to see why this genus has been so difficult to place phylogenetically. As Keyserling's generic name indicates, he considered the genus to be closely related to *Liocranum* L. Koch and other two-clawed clubionoid spiders. Like most of the two-clawed hunting spiders (the many families included in the group Dionycha), *Liocranoides* does have a distinct pair of claw tufts at the tip of each leg. Claw number has long been a classical key character for spider families, as the loss of the plesiomorphically present unpaired (third) claw does seem to be phylogenetically informative. Many of the spiders in which the third claw has been lost have developed claw tufts, as the shift has often involved the change from living in a web (where the third claw can help a spider maneuver on silk threads) to life as a webless hunter (where claw tufts can help a spider climb and cling to smooth surfaces). Because well over 99% of the spiders with claw tufts have only two claws, it has been routine for arachnologists to assume that any spider which has claw tufts has only two claws.

Forster (1970), however, noted that some desids have three claws as well as claw tufts, and *Liocranoides* is one of the very small set of taxa with that unlikely character combination. The classical placement of the genus, and its relatives, within the Dionycha, is therefore untenable. At best, one might suggest that the group represents the sister taxon of all other dionychans, a hypothesis no one has defended. As it happens, though, *Liocranoides* and its closest relatives also lack some of the other important characters of liocranids and related dionychans, such as extensions of the sternum to and between the coxae. Thus, it seems clear that Keyserling's initial hypothesis of relationships for *Liocranoides* was wildly wrong.

Only one alternative hypothesis has been offered, however, and (at least at first glance) that alternative seems equally improbable. Lehtinen (1967: 244) placed *Liocranoides* in the little-known family Tengellidae Dahl. The type genus, *Tengella* Dahl, contains very large, cribellate, web-building spiders found in the New World tropics (Wolff, 1977); these spiders build large webs that are inhabited by a wide variety of insect and spider symbionts (Eberhard et al., 1993). Associating smaller, ecribellate, temperate-zone, cursorial hunting spiders like *Liocranoides* with *Tengella* seems far-fetched, to say the least. Because Lehtinen (1967: 320, footnote to table 12) provided no character evidence whatever to support his novel hypothesis, it has received no wider support than many of the other unsubstantiated placements made in that paper. Hence, for example, Roth (1985, 1993) continued to list and key *Liocranoides* as a member of the Clubionidae.

Surprisingly, however, in this case Lehtinen's placement seems to be reasonable, despite the multitude of differences between *Tengella* and *Liocranoides*. Griswold (1993: figs. 9, 19, 25) discovered a remarkable character in the male palps of several groups of spiders; the character consists of a pair of interlocking lobes on the promargin of the palpal tegulum and the retromargin of the palpal subtegulum. These lobes do occur in *Liocranoides* (figs. 11, 15), and are otherwise now known to occur in a fairly wide variety of genera belonging to the three subclades of one large group (Griswold et al., 1999). The lobes are found in several groups belonging to the large superfamily Lycosoidea; lycosoids are united by the presence of a grate-shaped tapetum, but *Liocranoides* has a more plesiomorphic canoe-shaped tapetum and is unlikely to be a lycosoid. The sister group of



Figs. 1–6. *Liocranoides archeri*, new species, female. **1.** Tarsal organ from leg II, dorsal view. **2.** Trichobothrial base from tarsus I, dorsal view. **3.** Anterior lateral spinneret, distal view. **4.** Posterior median spinneret, distal view. **5, 6.** Posterior lateral spinnerets, distal view.

lycosoids appears to be the family Zorocratidae Dahl (Griswold et al., 1999), based on the presence (in at least the basal members of both groups) of many cylindrical gland spigots and a cymbial scopula. Here again, however, *Liocranoides* lacks those features, as well as the male tibial crack found in most zorocratids, and it therefore seems unlikely that *Liocranoides* belongs to the Zorocratidae or to the Zorocratidae plus Lycosoidea clade. The third subclade in which the interlocking palpal lobes are known to occur is the Tengellidae, which has therefore been placed as the sister group of the Zorocratidae plus Lycosoidea. *Liocranoides* shares with *Tengella* a variety of other characters that seem significant at this level, including notched trochanters, two rows of tarsal trichobothria that do not show a steady increase in length toward the distal end of the tarsus, scopulae on the posterior legs of females, and a hyaline conductor on the male palp. None of these are features shared uniquely with *Tengella*, unfortunately, but it nevertheless appears that Lehtinen's (1967) placement of *Liocranoides* in the Tengellidae is currently the least contradicted hypothesis. Placement in the Zorocratidae instead could be supported by the similar presence, in *Zorocrates*, of three claws and claw tufts, but there does not seem to be sufficient evidence available, as of yet, to overcome the extra steps that hypothesis would entail.

Also note that a few liocranids, such as some species of *Agroeca* Westring, have interlocking lobes on the male palp. However, in those species, the lobes are situated far more anteriorly than in the Tengellidae, Zorocratidae, or Lycosoidea, and the promarginal lobe appears to be on the base of the embolus rather than on the tegulum itself, so it is unlikely that this represents a homologous condition.

Although essentially no modern work has been published on *Liocranoides*, the genus and its relatives were long of interest to the late Willis J. Gertsch, who avidly amassed specimens and records, especially of the many cave-inhabiting species; over the years, several of his preliminary assessments have been cited by other workers. Largely because of Gertsch's unpublished work, it has long been thought that the closest relatives of *Liocranoides* occur in California and adjacent areas. At times (Roth, 1985), Gertsch apparently considered the entire eastern and Californian faunas to belong to *Liocranoides*, even though at least two generic names are available for the Californian taxa (*Titiotus* Simon and *Anachemmis* Chamberlin). More recently, Gertsch (in Roth, 1993) seemingly concluded that each of these generic names is valid, even though Lehtinen (1967: 213) had earlier published a synonymy, attributed to the late Wilton Ivie, of *Anachemmis* with *Titiotus* (a synonymy here rejected). At that later stage, Gertsch apparently considered *Liocranoides* to comprise the Appalachian fauna described below plus those similar Californian species in which the male tibial apophysis is bifid.

