

No. 4.— *The Millipeds Collected in Appalachian
Caves by Mr. Kenneth Dearolf*

By H. F. LOOMIS

In the years 1935 to 1938, Mr. Kenneth Dearolf, Wyomissing Hills, West Lawn, Pennsylvania, gathered one of the most extensive collections of invertebrates from caves that has been made in this country, over 60 caves in seven Eastern States, four in Texas and five in Missouri, having been visited in the project. A description of collecting methods and summarized results have been reported by him¹, while the animals themselves were turned over to specialists for detailed study. He has since published a list of the molluscs and myriapods found in the Pennsylvania caves he visited².

The millipeds from the Eastern collection were sent for identification to the U. S. Bureau of Entomology, Washington, D. C., and by them kindly forwarded to me. The Mid-western material, composed of five species from nine caves, was sent direct to me by Mr. Dearolf. The Eastern material came from 37 caves and included 24 identifiable species and several others which, through lack of sufficient specimens, were referable only to genera. Not more than three species of millipeds were found in any one cave, as the following list of the Eastern caves and their respective milliped inhabitants shows, but it will be seen that several species were quite widely distributed.

Pennsylvania

1. Aitkin Cave, Mifflin County: *Conotyla vaga* Loomis.
2. Brownstone Cave, Dauphin County: *Conotyla vaga* Loomis; *Polydesmus moniliaris* (Koch); *Oxidus gracilis* (Koch).
3. Dragon Cave, Berks County: *Conotyla vaga* Loomis; *Scytonotus granulatus* (Say), possibly from Schofer Cave, Berks County.
4. Lisburn Cave, York County: *Polydesmus hortus* Wms. & Hef.
5. Merkle Cave, Berks County: *Conotyla vaga* Loomis; *Polydesmus* *sp.*
6. Schofer Cave, Berks County: *Conotyla vaga* Loomis; *Polydesmus serratus* Say; *Scytonotus granulatus* (Say), possibly from Dragon Cave, Berks County.
7. South Temple Cave, Berks County: *Conotyla vaga* Loomis.
8. Upper Johnson Cave, Mifflin County: *Conotyla vaga* Loomis.

¹ Proc. Penn. Acad. Sci., pp. 42 - 47, vol. 11, 1937.

² Proc. Penn. Acad. Sci., pp. 64 - 67, vol. 12, 1938.

Maryland

9. Crystal Grottoes, Boonsboro: *Conotyla vaga* Loomis.

Virginia

10. Cassel Farm Cave, Burks Garden: *Pseudotremia tuberculata* Loomis.
11. Endless Caverns, New Market: *Zygonopus whitei* Ryder.
12. Lawson Cave, Burks Garden: *Pseudotremia* sp.; *Brachydesmus pallidus* Loomis.
13. Shenandoah Caverns, New Market: *Zygonopus whitei* Ryder.

West Virginia

14. Arbuckle Cave, Maxwelton: *Pseudotremia* sp.
15. Eagle Cave: *Pseudotremia princeps* Loomis.
16. Higginbotham Cave, Frankford: *Pseudotremia* sp.
17. Lakeland Cave, Charleston: *Paraiulus impressus* (Say); *Brachydesmus pallidus* Loomis.
18. Seneca Caverns, Pendleton County: *Dearolfia lusciosa* Loomis; *Zygonopus whitei* Ryder.
19. Simmon's Cave, Cave: *Pseudotremia simulans* Loomis; *Zygonopus whitei* Ryder.
20. Smoke Hole Cave, Pendleton County: *Pseudotremia princeps* Loomis.
21. Trout Rock Cave, Pendleton County: *Zygonopus whitei* Ryder.

Kentucky

22. Bat Cave, Carter County: *Pseudotremia sodalis* Loomis.
23. Cascade Cave, Carter: *Pseudotremia cavernarum* Cope.
24. Cedar Sinks, Cave City: *Apheloria coriacea* (Koch).
25. Great Onyx Cave, Cave City: *Scoterpes copei* (Packard).
26. Laurel Cave, Carter: *Cambala cristula* Loomis; *Pseudotremia carterensis* Bollman.
27. Mammoth Cave, Cave City: *Scoterpes copei* (Packard).
28. White's Cave, Cave City: *Scoterpes copei* (Packard); *Chaetaspis albus* Bollman.

Tennessee

29. Crystal Cave, Monteagle: *Spirostrephon lactarium* (Say).
30. English Cave, Harrowgate: *Pseudotremia nodosa* Loomis.
31. Indian Cave: *Cambala cristula* Loomis.
32. Lookout Mountain Cave, Chattanooga: *Pseudotremia* sp.

33. Nickajack Cave, Shell Mound: *Cambala cristula* Loomis; *Arctobolus marginatus* (Say).
34. Wonder Cave, Monteagle: *Pseudotremia* sp.; *Scoterpes copei* (Packard).

Georgia

35. Creek Bed Cave, Rising Fawn: *Pseudotremia* sp.; *Polydesmus* sp.
36. Cricket Cave, Rising Fawn: *Pseudotremia eburnea* Loomis.
37. Saw Mill Cave, Rising Fawn: *Scoterpes copei* (Packard).

The majority of the species in this collection are typical surface humus inhabitants which may have been only casual visitants in the caves where they were found, but a definite statement cannot be made, for in small caves or in the entrances of the larger ones, conditions may be not only acceptable to surface species but, by their constancy, may be even more attractive than the conditions in the surface humus, where fluctuations of temperature and moisture are far greater. Relatively few millipeds are completely cavernicolous, and probably not more than half a dozen species in the present collection fall in this class. Characters, such as lack of color; reduction or loss of the eyes; lengthening of the appendages; and reduction of body size and chitinization, which in insects are associated with restricted cave life, are not always safe criteria of a cave existence in the millipeds, for these characters may be found, not too infrequently, in species that live in the surface humus, conditions there being near enough to those found in caves that such characters may develop or at least are not suppressed. In this collection are several previously described species, which, like those here described for the first time, have never been found outside of caves. This, however, probably indicates that the interiors of the caves have been more carefully searched than the surface of the ground adjacent to their mouths. It is quite certain that the wide distribution of *Conotyla vaga*, for instance, which was found in seven of the eight Pennsylvania caves containing millipeds, and in one in Maryland, could have come about only through surface migration.

The most remarkable single feature of the collection is the unexpected abundance of species of *Pseudotremia*, a genus which has suddenly been increased from two species by the addition of six new ones. The discovery of a new species of the genus *Tingupa*, far to the east of the previously known range, also is noteworthy.

In studying the Chordeumoid millipeds in this collection, Attems'

paper in Kükenthall's Handbuch der Zoologie, Vol. 4, 1926, was referred to and several taxonomic points were found that appear to need correction. On page 156 *Trachysomidae* Verhoeff 1913 must be replaced by *Trachygoniidae* Cook 1896, as Cook observed that *Trachysoma* Attems was preoccupied and suggested *Trachygona* and *Trachygoniidae* for the genus and family. On page 160 credit for *Conotylidae* should be Cook 1896 instead of Verhoeff 1909. On page 167 *Verhoeffiidae* should be changed to *Haplogoniidae* (new name) as Cook, Brandtia, p. 7, 1896, stated that *Haplogona* had priority over *Verhoeffia*. On page 170 *Pseudocleididae* Attems 1899, containing the genus *Cleidogona*, must be replaced by the earlier name *Cleidogoniidae* Cook 1896.

Type specimens of the species described in this paper are deposited in the Museum of Comparative Zoology, Cambridge, Mass. Paratype males, where available, have been deposited in the U. S. National Museum.

PARAIULUS IMPRESSUS (Say)

Two young females, Lakeland Cave, Charleston, W. Va., Sept. 2, 1937.

SPIROSTREPHON LACTARIUM (Say)

A male, Crystal Cave, Monteagle, Tenn., June 30, 1937. A female, probably of this species from Rubidoux Cave, Waynesville, Mo., June 8, 1938.

CAMBALA CRISTULA Loomis

A male, Laurel Cave, Carter, Ky., June 25, 1937; two specimens, Aug. 30, 1935, and many specimens, July 1, 1937, from Nickajack Cave, Shell Mound, Tenn.; several immature specimens, Indian Cave, Tenn., Aug. 31, 1935.

ARCTOBOLUS MARGINATUS (Say)

A male, Nickajack Cave, Shell Mound, Tenn., July 1, 1937.

PSEUDOTREMIA PRINCEPS spec. nov.

Several broken specimens of both sexes, Smoke Hole Cave, Pendleton Co., W. Va., April 20, 1935; from Eagle Cave, W. Va., a male and female, April 22, 1935, and two males (one the type) and a female, June 1, 1935.

Diagnosis. Not only is this the largest member of the genus but it exceeds in size any other species of the suborder Chordeumoidea in North America. Dorsum less extensively and more faintly tuberculate than in any of the larger species recognized and with more prominent raised lateral shoulders. The chief differences, however, are found in the gonopods.

Description. Largest male 31 mm. long, largest female 34 mm. long; body more fusiform than shown in illustration of *P. cavernarum* by Cook & Collins (Ann. N. Y. Acad. Sci. pl. 1, fig. 11, vol. 9, 1895).