Preliminary examination of a wide range of Californian specimens, including all those available to Gertsch, suggests that this arrangement is untenable. The Californian taxa with bifid tibial apophyses seem to share no special genitalic synapomorphies with the Appalachian species; indeed, the Appalachian species will probably prove to be more closely related to the western *Anachemmis* than to those Californian species placed in *Liocranoides* by the characters in Roth's (1993) key. Although a detailed analysis clearly must await thorough study of the large number of (mostly undescribed) Californian species, it seems likely that no Californian species are actually members of *Liocranoides*. For the moment, at least four seemingly monophyletic groups are recognizable: *Liocranoides* from the Appalachians, *Anachemmis* (about 10 species from California and adjacent states), *Titiotus* (probably with some 30 species in California), and an apparently unnamed group of around 10 species most common in southern California but clearly not congeneric with any of the above taxa. Pending planned revisions of the western fauna, *Liocranoides*, *Titiotus*, and *Anachemmis* should thus each be regarded as valid tengellid genera.

Lehtinen (1967) also placed the western North American genus *Lauricius* Simon in his Tengellinae, but those spiders have only two claws, no claw tufts, and no tegular lobe, and they do not appear to be closely related to the *Liocranoides* group of genera. Here

again, Lehtinen provided no character evidence to support his placement, which seems unlikely to be correct.

All five of the species discussed below have been taken in caves, and two of them (*L. unicolor* and *L. archeri*, new species) are so far known only from subterranean habitats. Those two species show no obvious specializations to cave life, however, and may well be found in epigean habitats within their respective distributional ranges. The species ranges generally appear to be allopatric, but there may be limited areas of sympatry between the new species *L. tennesseensis* and *L. coylei* in southeastern Tennessee, and between the new species *L. archeri* and *L. gertschi* in northeastern Alabama.

Most of the specimens studied here are from the collections of the American Museum of Natural History (AMNH), including an important selection of material from the Smoky Mountains that was very generously donated by Dr. Frederick A. Coyle of Western Carolina University. Additional material has been made available from the collections of the Museum of Comparative Zoology (MCZ, courtesy of L. Leibensperger). The illustrations were provided by Dr. Mohammad Shadab (AMNH). I thank Jan Bosselaers, Diana Silva, and Darrell Ubick for helpful comments on a draft of the manuscript.

LIOCRANOIDES KEYSERLING

Liocranoides Keyserling, 1881: 290 (type species by monotypy *Liocranoides unicolor* Keyserling).

DIAGNOSIS: The combined presence of three claws and claw tufts distinguishes *Liocranoides* from all other eastern North American spiders. Members of the genus can be distinguished from the western species belonging to *Titiotus*, *Anachemmis*, and *Zorocrates* by the bifid retrolateral tibial apophysis of males; the western species (belonging to an undescribed genus) which do have a bifid retrolateral tibial apophysis lack the bifid median apophysis found in *Liocranoides* and the other western genera.

DESCRIPTION: Medium to large spiders, total length of males 6.4–8.0 mm, of females 7.8–9.1. Carapace oval, widest at rear of coxae II, abruptly narrowed at level of palpi to less than half of maximum width; thoracic groove long, longitudinal, very deep; surface coated with short recumbent and fewer, longer, erect dark setae, erect setae most numerous in ocular area; eight eyes in two rows; from above, both eye rows slightly recurved; from front, anterior row recurved, posterior row slightly procurved; anterior median eyes round, smallest; other eyes oval, subequal, with canoe-shaped tapeta; anterior median eyes separated by roughly their diameter, slightly closer to anterior laterals; posterior medians separated by roughly their diameter, farther from posterior laterals; lateral eyes of each side separated by less than their diameter; median ocular quadrangle wider in back than in front, wider in back than long; clypeal height about twice diameter of anterior median eyes, corners of clypeus with incised margins that overlie chelicerae boss; chilum weakly sclerotized, divided, composed of two triangular sclerites. Chelicerae vertical, anterior surface with few, erect setae; promargin with three teeth situated at proximal end of fang furrow, most proximal tooth reduced to denticle, retromargin with three larger, more distally situated teeth, short, narrow posterior sclerite present separating chelicerae at base. Labium short, distally invaginated at middle, reflexed at almost 90° angle relative to sternum. Endites rectangular, distally convergent, with anteromedian scopula and anterolateral serrula consisting of single row of teeth. Sternum rounded, without extensions to or between coxae, with few erect setae; posterior margin not extending between coxae IV. Leg formula 4123, Typical leg spination pattern (only surfaces bearing spines listed): femora: I d1-1-1, p0-2-1, r1-1-1; II d1-1-1, p1-2-1, r1-2-1; III d1-1-1, p2-1-1, r1-2-1; IV d1-1-1, p1-1-1, r0-0-2; patellae III, IV p0-1-0, r0-1-0; tibiae: I, II d1-0-1, p0-2-0, v4-4-6, r0-2-0; III, IV d1-0-1, p0-1-1, v2-2-2, r0-1-1; metatarsi: I p1-1-0, v2-2-2; II p1-1-0, v2-2-2, r1-1-0; III p1-2-2, v2-2-1, r1-1-2; IV p1-1-2, v2-2-2, r1-2-2; tarsi with three claws and claw tufts, superior claws with several teeth, most distal teeth largest, inferior claws unarmed; all tarsi with strong ventral scopulae, scopular hairs distinct from those of claw tufts; distal segments with trichobothria in two rows, bases ridged (fig. 2); tarsal organ