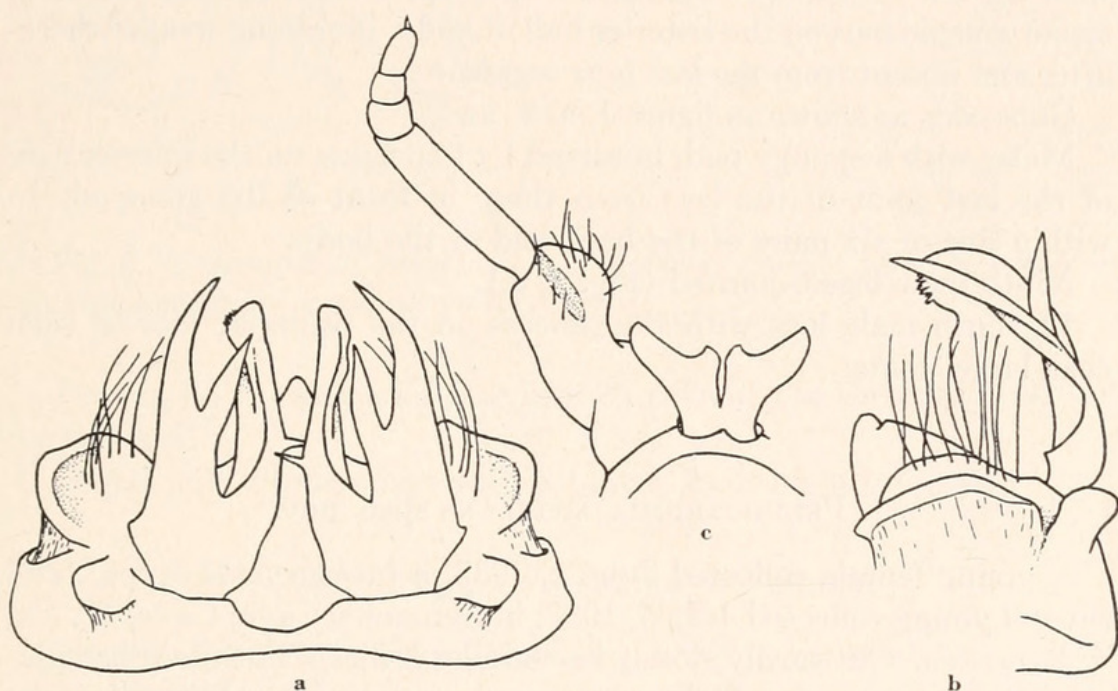


Fig. 1. *Pseudotremia princeps*. a, Gonopods, anterior view; b, Gonopod, outer lateral view; c, Ninth leg and bifid laminae of gonopods, posterior view.

Color in alcohol bluish slate-gray, probably much as in life, the metazonites darker than the prozonites and with a large, transverse, oval or reniform, light maculate area extending inward from each shoulder, a similar area on each side of the prozonite approaches nearer the colorless median line.

Ocelli well pigmented, 20-22 in number, arranged in quite definite vertical series parallel the back of the head: 6-5-4-3-1-1, counting forward.

First segment with each lateral angle prominently thickened; shoulder of second segment conspicuous, thick, the shoulders of segments 3 and 4 slightly thicker but those of segments 5, 6, and 7 suddenly

much more so, thereafter decreasing in size and not evident behind segment 20; shoulders of segments 3, 4, and 5 strongly elevated above the level of the side of the dorsum. First five segments entirely smooth on the dorsum, or at most with very faint longitudinal surface irregularities on either side of segments 4 and 5, but with no tubercles; from segment 6 caudad a few faint elongate swellings scarcely worthy the name of tubercles are present on the sides of the dorsum but nowhere approach closer to the median line of the segment than the inner seta; last five or six segments not tuberculate, the foremost of these segments with the surface faintly impressed lengthwise behind the setae; lateral striae conspicuous on the anterior half of body, becoming weaker thereafter and absent from the last four segments.

Gonopods as shown in figure 1, a, b, and c.

Males with a spongy pad, bordered by fine hairs, on the inferior face of the last joint of the legs from those in front of the gonopods to within five or six pairs of the back end of the body.

Ninth male legs 5-jointed (Fig. 1, c.).

Eleventh male legs with the process on the posterior face of each coxa large, conic.

PSEUDOTREMIA SIMULANS spec. nov.

A young female collected June 1, 1935, a broken male (type), and several young collected July 5, 1937, in Simmon's Cave, Cave, W. Va.

Diagnosis. Outwardly closely resembling *princeps* but the tuberculation of the dorsum is a little more prominent, the lateral shoulders are evident further back on the body; and the gonopods are materially different.

Description. Body of the same shape, color and almost as large as *princeps*.

Ocelli 17-18, mostly irregularly placed, only the five closest to the back margin of the head forming a vertical row.

Anterior segments with lateral shoulders as in *princeps*, those of segments 3-5 similarly elevated; on the posterior segments lateral shoulders faintly evident to the antepenultimate segment. Tuberculation of the dorsum distributed as in *princeps* but somewhat more prominent, being composed of oval or elongate ridge-like tubercles quite sharply defined and present as far caudad as segment 25 behind which the posterior half of the metazonites is longitudinally rugose or faintly ridged.

Gonopods and ninth legs as shown in figure 2, a and b, the ninth legs 5-jointed.

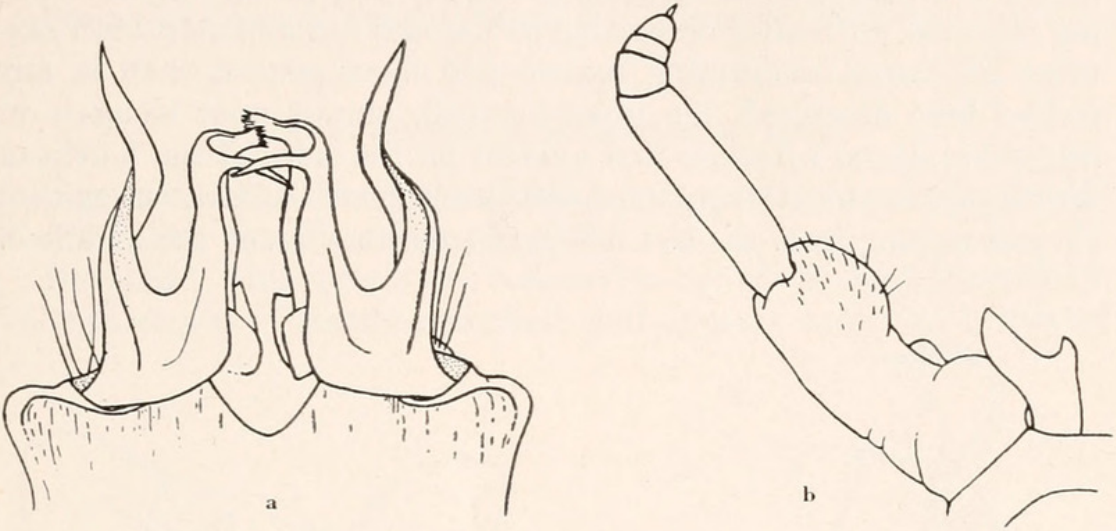


Fig. 2. *Pseudotremia simulans*. a, Gonopods, anterior view; b, Ninth leg and bifid lamina of gonopod, posterior view.

Process on the posterior face of each coxa of the eleventh male legs large, conic.

Distal joint of male legs with subtarsal pads as in *princeps*.

PSEUDOTREMIA CARTERENSIS Bollman

Several females, apparently of this species, Laurel Cave, Carter Ky., June 25, 1937.

PSEUDOTREMIA TUBERCULATA spec. nov.

A single broken male from Cassel Farm Cave, Burks Garden, Va., July 3, 1937.

Diagnosis. A more generally tuberculate species than any other here described and probably even more so than *carterensis*; the anterior gonopods are strikingly different from those of the other species, and the posterior portions, the bifid laminae, show definite thickening.

Description. Length about 27 mm; body very fusiform, the first three segments narrow, segments 4, 5, and 6 broadening rapidly, 7 and 8 less rapidly, after which the sides converge to the narrow last segment. Color as in *princeps*.

Ocelli about 19, in quite definite oblique-vertical series.

First segment with each lateral angle small, scarcely projecting and little thickened; shoulders of segment 2 faint, those of segments 3, 4, 5, and 6 increasing in size gradually, slightly projecting, thickened but not elevated, thereafter decreasing in size and not apparent after segment 20; dorsal sculpturing coarser and more general than in any species here described, the tubercles oval, almost none elongate or ridge-like; dorsal tubercles first evident on the sides of the fourth or fifth segment, and strongly developed to segment 24, faint on segment 25, and lacking from the last five segments; they reach the middle of

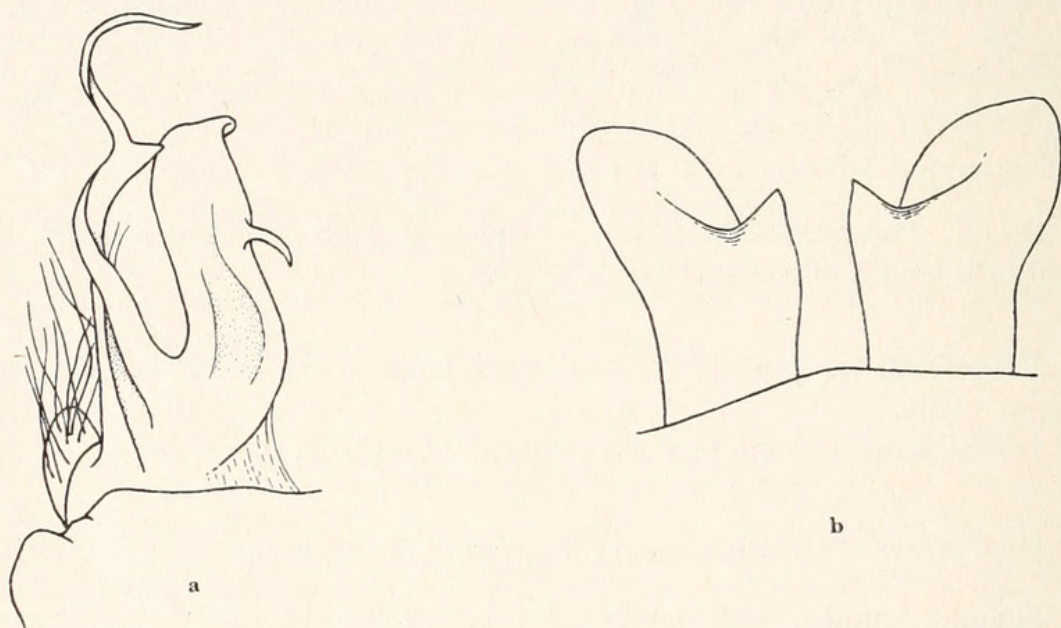


Fig. 3. *Pseudotremia tuberculata*. a, Left gonopod, anterior view; b, Bifid laminae of gonopods, posterior view.

the dorsum from segment 12 backward but are not as large or well defined as near the sides; lateral striae strong on anterior segments and continuing, although very faintly, to the antepenultimate segment.

Gonopods as shown in figure 3, a and b; the bifid laminate plates thicker than in any other species.

Males with subtarsal pads present on the legs to near the posterior end of the body.

Ninth male legs 4-jointed, the basal joint thinner at apex than in the other species.

Eleventh male legs with process on the posterior face of each coxa greatly reduced in size, very small, conical.

PSEUDOTREMIA CAVERNARUM Cope

A half dozen immature specimens appearing to belong to this species collected in Cascade Cave, Carter, Ky., June 24, 1937.

PSEUDOTREMIA SODALIS spec. nov.

Two males (one the type) and two young specimens collected in Bat Cave, Carter Co., Ky., June 25, 1937.

Diagnosis. This species was collected in one of the caves from which *carterensis* was originally described, and appears more closely related

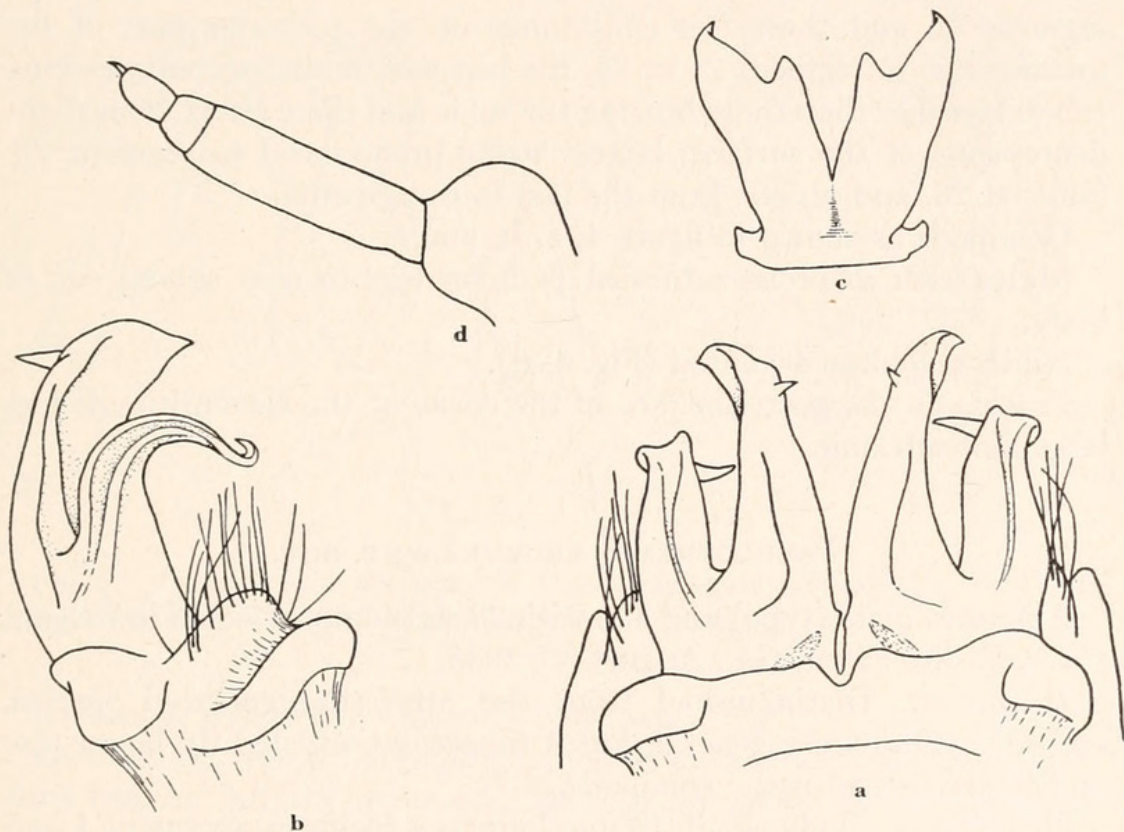


Fig. 4. *Pseudotremia sodalis*. a, Gonopods, anterior view; b, Gonopod, outer lateral view; c, Bifid laminae of gonopods, posterior view; d, Ninth leg of male.

to it than to the other species but differs in the much smaller body and peculiarities of the gonopods; the latter also obviously distinct from the other species.

Description. Body of male 15–16 mm long, nearly as small as the unpigmented and peculiarly tuberculate *nodosa*; body scarcely fusiform,

quite like *carterensis*, the sides in front of the last few segments nearly parallel.

Color similar in shade and distribution to that in *princeps*.

Eyes composed of 18–20 subequal ocelli compactly arranged in a sub-triangular group, sometimes in rather definite series.

First segment with lateral angles small, inconspicuous; lateral shoulders of segment 2 barely indicated, those of segments 3–6 increasing in size but not attaining the development found in *princeps* or *simulans* and not at all elevated, shoulders disappearing on the posterior segments as in the other species; dorsal tubercles numerous, small, low, elongate-oval and not sharply defined, beginning on the sides of segment 6 and attaining the middle of the dorsum at about segment 15 and thereafter continuous on the posterior part of the metazonites to segment 24 or 25, the last five or six segments lacking tubercles other than those bearing the setae and these rising from slight depressions of the surface; lateral striae pronounced to segment 25, faint on 26, and absent from the last four segments.

Gonopods as shown in figure 4, a, b, and c.

Males with scabrous subtarsal pads on legs to near caudal end of body.

Ninth male legs 4-jointed (Fig. 4, d).

Process on the posterior face of the coxae of the eleventh male legs large and subconic.

PSEUDOTREMIA EBURNEA spec. nov.

A mature male (type) and one with 28 segments collected in Cricket Cave, Rising Fawn, Ga., August 30, 1935.

Diagnosis. Distinguished from the other unpigmented species, *nodosa*, by the more general dorsal tuberculation, slightly larger size and the structure of the gonopods.

Description. Body small, 19 mm long; not fusiform; segments 1 and 2 of equal width, narrow; segments 3 to 7 widening gradually and uniformly instead of having 5 and 6 suddenly widened as is general in other species; from segment 8 caudad the body is nearly parallel sided to the last five segments which narrow abruptly. Color of living animal probably almost white, the alcoholic specimens stained, light brown.

Eyes composed of about 12 unpigmented ocelli.

First segment with each lateral angle small, scarcely thickened; second segment with almost no indication of lateral shoulders; segments 3–6 with swollen shoulders increasing in prominence but not

elevated or approaching the development of those in *princeps*; shoulders of ensuing segments decreasing and obliterated a short distance behind the middle of the body. Lateral striae evident on all except segments 1 and 30, those on segments 28 and 29 very faint. Segments with a few rather large, indefinite, rounded tubercles first evident at the sides of segment 5 and continuing to about the fourth from the last segment; on the segments behind the middle of the body the tubercles approach almost to the median line.

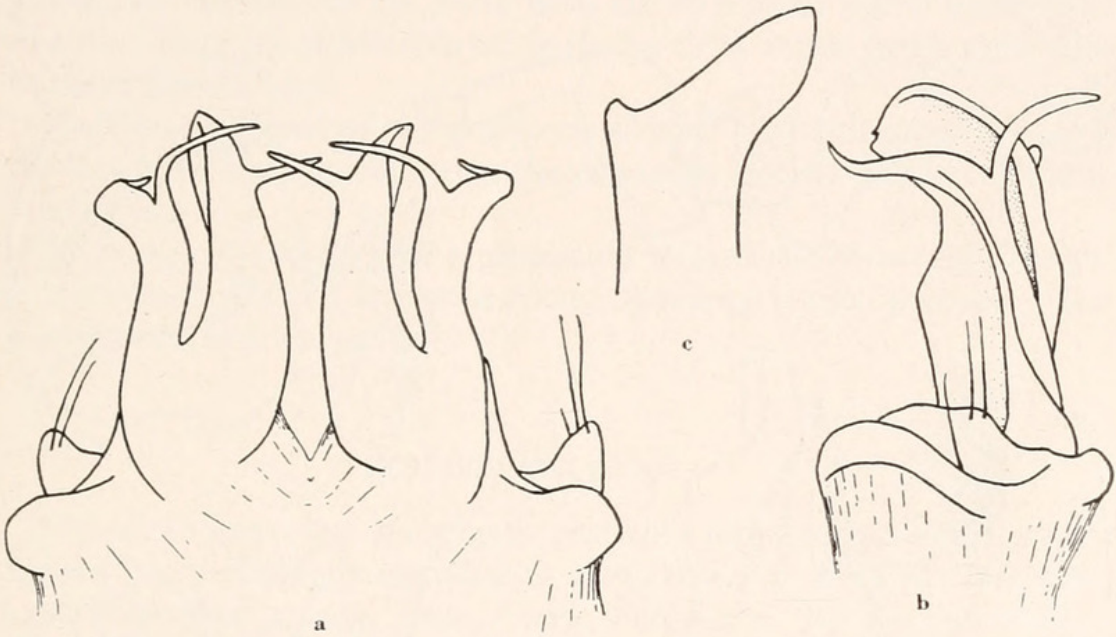


Fig. 5. *Pseudotremia eburnea*. a, Gonopods, anterior view; b, Gonopod, outer lateral view; c, Bifid lamina of gonopod, posterior view.