capsulate (fig. 1); trochanters notched, posteriors more strongly so than anteriors; males without tibial crack; metatarsi without preening combs. Abdomen without anterior or dorsal scutum; anterior lateral spinnerets large, composed of two articles, distal article with two major ampullate gland spigots and about 15 small piriform gland spigots with wide short bases and long shafts (fig. 3); posterior median spinnerets composed of one article, those of male small, tubular, those of female triangular, expanded posteriorly, where bearing three large cylindrical gland spigots arranged in triangle (two spigots situated anteriorly, one posteriorly), anterior two cylindrical gland spigots separated by single smaller aciniform or minor ampullate gland spigot, additional smaller spigots present on anterior portion of spinneret (fig. 4); posterior lateral spinnerets composed of two articles, distal article about one-fifth as long as proximal article, those of female with at least two large cylindrical gland spigots at base, smaller and one larger spigot on tip (figs. 5, 6); colulus represented only by setae; posterior spiracle leading to two simple, narrow tracheal tubes. Male palp with retrolaterally widened patella, retrolateral tibial apophysis bifid; subtegulum and tegulum with interlocking processes, median apophysis heavily sclerotized, embolus lamellate, accompanied by hyaline conductor. Female palp with extremely long, dentate claw. Epigynum with anterior hood and paired lateral bulges; atrium typically filled with gelatinous (rather than hard) mating plug.

IDENTIFICATION: The median apophysis is very loosely set in unsclerotized cuticle and can assume a variety of positions in preserved specimens; as a result, only the shape, and not the orientation, of that sclerite is useful for purposes of identification.

KEY TO SPECIES OF *LIOCRANOIDES*

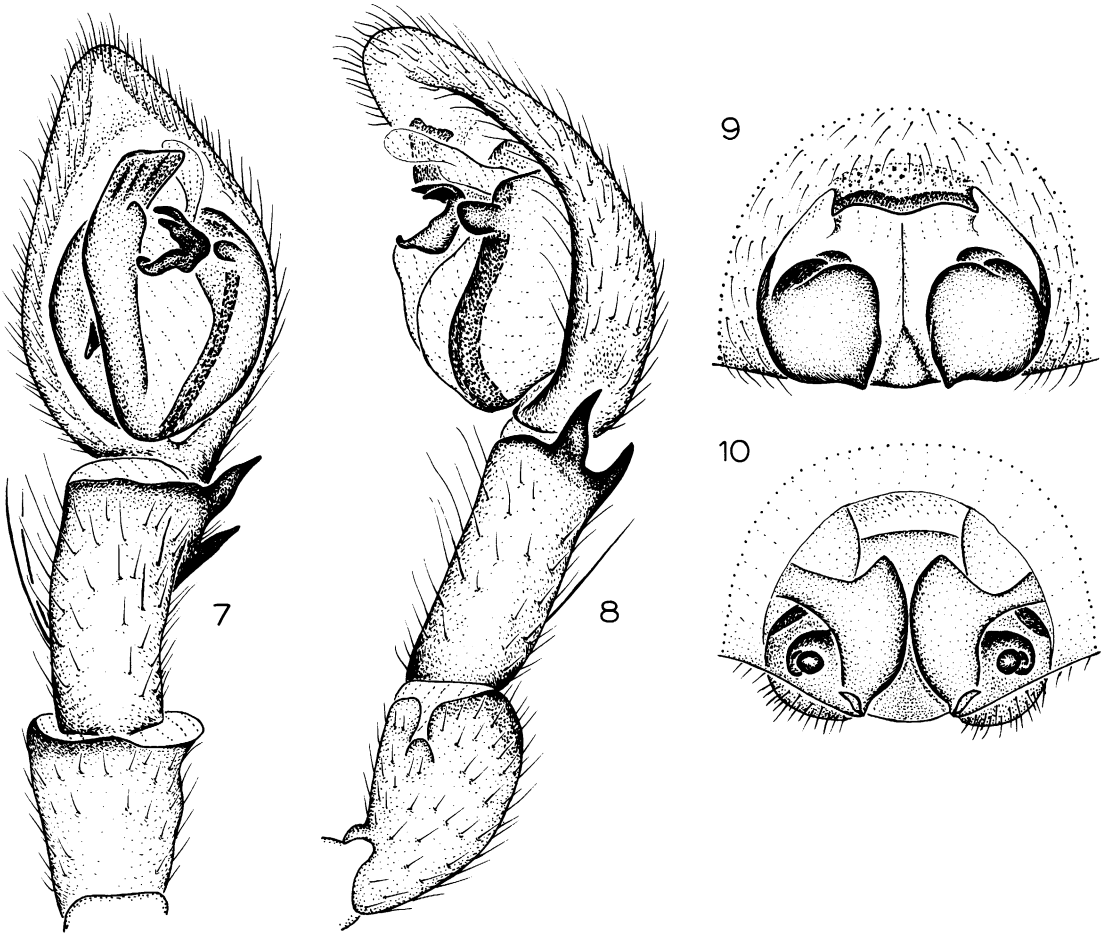
1. Males 2
– Females 6
2. Ventral prong of retrolateral tibial apophysis much wider than dorsal prong (figs. 12, 16, 24) 3
– Ventral prong of retrolateral tibial apophysis roughly equal to dorsal prong in width (figs. 8, 20) 5
3. Ventral prong of retrolateral tibial apophysis relatively long, narrow (fig. 12) ..... *tennesseensis*
– Ventral prong of retrolateral tibial apophysis relatively short, wide (figs. 16, 24) 4
4. Ventral prong of retrolateral tibial apophysis arrow-shaped (fig. 24) ..... *gertschi*
– Ventral prong of retrolateral tibial apophysis scoop-shaped (fig. 16) ..... *coylei*
5. Dorsal prong of retrolateral tibial apophysis with truncated tip (fig. 20) ..... *archeri*
– Dorsal prong of retrolateral tibial apophysis with pointed tip (fig. 8) ..... *unicolor*
6. Epigynal midpiece a narrow ridge, much lower than lateral epigynal lobes (figs. 9, 21) 7
– Epigynal midpiece wider, more elevated (at least at posterior end; figs. 13, 17, 25) .. 8
7. Anterior ends of median epigynal ducts forming m-shaped ridge (fig. 10) .... *unicolor*
– Anterior ends of median epigynal ducts rounded (fig. 22) ..... *archeri*
8. Epigynal hood with large triangular invaginations connected to epigynal midpiece (fig. 17) ..... *coylei*
– Epigynal hood without large triangular invaginations, set well above epigynal midpiece (figs. 13, 25) 9
9. Epigynal midpiece greatly elevated, protruding above lateral epigynal lobes (fig. 13) ..... *tennesseensis*
– Epigynal midpiece not protruding above lateral epigynal lobes (especially anteriorly, fig. 25) ..... *gertschi*

Liocranoides unicolor Keyserling
Figures 7–10

Liocranoides unicolor Keyserling, 1881: 291 (juvenile holotype from "Elyhöhle," Mammoth Cave, Edmondson Co., Kentucky, in MCZ, examined).