Gonopods as shown in figure 5, a, b, and c.

In the male, legs 3-7 are crassate and have ventral pads on the outer joint but behind the gonopods the legs are more slender and lack tarsal pads; ninth legs 4-jointed; a prominent teat-like tubercle on the posterior face of each coxa of the eleventh legs.

PSEUDOTREMIA NODOSA spec. nov.

A broken male (type), a female and several young from English Cave, Harrowgate, Tenn., July 2, 1937.

Diagnosis. The small size coupled with the unpigmented, nearly parallel-sided body, especially of the female; and lack of dorsal tuber-

cles except at the back margin of the segments, where they are unusually prominent, distinguish this species from other known forms.

Description. The smallest member of the genus, the female 17 mm long, the broken male about 15 mm long; body of the female widening gradually and evenly from the first to the seventh segment, the male with the first five segments widening gradually but segment 6 suddenly increased in width; body of both sexes parallel-sided from segment 8 to segment 22 or 23, thereafter narrowing gradually to the relatively

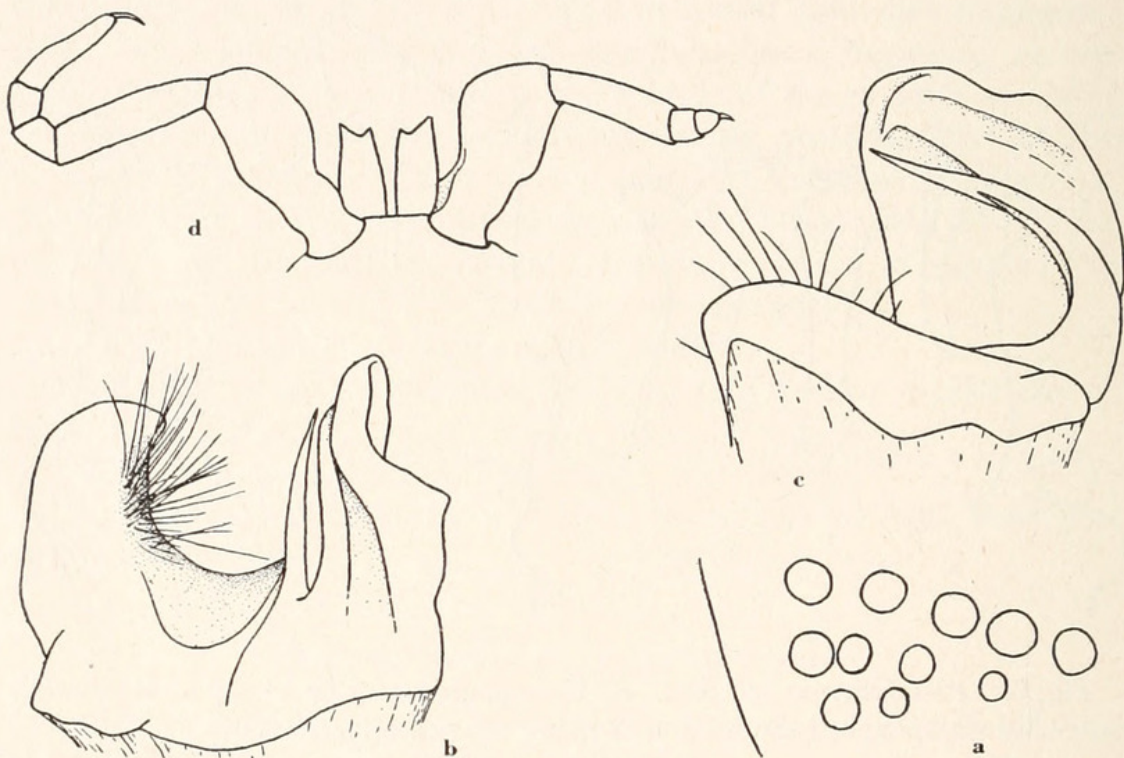


Fig. 6. *Pseudotremia nodosa*. a, Back margin of head and ocelli; b, Left gonopod, anterior view; c, Left gonopod, outer lateral view; d, Sternum, ninth legs and bifid laminae of gonopods, posterior view.

broad last segment; lateral carinae more reduced than in other species, only faintly indicated as slight swellings of the anterior segments in the female, a little more prominent in the male but not developed as much as in *eburnea* where almost a minimum is reached; lateral striae fine; in the male extending over half way to the lateral shoulder on the anterior segments and not evident on the last eight or ten segments; in the female only three or four striae are obvious on the anterior segments and are faintly indicated on midbody segments but lacking on the posterior segments.

Body unpigmented, white in alcohol; the 8-11 ocelli black or dark brown, variable in size and arrangement as shown in figure 6, a.

Dorsal sculpture of segments restricted, anterior part of metazonite smooth and shining except for the small tubercles supporting the setae, a series of 10-12 equidistant, large, sharply raised, nodular tubercles along the posterior margin beginning with segment 5 or 6 and extending to segment 25 or 26, several smaller tubercles sometimes are scattered just in advance of the marginal series.

Gonopods as shown in figure 6, b, c, and d, the ninth legs in d, four-jointed on one side of the body with the two outer joints reduced in size, the other leg is five-jointed with the three outer joints quite like those of normal legs.

Male legs in front of the gonopods slender but with a pad beneath the last joint, the legs following the gonopods also slender but without tarsal pads.

Male legs 10 and 11 with a prominent lobe at the disto-mesial angle of the coxae; eleventh legs with a long, slenderly conical process on the posterior face of the coxae.

PSEUDOTREMIA spp.

Female or immature specimens, probably representing three or four species but definitely assignable to none, collected from the following localities: three young, from Creek Bed Cave, Rising Fawn, Ga., August 30, 1935; one young, from Lookout Mountain Cave, Chattanooga, Tenn., July 1, 1937; a female, Wonder Cave, Monteagle, Tenn., June 30, 1937; a female, Lawson Cave, Burks Garden, Va., July 3, 1937; two females, Higgenbotham Cave, Frankford, W. Va., July 4, 1937; three females, Arbuckle Cave, Maxwelton, W. Va., July 4, 1937.

DEAROLFIA gen. nov.

Type. *D. lusciosa* spec. nov.

Diagnosis. The position of this genus is between *Pseudotremia* and *Cleidogona*, having the form but not the sculpturing, and the eye development resembling the former genus, while the gonopods resemble those of *Cleidogona*, but the sternum between the twelfth male legs lacks the process characteristic of that genus and the ninth legs are only 3-jointed.

Description. Body of medium size, slender, fusiform, narrowing

caudad from segment 7 or 8; dorsum smooth, without tubercles except the small ones supporting the dorsal setae.

Ocelli small, few in number, unpigmented; antennae long and very slender, even surpassing those of *Pseudotremia*.

First segment somewhat longer than that of *Cleidogona*; subreniform, very broadly rounded in front and somewhat emarginate at middle behind; second segment as wide as segment 1, the two much narrower than the head; segments 3 and 4 gradually wider; segments 5, 6, and 7 suddenly increasing in width, the latter wider than any other segment, those thereafter very gradually decreasing in width to the posterior end of the body; lateral shoulders present on the anterior segments as rounded swellings about as prominent as in *Pseudotremia*; lateral striae coarse and few in number.

Sternal plates with a pronounced median carina abruptly elevated.

Gonopods resembling those of *Cleidogona*, lacking the pair of bifid laminae found in *Pseudotremia*.

In the male the first and second legs are reduced in size; legs 3-7 a little thickened, the outer joint with a ventral granular pad not present on the legs following the gonopods; ninth legs 3-jointed, terminating in a claw; legs 10 and 11 with coxal pouches, the latter coxae with processes on the posterior face similar to those in *Pseudotremia*; sternum between the twelfth legs similar to those ensuing.

DEAROLFIA LUSCIOSA spec. nov.

The male type, a female, and two nearly mature specimens from Seneca Caverns, Pendleton Co., W. Va., June 1, 1935; a male and two immature specimens from the same cavern, April 21, 1935.

Description. Length 17-18 mm; color white.

Eye cluster much smaller than the antennal socket, composed of 4-7 unpigmented ocelli no larger than the organ of Tömösvary, which is intermediate in position between the eye and the antenna as shown in figure 7, a; antennae long and very slender, joint 3 longest, joints 2-5 quite suddenly thickened distally (Fig. 7, b).

Head and first two segments shown in dorsal view in figure 7, c; segments 1 and 2 with lateral shoulders faintly indicated, those of segment 4 of moderate size and on segments 5-7 they suddenly become prominent as rounded swellings which slowly decrease in size on succeeding segments and are not evident on the posterior half of the body; on the anterior segments six or seven coarse lateral striae are present reaching not more than half way to the lateral shoulder, on ensuing segments the

striae are restricted in prominence, number, and extent, and are absent from the last few segments.

Gonopods as shown in figure 7, d and e.

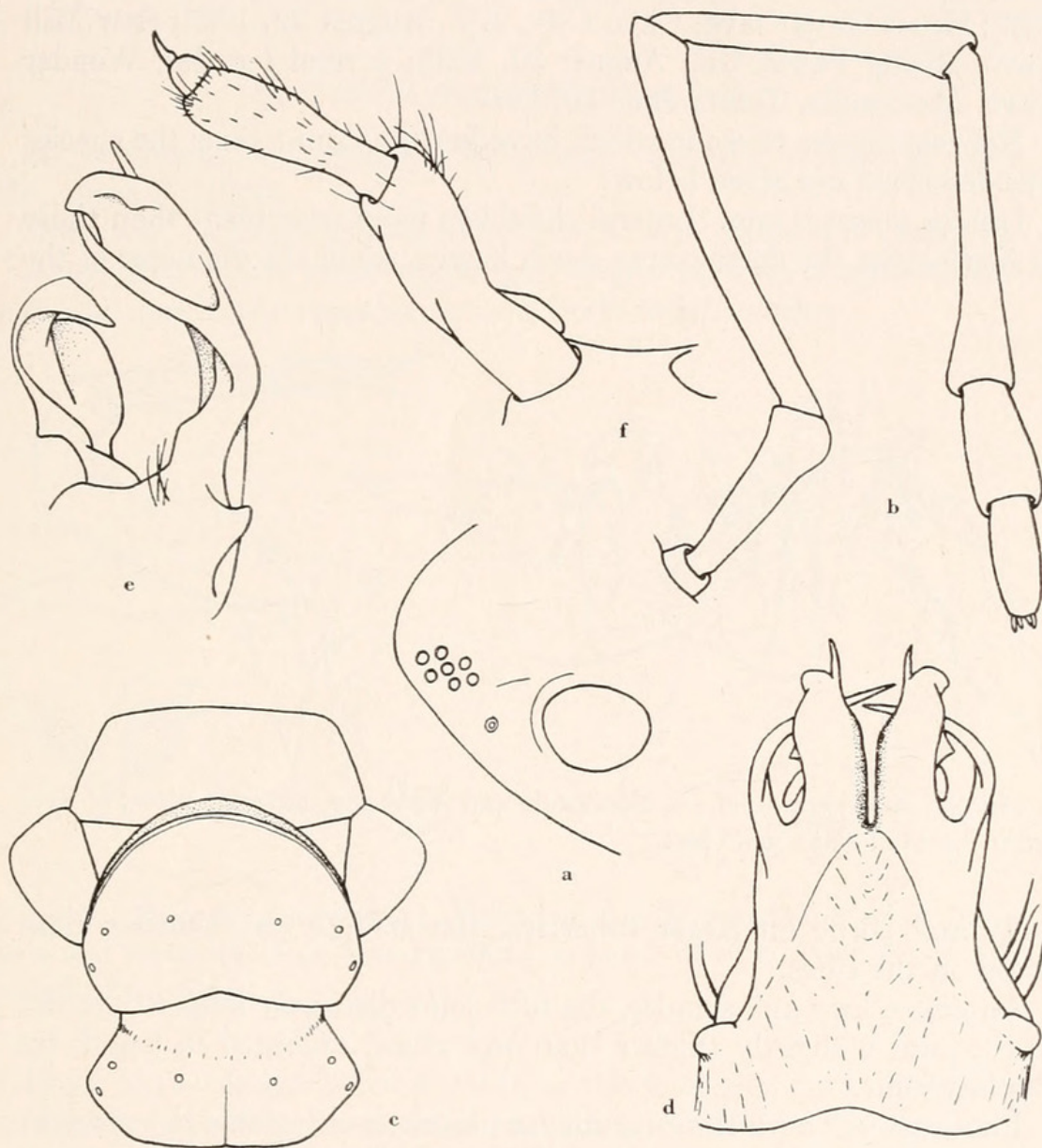


Fig. 7. *Dearolfia lusciosa*. a, Side of head showing ocelli, organ of Tomosvary and antennal socket; b, Antenna; c, Head and first two segments, dorsal view; d, Gonopods, anterior view; e, Gonopod, lateral view; f, Sternum and ninth male leg, posterior view.

Ninth male legs as shown in figure 7, f; the coxae of the eleventh legs each with an elongate conic process on the posterior face.

SCOTERPES COPEI (Packard)

A male, Whites Cave, Cave City, Ky., June 29, 1937; a single female from each of the following: Mammoth Cave, Cave City, Ky., June 26, 1937; Great Onyx Cave, Cave City, Ky., August 22, 1935; Saw Mill Cave, Rising Fawn, Ga., August 30, 1935; several females, Wonder Cave, Monteagle, Tenn., June 30, 1937.

New characters or some which have been in doubt since the species was described are given below:

Length about 8 mm. Lateral shoulders more prominent than those of *Zygonopus*, the dorsal setae much longer, equal the diameter of the

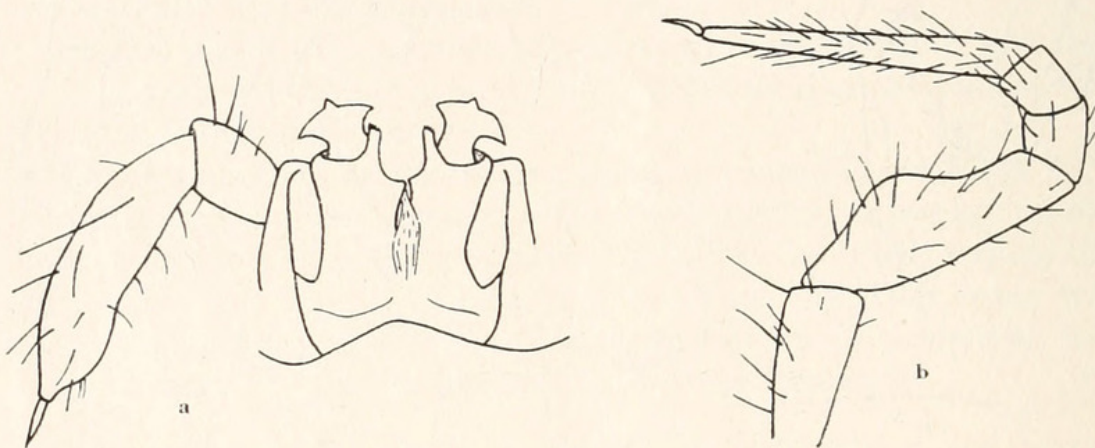


Fig. 8. *Scoterpes copei*. a, Gonopods and ninth leg, anterior view; b, Five outer joints of sixth male leg.

body and borne on larger tubercles, the median ones smaller than those on the sides.

Antennae long and slender, the fifth joint distinctly longer than the third; joint 6 slightly thicker than any other, exceeded in length by the last joint.

First segment with three equidistant setae on either side in a straight oblique row extending inward and forward from the posterior corner, the rows separated in front by a distance equal the length of a row; similar straight, oblique, widely spaced rows of setae are on ensuing segments, the posterior or outermost seta borne on the lateral shoulder.

Legs longer and more slender than those of *Zygonopus*, the last joint longer than joint 4 which, however, considerably exceeds it in thickness. Anterior male legs slender (somewhat crassate in *Zygonopus*), the

sixth pair having the fourth joint swollen along the ventral face (Fig. 8, a); other pregenital legs normal; ninth legs 2-jointed and ending in a strong, straight claw.

Gonopods and ninth legs as shown in figure 8, b.

SCOTERPES DENDROPUS spec. nov.

Six specimens, including the male type, collected in Marvel Cave, Mo., June 27, 1938.

Diagnosis. A larger species than *S. copei* with distinctive gonopods.

Description. Size relatively large; length of largest specimen, a male, 11 mm; body tapering toward both ends; colorless.

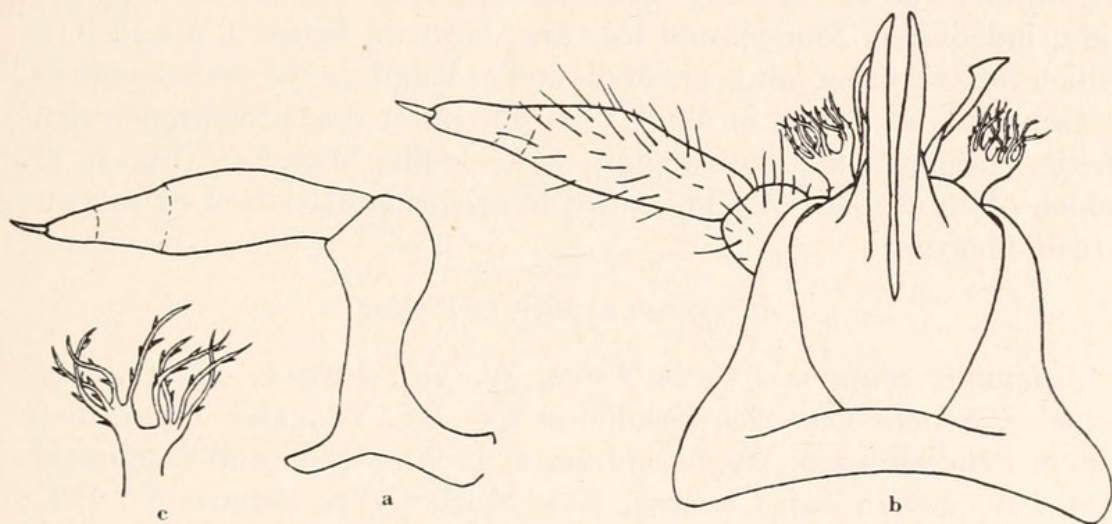


Fig. 9. *Scolerpes dendropus*. a, Ninth leg of male, posterior view; b, Gonopods and ninth leg of another specimen, anterior view; c, Apex of posterior branch of gonopod.