DIAGNOSIS: No adults from Kentucky have been available for study, but the specimens described below are associated with the holotype because of their geographic proximity and troglobitic habits. Males can be recognized by the sinuous ventral prong of the retrolateral tibial apophysis (fig. 8), females by the wide epigynal hood and narrow, greatly depressed epigynal midpiece (fig. 9), and by the m-shaped ridge formed by the anterior ends of the median epigynal ducts (fig. 10).

MALE: Total length 7.8 mm. Carapace yellow with orange triangular markings radiating from thoracic groove to intercoxal areas; abdomen pale yellow, without distinct pattern; femora yellow, more distal leg seg-



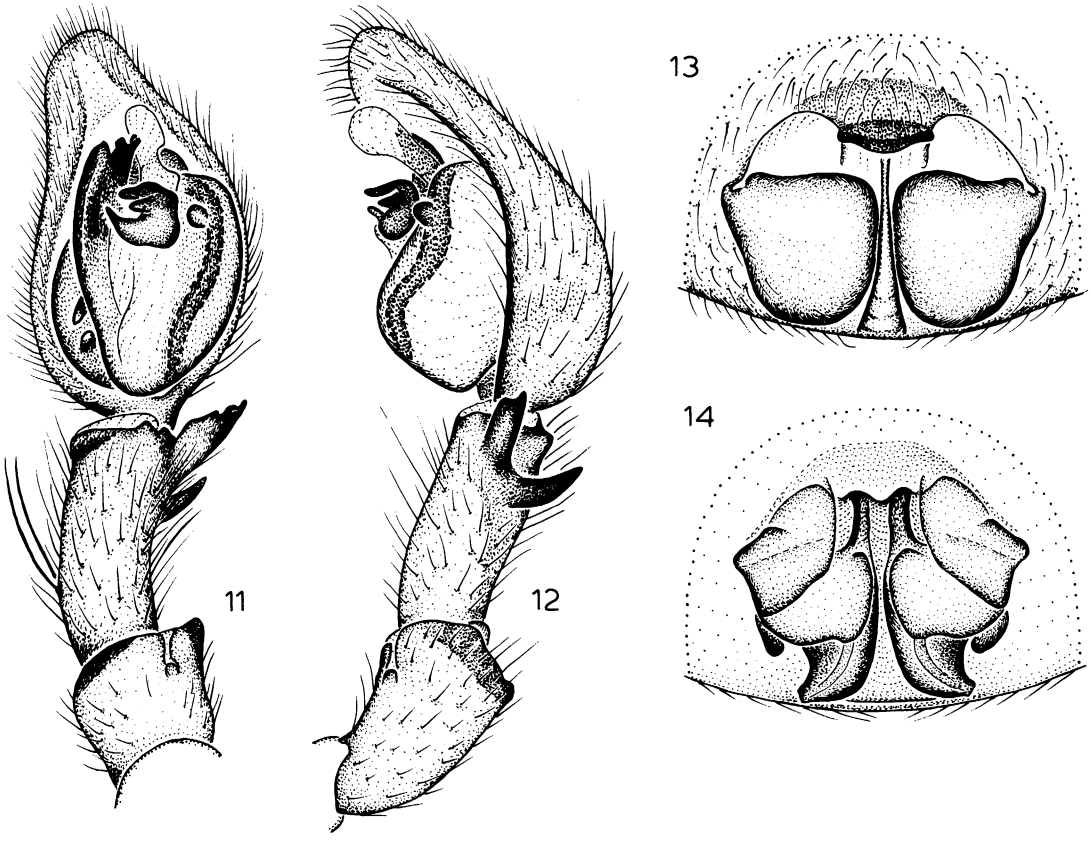
Figs. 7–10. *Liocranoides unicolor* Keyserling. **7.** Left male palp, ventral view. **8.** Same, retrolateral view. **9.** Epigynum, ventral view. **10.** Same, dorsal view.

ments grading to brown on metatarsi and tarsi. Leg spination: femora: I p0-3-1, r1-2-1; IV p1-2-1; patellae III, IV r0-0-0; tibiae: I r0-2-1; II p0-2-1, r0-2-1; III r1-1-1; IV p1-0-1, r1-0-1; metatarsi: I r1-1-0; IV p2-2-2, r1-1-1. Palpal patella relatively wide; ventral prong of retrolateral tibial apophysis sinuous, narrowed at tip, dorsal prong straight (fig. 8); median apophysis with tip bifid, directed proximally; embolus with flat, blunt tip (fig. 7).

FEMALE: Total length 7.9 mm. Coloration as in male. Leg spination: femora: I r0-2-1; II p1-1-1; IV r0-0-1; tibiae: I d0-0-0, p1-1-0; II d0-0-0; metatarsi: I p0-0-0; II p0-0-0, r0-0-0; III p1-1-2; IV r1-1-2. Epigynal hood very wide, epigynal midpiece very narrow, low, depressed far below surface of lateral epigynal lobes (fig. 9); anterior portion of spermathecal ducts very wide, median ducts forming m-shaped ridge near anterior end of epigynum (fig. 10).