Head large, almost twice as wide as the first segment; cheeks and vertex strongly inflated; antennae long and slender, joint 5 definitely exceeding joint 3 in length; gnathochilarium with a large triangular mentum but no promentum.

First segment semi-circular, three-fifths as long as wide, posterior margin slightly emarginate at middle, the three setae on each side on small, sharply raised, equidistant tubercles in a straight row beginning near the posterior corner and extending forward and inward, the two rows separated by a distance equal to the length of one row; on ensuing segments the rows also are oblique and gradually become separated

to a distance double the length of a row but on the caudal segments the median space lessens and on segments 28 and 29 the six tubercles are equidistant from each other along the posterior margin; from segment 2 to near the last segments the tubercles surmount an oblique swelling or crest most prominent at the outer tubercle where a distinct shoulder is formed; all setae nearly erect, the ones on the last segments as well as those farther forward, the outer seta of each row slightly longer than the inner ones, about three-fourths the diameter of the body.

Preanal scale shaped like a broadly truncated triangle.

First and second male legs with a comb of stiff hairs ventrally; ensuing pregenital legs slightly more crassate than those of the female but without other specializations; ninth male legs variable, definitely two-jointed in some specimens or indefinitely three- or four-jointed, the leg on one side of the body often differing from that on the opposite side; indefinitely four-jointed legs are shown in figure 9, a and b, in which the two outer joints are of dissimilar length in the two specimens.

Gonopods as shown in figure 9, b, the outer posterior branch dendritic, ending in numerous spiny, tentacle-like branches, (Fig. 9, c), which often are partially imbedded in an accumulation of extraneous organic matter.

ZYGONOPUS WHITEI Ryder

A female, Simmon's Cave, Cave, W. Va., June 1, 1935; several females, Seneca Caverns, Pendleton Co., W. Va., and Trout Rock Cave, Pendleton Co., W. Va., June 1, 1935; a male and female collected in Shenandoah Caverns, New Market, Va., August 30, 1937; two females, Endless Caverns, New Market, Va., August 31, 1937.

This species has not been reported since Cook and Collins' record of a specimen collected by L. M. Underwood in Luray Cave, Va., in September, 1887.¹

The dorsal setae are considerably shorter than those of *Scoterpes* and are in a forwardly bowed row on each side of the dorsum rather than in a straight oblique line as in that genus and the tubercles supporting the setae are smaller. The lateral shoulders of the segments are less conspicuous than in *Scoterpes*.

CONOTYLA VAGA spec. nov.

The male type and many other specimens collected in South Temple Cave, Berks Co., Pa., April 28, 1935. Additional specimens collected

¹ Ann. N. Y., Acad. Sci., pp 59-62, illus., Vol. 9, 1895.

elsewhere in Pennsylvania as follows: Schofer Cave, Berks Co., April 28, 1935, June 5, 1935; Dragon Cave, Berks Co., April 28, June 5, August 3, 1935, July 22, 1938; Merkle Cave, Berks Co., Sept. 25, 1935; Aitkin Cave, Mifflin Co., Nov. 28, Dec. 12, 1936; Jan. 1, April 4, 1937; Brownstone Cave, Dauphin Co., Jan. 16, 1937; Upper Johnson Cave, Mifflin Co., Jan. 23, 1937; Crystal Grottoes, Boonesboro, Md., Sept. 2, 1937.

Diagnosis. Closely related to *C. bollmani*, from which it is indistinguishable in many features and into which it may eventually have

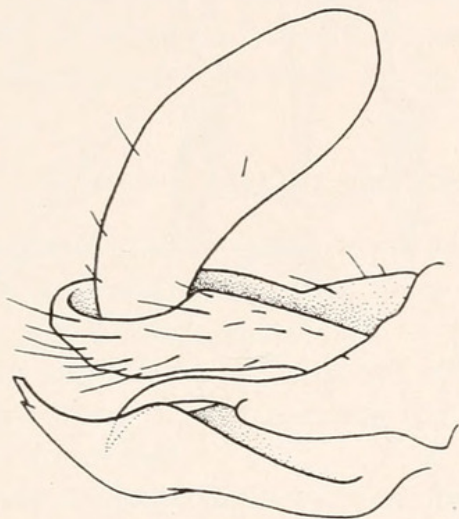


Fig. 10. *Conotyla vaga*. Gonopod and ninth leg, anterior view.

to be withdrawn, but the body is slightly smaller, the dorsum smooth and shining and the processes on the joints of anterior male legs differently arranged.

Description. Body 13–16 mm. long, shaped as in *bollmani* but the dorsal surface smooth and shining, not in the least minutely hispid.

Ocelli 19–23 in four horizontal rows, the upper one containing the most ocelli.

Gonopods (Fig. 10) differing in a few minor particulars from those of *bollmani* as illustrated by Cook and Collins, Ann. N. Y. Acad. Sci., pl. 5, fig. 79, Vol. 9, 1895.

Fourth male legs with the fourth joint simple, not equipped with a fungiform tubercle on the inner face, but such a tubercle projects from the posterior side, near the base, of the fourth joint of the seventh legs, where none is described for *bollmani*.

CONOTYLA SPECUS spec. nov.

A score of specimens, including the male type, taken from insect trap in Rice's Cave, three miles northeast of Goldman, Jefferson Co., Mo., Oct. 16, 1938, by Leslie Hubricht of the Missouri Botanic Garden. An immature and a mature male and female were collected by Kenneth Dearolf, June 7, 1938 in Fisher Cave, Meramec State Park, Mo.

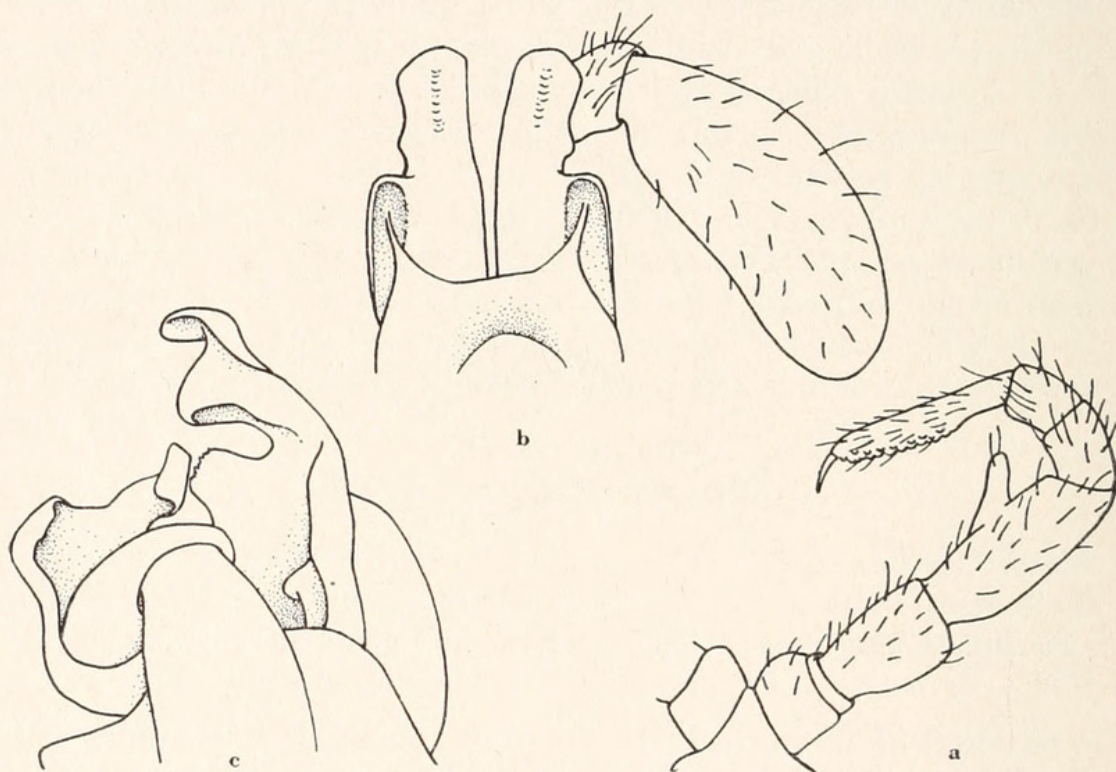


Fig. 11. *Conotyla specus*. a, Fourth male leg, anterior view; b, Gonopods and ninth leg, anterior view; c, Gonopod, outer lateral view.

Diagnosis. This is the smallest species of the genus thus far known with the exception of *C. glomerata* (Harger) and *C. wyandotte* (Bollman) both of which were based on females and later were more or less empirically placed in the genus *Conotyla*, where they have been allowed to remain pending discovery and study of males. The present species differs from them at least in the number and disposition of the ocelli.

Description. Maximum length 13 mm. Metazonites with rather irregular dark pigmentation, the prozonites with little, but the color of both obviously affected by the preservative.

Ocelli 21-23, in a quadrangular rather than triangular patch.

Segments with the humeral swellings distinct but not especially strongly projecting; preanal scale semi-circular behind or even a little more sharply rounded.

Males with first and second legs normal but for a comb of stiff hairs beneath the last joint; third and fourth legs with a relatively long digitate lobe on the ventral side of joint 4 at middle, that of the fourth leg largest (Fig. 11, a); joints 3 and 4 of these two pairs of legs stouter than the same joint of the adjacent legs; fifth, sixth, and seventh legs with granulations beneath the outer joint as on the third and fourth legs but without other specializations; tenth legs with the process on the anterior face of each coxa prominent, knob-like, the basal portion slightly constricted; eleventh and twelfth legs normal.