MATERIAL EXAMINED: *Kentucky:* **Edmonson Co.:** "Elyhöhle," Mammoth Cave (MCZ), 1 juvenile (holotype). *Tennessee:* **De Kalb Co.:** Cripp's Mill Cave, 5 mi SW Smithville, Dec. 27, 1956 (T. Barr, AMNH), 1♂; Fox Cave, 5 mi SW Smithville, Dec. 27, 1956 (T. Barr, AMNH), 1♂. **Smith Co.:** Piper Cave, Feb. 5, 1961 (T. Barr, AMNH), 1♂, 1♀. **Sumner Co.:** Fox Cave, Castalian Springs, Mar. 24, 1949 (W. Jones, A. Archer, AMNH), 3♀.

DISTRIBUTION: Presumed to range from



Figs. 11–14. *Liocranoides tennesseensis*, new species. **11.** Left male palp, ventral view. **12.** Same, retrolateral view. **13.** Epigynum, ventral view. **14.** Same, dorsal view.

south-central Kentucky to north-central Tennessee; so far known only from caves.

Liocranoides tennesseensis, new species
Figures 11–14

TYPE: Male holotype taken on the ground in an old-growth pine-oak forest at an elevation of 1300 ft at a site 300 m N of the junction of Tabcat Creek and Maynard Creek, Great Smoky Mountains National Park, Blount Co., Tennessee (May 18, 1998; I. Stocks), deposited in AMNH.

ETYMOLOGY: The specific name refers to the type locality

DIAGNOSIS: Males and females have not been taken together, and are here matched on the basis of geographic proximity. Males can easily be recognized by the distally trifid ventral prong of the retrolateral tibial apophysis (fig. 12), females by the relatively wide and greatly elevated epigynal midpiece (fig. 13).

MALE: Total length 8.0 mm. Coloration as in *L. unicolor* except abdominal dorsum dark gray with white cardiac mark, pair of white semicircular marks on sides of cardiac area, and four pairs of round, paramedian white marks posteriorly. Leg spination: femora I r1-1-2; tibiae III r0-1-2; metatarsi: I r1-1-0; II p1-1-1. Palpal patella expanded both prolaterally and retrolaterally; ventral prong of retrolateral tibial apophysis broad, trifid distally, dorsal prong strong (fig. 12); median apophysis short, tip not far from basal projection; embolus with doubly invaginated tip (fig. 11).

FEMALE: Total length 9.1 mm. Coloration as in male except dorsal abdominal pattern almost obsolete (even in epigean specimen). Leg spination: femora I r1-1-2; tibiae I d0-

0-0, v4-4-7. Epigynal hood relatively wide, epigynal midpiece relatively wide, greatly elevated (fig. 13); dorsally highest portions of median epigynal ducts relatively narrow (fig. 14).

OTHER MATERIAL EXAMINED: *Tennessee:* **Anderson Co.:** Weaver's Cave, ca. 4 mi N Clinton, Apr. 19, 1965, under rotting logs ca. 150 ft from entrance (J. Payne, AMNH), 1♀. **Cumberland Co.:** Saltpetre Cave, C. S. Brady farm, W side Grassy Cove, June 20, 1938 (A. Archer, AMNH), 1♀. **Putnam Co.:** Wall Cave, Nov. 19, 1950 (T. Barr, AMNH), 2♀. **Roane Co.:** near Rockwood, July 15, 1933 (W. Ivie, AMNH), 1♀. **Warren Co.:** Cumberland Caverns, Nov. 27, 1960 (T. Barr, AMNH), 2♀.

DISTRIBUTION: Epigean and cave localities in central and eastern Tennessee.

Liocranoides coylei, new species
Figures 15–18

Liocranoides unicolor (misidentification): Barrows, 1940: 138, fig. 11 (female).

TYPES: Male holotype and female allotype from Blowhole Cave in White Oak Sink, Great Smoky Mountains National Park, Blount Co., Tennessee (Oct. 31, 1998; W. Reeves), deposited in AMNH courtesy of Mr. W. Reeves and Dr. F. A. Coyle.

ETYMOLOGY: The specific name is a patronym in honor of Dr. Frederick A. Coyle of Western Carolina University, whose surveys of spider diversity in the Smoky Mountains have provided essential material for this revision.

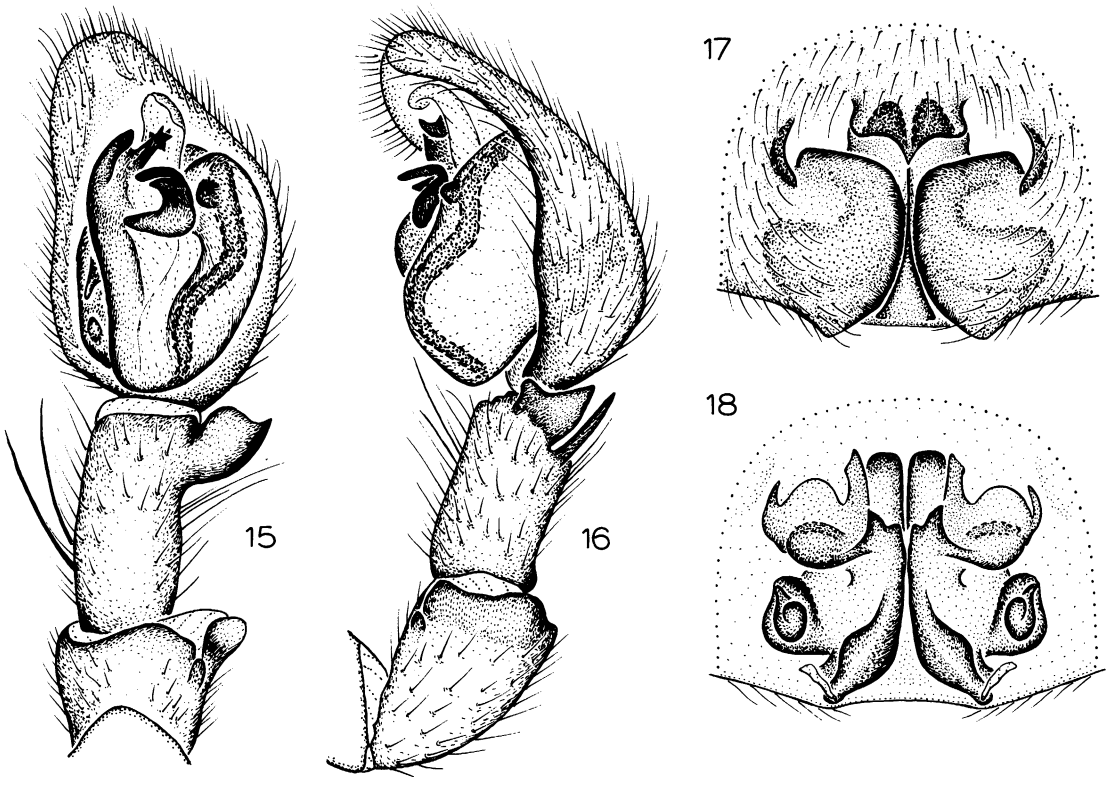
DIAGNOSIS: Males can easily be recognized by the scoop-shaped ventral prong of the retrolateral tibial apophysis (fig. 16), females by the large triangular invaginations of the epigynal hood, which are continuous with the epigynal midpiece (fig. 17).

MALE: Total length 6.6 mm. Carapace yellow with triangular dark marking at rear of pars cephalica and three pairs of triangular dark markings on pars thoracica; abdomen dark gray with white cardiac mark, pair of white semicircular marks on sides of cardiac area, and four pairs of round, paramedian white marks posteriorly, venter pale gray; femora yellow, more distal leg segments grading to brown on metatarsi and tarsi. Leg spination: metatarsi: I r1-1-0; II p1-1-1; IV p1-2-2. Palpal patella relatively wide; ventral prong of retrolateral tibial apophysis scoop-shaped, dorsal prong straight (fig. 16); median apophysis c-shaped in reverse, tip bifid; embolus with complex tip bearing four points (fig. 15).

FEMALE: Total length 7.9 mm. Coloration as in male except small abdominal spots wider. Leg spination: tibiae: I d0-0-0, r0-1-0; II d0-0-0, p0-1-0; metatarsi: I p0-0-0; II p1-0-0, r0-0-0; IV p1-2-2. Epigynum with narrow hood with large, triangular invaginations, midpiece narrow continuous with median ridge of hood (fig. 17); anterior spermathecal ducts relatively wide (fig. 18).

OTHER MATERIAL EXAMINED: *North Carolina:* **Buncombe Co.:** Black Mountain (Beutenmüller, AMNH), 1♀, (N. Banks collection, MCZ), 1♀; 4 mi N Oteen, Oct. 16, 1965 (J., W. Ivie, AMNH), 1♀. **Haywood Co.:** Cataloochee, 150 m S mouth Palmer Br. at Caldwell Fork, Great Smoky Mountains National Park, Apr. 26, 1996, pitfall, hemlock (F. Hain, F. Hastings, AMNH), 1♀, May 2–9, 1997, pitfall in old growth hemlock forest, elev. 2800–3000 ft (F. Coyle, R. Edwards, R. Wright, AMNH), 1♂, June 15, 1997, ground (R. Edwards, AMNH), 1♀. **Jackson Co.:** Brushy Fork Hollow, near Cullowhee, May 12, 1970, rhododendron (W. Shear, MCZ), 1♀; N slope, Little Panther Knob, Long Branch, Cullowhee, May 17, 1983, under old burned and rotting log, elev. 2600 ft (R. Bennett, AMNH), 1♀. *Tennessee:* **Cocke Co.:** Cosby Campground, Great Smoky Mountains National Park, Sept. 3–8, 1995, pitfall (F. Hain, F. Hastings, AMNH), 1♀; Apr. 26, 1996, pitfall, hemlock (F. Hain, F. Hastings, AMNH), 1♂. **Sevier Co.:** Elkmont, Great Smoky Mountains National Park, June 5, 1995, pitfall, hemlock (F. Hain, F. Hastings, AMNH), 1♀; Porters Creek Trail, S of bridge over Porters Creek, Great Smoky Mountains National Park, July 21–Aug. 9, 1995, pitfall, old growth cove hardwood forest, elev. 2400 ft (F. Coyle, D. Williams, M. Carbiener, AMNH), 4♀. **Unicoi Co.:** Erwin, July 8, 1933 (W., A. Ivie, AMNH), 1♀. *Virginia:* **Washington Co.:** Neals Cave, 7 mi SE Abingdon, July 14, 1979 (J. Holsinger, D. Culver, V. Tipton, AMNH), 1♀.

DISTRIBUTION: Epigean and cave species



Figs. 15–18. *Liocranoides coylei*, new species. **15.** Left male palp, ventral view. **16.** Same, retrolateral view. **17.** Epigynum, ventral view. **18.** Same, dorsal view.

from far southwestern Virginia, far western North Carolina, and far eastern Tennessee. Although the female specimen discussed by Barrows (1940), which was collected on Sept. 17, 1937, under a rock on a hillside above the C.C.C. Camp in the Great Smoky Mountains National Park, Tennessee, has not been rediscovered in the Barrows collection at Ohio State University, his figure of the epigynum leaves no doubt that it belongs to this species.