Gonopods and ninth legs as shown in figure 11, b and c.

TINGUPA PALLIDA spec. nov.

Two entire specimens, one the male type, and five broken ones collected in River Cave, Hahatunka, Mo., June 8, 1938.

Diagnosis. The light color; small size of the body; comparative lengths of antennal joints 3 and 5; reduced number of ocelli; and the structure of the gonopods are characters distinguishing this species from those already described.

Description. Body without pigmentation, the ocelli dark brown or black; length 5 to 6 mm.

Head with vertex sharply rounded but without surface modifications except evenly scattered erect setae similar to those elsewhere on the surface but less abundant; ocelli 8 to 12 in number, arranged in two to four horizontal rows, usually a single ocellus uppermost below which the ocelli may be arranged in rows as follows: 5, 4, 2; 5, 4; 5, 3 or 5, 2; one specimen has an eye composed of 10 ocelli, six above and four below; antennae moderately slender, the third joint definitely longer than the fifth which exceeds all others in width (Fig. 12, a).

Segments with dorsal sculpture as described for the genus, composed of many tiny, short, longitudinal crests without definite arrangement; dorsal setae slightly clavate, one projecting backward and outward from the margin just mesad of the posterior corner of the lateral keel; the other two setae on each side are directed upward and inwards, one from a broad depression at the anterior junction of the lateral keel with the body, the innermost seta from near the anterior margin of the metazonite half way between the second seta and the median line of the segment; lateral keels thick, distinctly bent forward on all but

eight or ten of the last segments, the outer margin rounded in outline, granular; segment 27 with keels suddenly reduced in size, those of segment 28 almost obsolete, entirely lacking from segment 29; posterior end of body gradually narrowing to the truncate apex of the last segment.

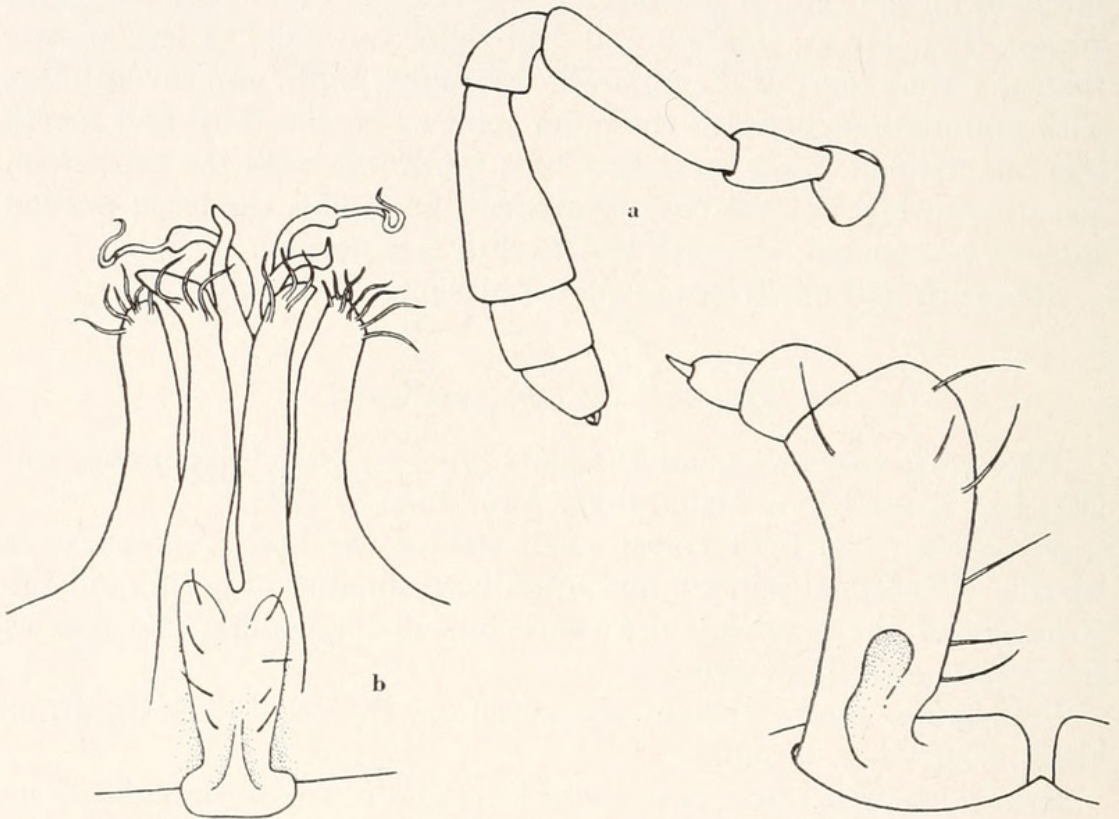


Fig. 12. *Tingupa pallida*. a, Antenna; b, Gonopods, *in situ*, vertical view; c, Ninth leg of male, anterior view.

Gonopods as shown in figure 12, b; they are held horizontally outside the body and project back between the coxae of the ninth legs and cover those of the tenth pair.

Ninth male legs three-jointed and with a tiny claw as shown in figure 12, c; the basal joint L-shaped with a long transverse basal portion from the outer part of which arises an upright shaft supporting the two small terminal joints, the erect shaft excavated on the front face at base.

Legs in front of the gonopods slightly more crassate than those of the female but otherwise unmodified.¹

¹ It seems desirable to report the collection of *Striaria columbiana* Cook in Allen's Cave, Front Royal, Va., July 3, 1938, by H. S. Barber, U. S. Bureau of Entomology, Washington, D. C.

POLYDESMUS HORTUS Wms. & Hef.

A single male, Lisburn Cave, York County, Penn., Jan. 16, 1937.

POLYDESMUS MONILIARIS (Koch)

A young male, Brownstone Cave, Dauphin County, Penn., Sept. 3, 1937.

POLYDESMUS SERRATUS Say

A female, Schofer Cave, Berks County, Penn., April 28, 1935.

POLYDESMUS sp.

A male, Creek Bed Cave, Rising Fawn, Ga., August 30, 1935.

This species is quite close to, if not identical with, *P. americanus* Carl but the gonopods show minor variations which may exclude it from that species when further study of sufficiently large suites of specimens allows appraisal of the constancy of these differences.

POLYDESMUS sp.

Fragments of two specimens, Merkle Cave, Berks Co., Pa., Aug. 25, 1938.

SPEODESMUS gen. nov.

Type. *S. echinourus* spec. nov.

Diagnosis. This tiny cave milliped, while having the general outlines of other polydesmids, has several striking generic differences. The dorsum of the segments lacks swollen, quadrate areas, or a transverse furrow, and there are more seta-bearing tubercles in each of the three transverse series than is customary. Most noteworthy character and extreme departure, however, is the peculiar preanal scale with its numerous long setae. The coxal joints of the gonopods also are unusually large.

Description. Body colorless, small, slender, delicate; number of segments 20.

Head subglobular, wider than segment one; vertex evenly inflated, with a fine, distinct median sulcus; surface with minute short scattered setae except on the posterior half of the vertex which is glabrous; an-

tennae long and slender; joint 6 with a sensory organ on the upper side near apex.

First segment semicircular, the posterior margin straight across; a series of small seta-bearing tubercles just behind the front margin, a similar series across the middle of the segment and another at the posterior margin.

Second segment equalling the head in width and wider than segments 1, 3, or 4, the outer margin of the keels longer than on the next two segments and with six or seven more or less distinct teeth; this and succeeding segments with three transverse rows of setiferous tubercles, those of the posterior row projecting slightly beyond the back margin; outer margin of the keels of segments 3 to 18 with five distinct teeth, including the produced posterior corner of the segment; surface of segments smooth between the tubercles, the dorsum with a very shallow, indefinite, transverse depression between the first and second row of tubercles; pores in normal sequence, opening on the dorsum at the base of the produced posterior corner of the carina; penultimate segment with lateral keels much smaller than on the foregoing segment, the posterior angles much less produced; last segment conical, with a short decurved mucro, dorsal setae apparently not in definite arrangement; anal valves strongly and evenly inflated, the inner margins thinly elevated; preanal scale the shape of a truncated triangle, the surface and margin of the apical half with a dozen or more tubercles each bearing a long stiff seta.

Legs long and slender, the terminal joint much exceeding the others in length; joints 2, 3, and 4 of the males with nodular granulations below. Gonopods with basal joint large and swollen, the terminal joint horizontal, curving inward, instead of being vertical and curving away from the body as in *Polydesmus*.

SPEODESMUS ECHINOURUS spec. nov.

Ten specimens, including the male type, from Prassel Ranch Cave, Kerrville, Texas, June 17, 1938, numerous other specimens from Schneider Cave and Cascade Cave, Boerne, Texas, June 17 and 18, 1938, and a single female from Ezell's Cave, San Marcos, Texas, June 21, 1938.

Description. Size small, 10 to 11 mm long; slender; white or colorless, with the dark median ganglion showing through the integument of the middle and last segments; shape resembling that of other small polydesmids.