Liocranoides archeri, new species

Figures 1–6, 19–22

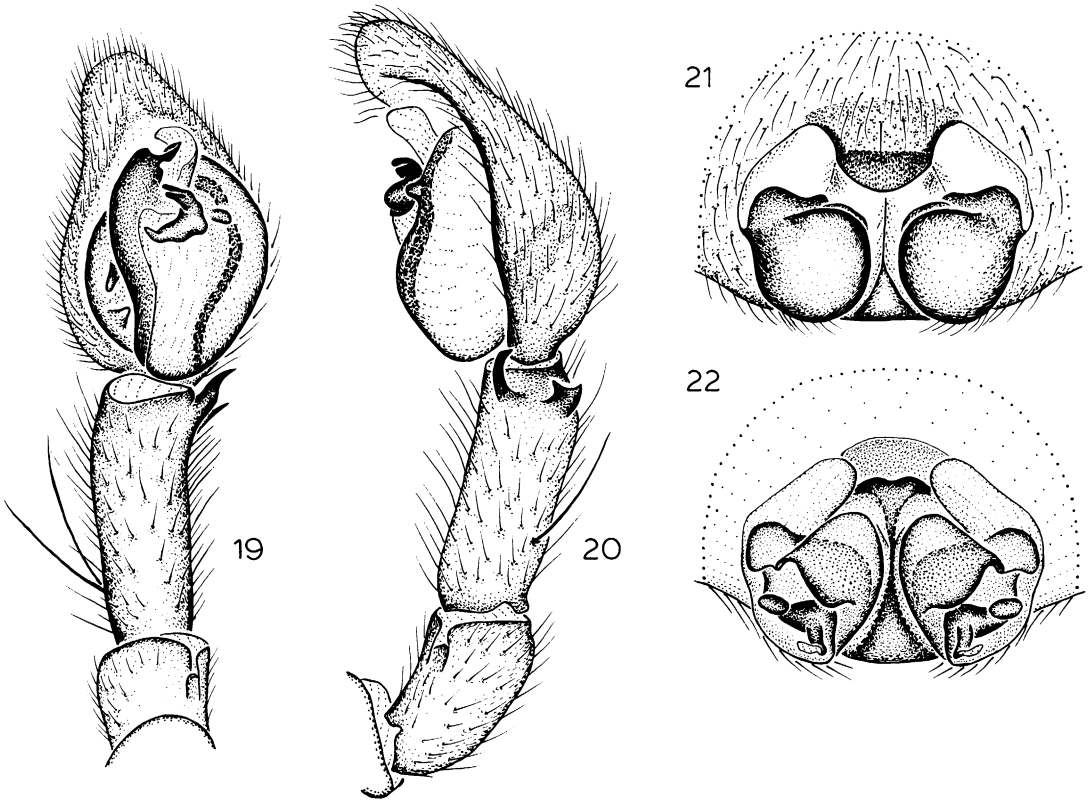
TYPE: Male holotype from Hutton Cave, Sharp's Cove, Madison Co., Alabama (Jan. 3, 1942; W. Jones), deposited in AMNH.

ETYMOLOGY: The specific name is a patronym in honor of the late Dr. Allan F. Archer, who collected much of the available *Liocranoides* material.

DIAGNOSIS: Males closely resemble those of *L. unicolor* but have the tip of the ventral prong of the retrolateral tibial apophysis abruptly bent, have a much wider dorsal prong on that apophysis, and have an arrow-shaped embolar tip (figs. 19, 20); females also resemble those of *L. unicolor* but have a narrower epigynal hood (fig. 21) and more rounded median epigynal ducts that do not meet along the midline (fig. 22).

MALE: Total length 6.6 mm. Coloration as in *L. unicolor* except distal leg segments only slightly darker than femora. Leg spination: femora: I r1-2-1; II p1-1-1; patellae III r0-0-0; tibiae: I, II v4-4-8; metatarsi: I r1-1-0; IV r1-1-2. Palpal patella only slightly widened; ventral prong of retrolateral tibial apophysis abruptly bent distally, dorsal prong wide, tip obliquely truncated (fig. 20); median apophysis relatively wide, base with distally directed projection, embolus distally twisted, arrow-shaped (fig. 19).

FEMALE: Total length 7.8 mm. Coloration



Figs. 19–22. *Liocranoides archeri*, new species. **19.** Left male palp, ventral view. **20.** Same, retrolateral view. **21.** Epigynum, ventral view. **22.** Same, dorsal view.

as in male. Leg spination: femora: II p1-1-1, r1-1-1; tibiae: I d0-0-0, v4-4-8; III d1-1-1, r0-1-2; metatarsi: I p0-0-0; II r1-0-0. Epigynal hood relatively narrow, epigynal midpiece very narrow, depressed far below level of lateral lobes (fig. 21); anterior ends of median ducts rounded, those ducts not touching at midline (fig. 22).

OTHER MATERIAL EXAMINED: *Alabama:* **Jackson Co.:** Blowing Cave, near Garth, Feb. 29, 1940 (W. Jones, A. Archer, AMNH), 1♀; Daves Double Drop, Oct. 15, 1986 (A. Grubbs, S. Gaye, M. Smith, AMNH), 1♂; Nat Cave, 1.5 mi SE Paint Rock, July 9, 1967 (S. Peck, A. Fiske, AMNH), 1♀; Shiffman Cave, 3 mi NW Limrock, Jan. 24, 1967 (S. Peck, AMNH), 2♀. **Madison Co.:** Jacks Cave, near New Market, Dec. 26, 1941 (W. Jones, AMNH), 1♀; Twin Cave, near Brownsboro, Jan. 3, 1942 (W. Jones, AMNH), 2♀. **Marshall Co.:** Dunham Cave, 4.5 mi S Grant, Aug. 14–18, 1967 (S. Peck, A. Fiske, AMNH), 3♀. *Tennessee:* **Grundy Co.:** Crystal Cave, Monteagle, Apr. 18, 1935 (Valentine, Beakley, AMNH), 1♀.

DISTRIBUTION: Known only from caves in south-central Tennessee and northeastern Alabama.