Head subglobular; the vertex evenly inflated and with a fine impressed sulcus; surface sparsely hispid except at the back of the vertex;

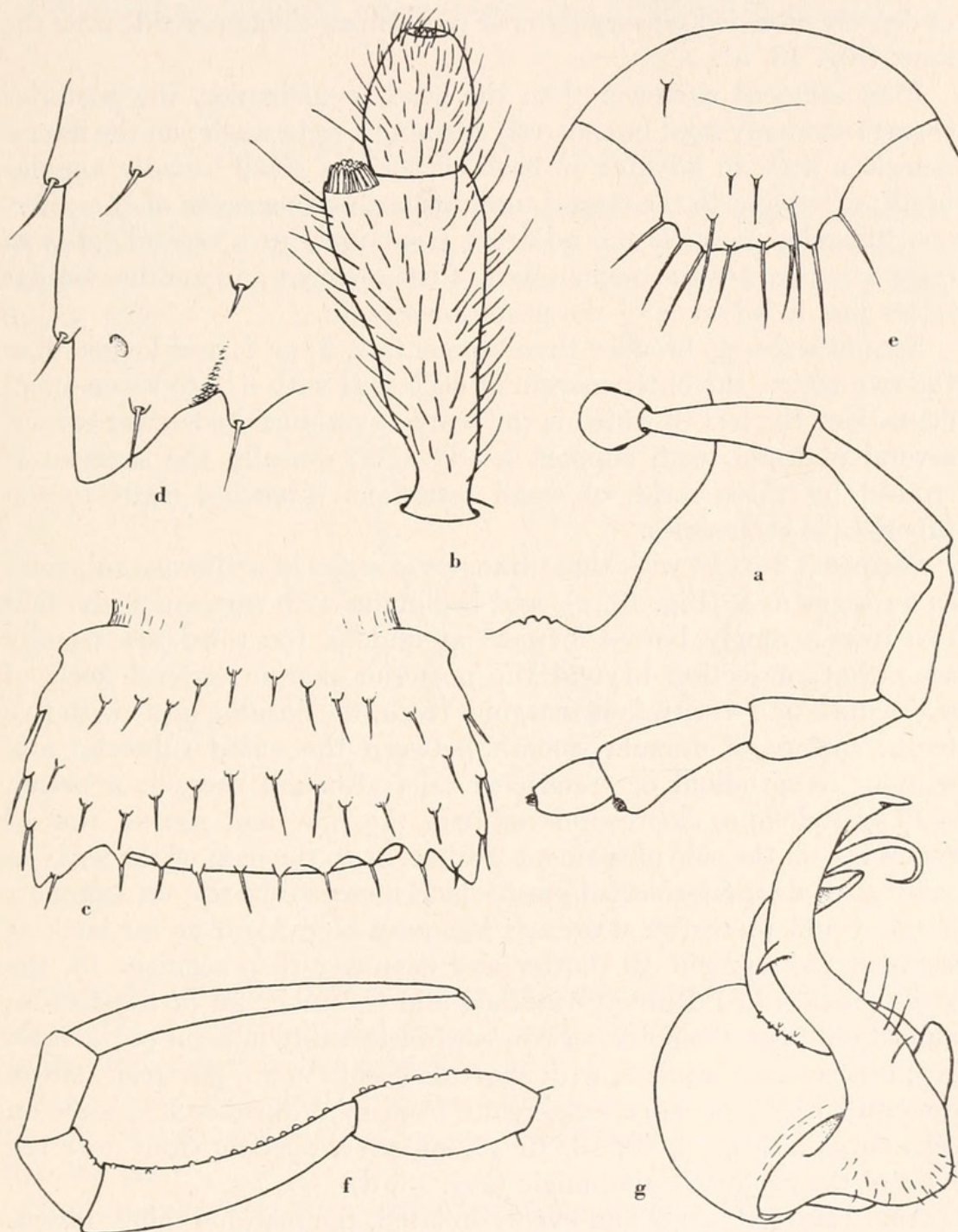


Fig. 13. *Speodesmus echinourus*. a, Part of head, with antenna, anterior view; b, Joints 6 and 7 of antenna; c, Segment 8; d, Posterior corner of segment 10, with pore; e, Preanal scale; f, Joints 2 to 6 of male leg from middle of body; g, Left gonopod, vertical view.

antennae (Fig. 13, a) slender, long, capable of extending back over the dorsum nearly to the posterior border of segment 4; joints 2, 3, 4, and 6 subequal, 5 slightly shorter; joint 6 widest and with a rounded area of densely crowded sensory hairs or papillae on the upper side near the apex (Fig. 13, b).

First segment narrower than the head, semicircular, the posterior corners suddenly bent but scarcely forming a right angle; on the lateral margin a little in advance of each corner is a small broadly angular tooth; extending to the lateral tooth on each side a series of 14 setiferous tubercles parallels the adjacent front margin; a second series of eight setae crosses the median part of the segment and another similar series just in advance of the posterior margin.

Second segment broader than segments 1, 3, or 4, and longer than the two latter, the outer margin of each keel with five to seven small dentations the last of which is the scarcely produced posterior corner, several of these teeth support a stiff seta; dorsally the segment is crossed by three series of small setiferous tubercles, eight to ten tubercles in each series.

Segments 3 to 18 with three transverse series of setiferous tubercles as on segment 2 (Fig. 13, c), and beginning with segment 6 the first two rows strongly bowed forward at middle, the third row usually somewhat projecting beyond the posterior margin; lateral keels of segments 3 and 4 with four marginal teeth, the ensuing keels with five teeth; surface of dorsum smooth between the series of tubercles and without longitudinal or transverse sulci although there is a broad, shallow indefinite depression between the first and second row of tubercles; on the side of segment 2 adjacent to the base of the legs is a small two- or three-toothed crest which increases in size on segments 3 and 4 and thereafter decreases but may be evident as far back as segment 15; segment 19 shorter and narrower than segment 18, the keels smaller, less distinctly toothed and the tubercles of the dorsum almost obsolete, the posterior row set considerably in front of the margin; last segment conical, with short deflexed mucro, posterior half of dorsum with 12 or more setae rising from minute tubercles; pores on segments 5, 7, 9, 10, 12, 13, 15-19, superior, opening from near the base of the produced hind angle (Fig. 13, d).

Anal valves strongly and evenly inflated, the margins thinly raised. Preanal scale as shown in figure 13, e.

Legs moderately long and slender, first or coxal joint small; joint 2 heavy, tapering to both ends from the middle; ensuing joints more slender, the sixth joint longest and slenderest, followed in length by

joint 3; in the male, joints 2, 3, and 4 have tiny granular tubercles on the ventral surface (Fig. 13, f), otherwise the legs show no secondary sex modifications.

Gonopods as described for the genus and as shown in figure 13, g.

BRACHYDESMUS PALLIDUS spec. nov.

A number of mature and immature specimens, including the male type, Lakeland Cave, Charleston, W. Va., Sept 2, 1937; two males, a female and a young specimen, Lawson Cave, Burks Garden, Va., July 3, 1937.

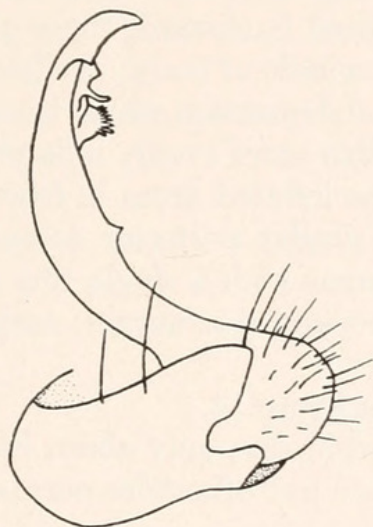


Fig. 14. *Brachydesmus pallidus*. Gonopod, outer lateral view.

Diagnosis. Smaller than *gladiolus*, the only other definitely known member of the genus in the eastern part of this country, and with obvious differences in the gonopods.

Description. Size small, not exceeding 8 mm. in length; segments, 19; color white or very pale brown, the antennae apparently darker than the body.

Head subglobular, the vertex broadly rounded, finely sulcate at middle, surface dull, minutely pitted; remainder of head, including the very prominent mandibular stipes, finely hispid. Antennae strongly clavate, the sixth joint over twice as thick as the basal joints; joint 3 longest.

First segment subelliptical, the anterior margin more broadly rounded than the posterior margin; a row of ten small setae immediately behind the front margin, six setae across middle and ten in front of the back margin, the outer seta of this series in the lateral angle and capable of being included as belonging to the anterior row when the count would be 12-6-8; all setae on tiny tubercles; surface otherwise smooth.

Second segment with carinae slightly produced forward; the outer margin long, exceeding that of the next segment, with four tiny teeth, the foremost smallest, at times scarcely evident; succeeding non-poriferous segments with carinae 4-dentate, the poriferous carinae 5-dentate, with the anterior corner more angular and bearing a tiny tooth, the pores opening obliquely outward from between the fourth and fifth teeth, not opening from the dorsal surface; posterior corners of carinae slightly produced backward, those of the caudal segments slightly more so than at middle of body; poriferous carinae inflated on each side of a longitudinal depression which is scarcely indicated in the other segments, the surface more evenly inflated; dorsum of segments with two large transverse inflated areas in front, four small quadrate median areas and four similar posterior areas with a much smaller area on either side, all areas with a single tiny seta, those of the posterior areas projecting beyond the margin; entire surface of segments shining.

Gonopods as shown in figure 14.

First male legs reduced in size, only about half as large as legs 3-7, which are slightly crassate but otherwise normal.

CHAETASPIS ALBUS Bollman

A female, White's Cave, Cave City, Ky., June 29, 1937.

Although this is the first record of this species as a cave resident, it seems probable it will be found in other caves, as it appears to go deeper in the surface soil or humus than other members of the family and would find cave conditions quite to its liking.

SCYTONOTUS GRANULATUS (Say)

One specimen in bottle labeled "Dragon and Schofer Caves, Berks County, Penn., June 5, 1935."



Loomis, H. F. 1939. "The millipeds collected in Appalachian caves by Mr. Kenneth Dearolf." *Bulletin of the Museum of Comparative Zoology at Harvard College* 86(4), 165–193.

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