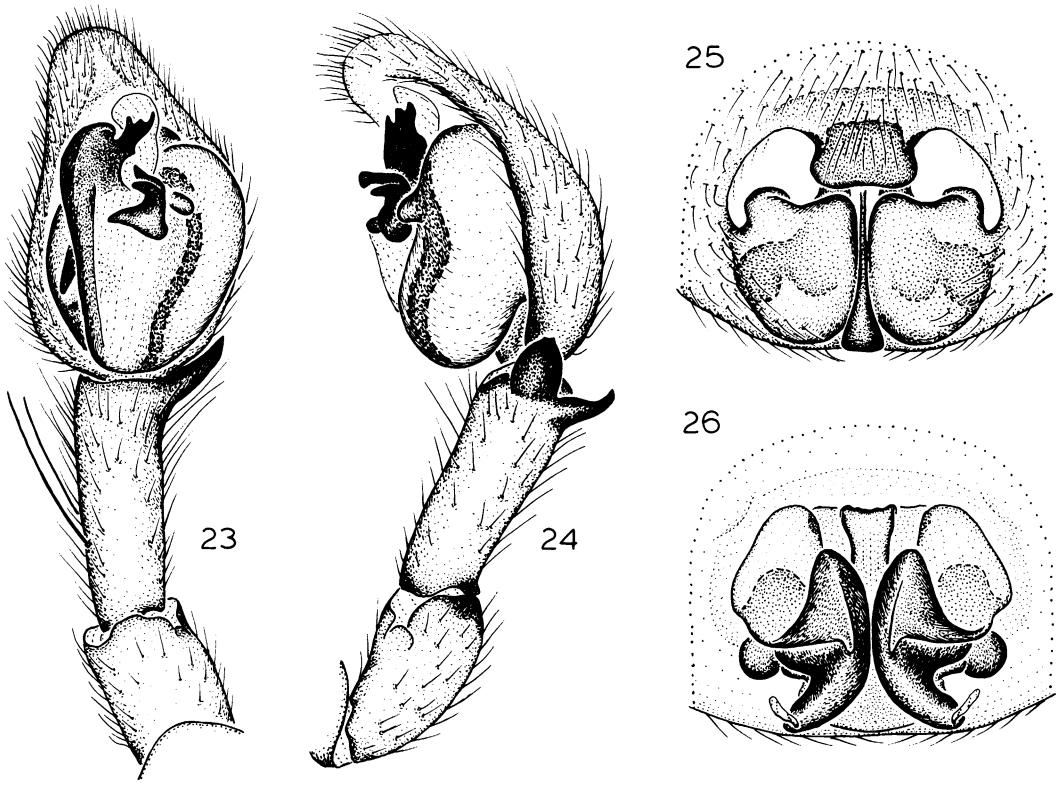
Liocranoides gertschi, new species

Figures 23–26

TYPE: Male holotype from Thrasher Cave, Lawrence Co., Alabama (Sept. 12, 1947; W. Jones, C. Royer), deposited in AMNH.

ETYMOLOGY: The specific name is a patronym in honor of the late Dr. Willis Gertsch, who first recognized the species as new.

DIAGNOSIS: Males can easily be recognized by the arrow-shaped ventral prong of the retrolateral tibial apophysis (fig. 24), females by the relatively wide epigynal septum, which is more highly elevated posteriorly than anteriorly (fig. 25).



Figs. 23–26. *Liocranoides gertschi*, new species. **23.** Left male palp, ventral view. **24.** Same, retrolateral view. **25.** Epigynum, ventral view. **26.** Same, dorsal view.

MALE: Total length 6.4. Coloration as in *L. unicolor* except distal leg segments only slightly darker than femora. Leg spination: femora: I p1-2-1; II p1-1-1; tibiae: I, II v4-4-8; metatarsi I r0-1-0. Palpal patella only slightly widened; ventral prong of retrolateral tibial apophysis arrow-shaped, dorsal prong narrower (fig. 24); median apophysis sinuous, base with slightly protruding triangular extension, embolus with scooped tip, distinct retrolaterally directed process present below tip (fig. 23).

FEMALE: Total length 8.4. Coloration as in male. Leg spination: femora I p1-2-1; tibiae: I d0-0-0, v4-4-8; II v4-4-8; metatarsi I p0-0-0. Epigynal septum relatively wide, much higher posteriorly than anteriorly (fig. 25); anterior epigynal ducts occupying only median portion of dorsal surface of epigynal hood area (fig. 26).

OTHER MATERIAL EXAMINED: *Alabama:* **Bibb Co.:** Pratts Ferry Cave, 0.5 mi up from bridge, Jan. 18, 1951 (B. Valentine, W. Seeyons, AMNH), 1♀. **Blount Co.:** Bangor Cave, 1 mi NE Bangor, Mar. 9, 1940 (W. Jones, AMNH), 1♀; Horseshoe-Crump Cave, 7 mi S Cleveland, June 28, 1967 (S. Peck, A. Fiske, AMNH), 1♀. **Calhoun Co.:** Lady Cave, May 5, 1940 (W. Jones, A. Archer, AMNH), 1♀. **De Kalb Co.:** DeSoto Park, near Fort Payne, July–Aug. 1937 (W. Jones, AMNH), 1♂, Dec. 1937 (W. Jones, AMNH), 1♂. **Jefferson Co.:** Hickman cave, 1 mi E Mt. Pinson (Jones, Park, Valentine, AMNH), 1♀. **Lauderdale Co.:** Key Cave, 8 mi WSW Florence, Nov. 18, 1967 (J., M. Cooper, AMNH), 1♂. **Madison Co.:** Monte Sano, Oct.–Nov. 1937, traps (W. Jones, AMNH), 1♂, summer 1940 (A. Archer, AMNH), 2♀. **Marshall Co.:** Keller Cave, 2.5 mi S New Hope, June 26, 1967 (S. Peck, A. Fiske, AMNH), 1♀; Lime Point Cave,

Jan. 15, 1939 (W. Jones, AMNH), 1♀; Painted Bluff cave, 4 mi N Union Grove, Mar. 16, 1966 (S. Peck, AMNH), 1♀, June 26, 1967 (S. Peck, A. Fiske, AMNH), 1♂; Warrenton Cave, Dec. 29, 1938 (W. Jones, AMNH), 2♀. *Georgia:* **Dade Co.:** Byers Cave, 1.5 mi SW Rising Fawn, June 18, 1967 (J. Holsinger, S. Peck, A. Fiske, R. Baroody, AMNH), 1♀; Hurricane Cave, Dec. 1998, on debris (W. Reeves, AMNH), 1♂.

DISTRIBUTION: Widespread in the northern half of Alabama and far northwestern Georgia, in both epigean and cave habitats.

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