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NEW SPECIES OF *APOCHTHONIUS*, MAINLY FROM  
CAVES IN CENTRAL AND EASTERN UNITED STATES  
(PSEUDOSCORPIONIDA, CHTHONIIDAE)

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Since my earlier publication on cave species of *Apochthonius* (Muchmore, 1967), many interesting specimens belonging to this genus have been collected, another species has been described (Benedict and Malcolm, 1973), and the genus has been given a firmer base by the redescription of the type species, *Apochthonius moestus* (Banks) (Muchmore and Benedict, 1976). Though there is still very little knowledge about the common epigean forms of *Apochthonius* in the eastern United States, lack of time prohibits a comprehensive treatment of the genus now. However, it does seem worthwhile to describe several new cave-associated species, which will improve our understanding of the cavernicolous fauna. Types of the new species are deposited in the Florida State Collection of Arthropods in Gainesville, Florida.

Family Chthoniidae Hansen  
Genus *Apochthonius* Chamberlin

The diagnostic characters of this genus are presented at length by Muchmore and Benedict (1976).

***Apochthonius titanicus*, new species**

Figures 1-3

*Material*: Holotype male (WM 1383.01001) and two paratype tritonymphs found under a bit of paper near "The Titans" in Blanchard Springs Caverns, three miles east of Fifty Six, Stone County, Arkansas, 27 September 1967 (Thomas C. Barr, Jr. and Terry Marsh).



**Diagnosis:** A large species of *Apochthonius*, with only two eyes and attenuated appendages; generally similar to *A. malheuri* Benedict and Malcolm (1973), but with only eight setae, rather than ten, at anterior margin of carapace. Of similar size and proportions to *A. typhlus* Muchmore (1967), but with two eyes rather than none.

**Description of holotype male:** With the general features of the genus (see Muchmore and Benedict, 1975). All sclerotized parts light tan. Carapace about as long as broad, distinctly narrowed posteriorly; with small denticulate epistome; two indistinct eyes, about two ocular diameters from anterior margin; chaetotaxy 8-4-4-2-4 = 22. Abdomen typical; tergal chaetotaxy 4:4:6:6:6:8:8:9:8:6:1T2T1:0; sternal chaetotaxy 13:[4-4]:(4) $\frac{8-7}{4-4}$ (4):(4)6(4):13:13:13:12:11:T2T2T2T:0:2. Coxal chaetotaxy 2-2-1:3-0-CS:3(2)-2(3):2-3:2-3; each coxa I with three spine-like setae of the usual kind, the anterior and posterior bases on each side with long prominent spurs, the middle base poorly developed and without a spur (Fig. 1); no intercoxal tubercle.

Chelicera 0.88 as long as carapace; hand with seven setae; fixed finger with 12 marginal teeth, and movable finger with five, including one isolated subterminally; spinneret a barely discernible elevation of the finger margin; serrula exterior with 18 blades; flagellum of eight pinnate setae.

Palp relatively large and slender (Fig. 2); femur 1.25 and chela 1.90 times as long as carapace; trochanter 1.9, femur 5.7, tibia 2.2, and chela 5.9 times as long as broad; movable finger 2.04 times as long as hand. Trichobothria typical, as in Fig. 3. Fixed finger with 98 and movable finger with 77 contiguous, marginal teeth evenly graded in size with none conspicuously larger than adjacent ones. Movable finger with rounded sensillum on external surface, closer to *st* than to *sb*.

Legs slender; leg IV with entire femur 3.3 and tibia 5.0 times as long as deep. Tactile setae on tibia and both tarsi of leg IV.

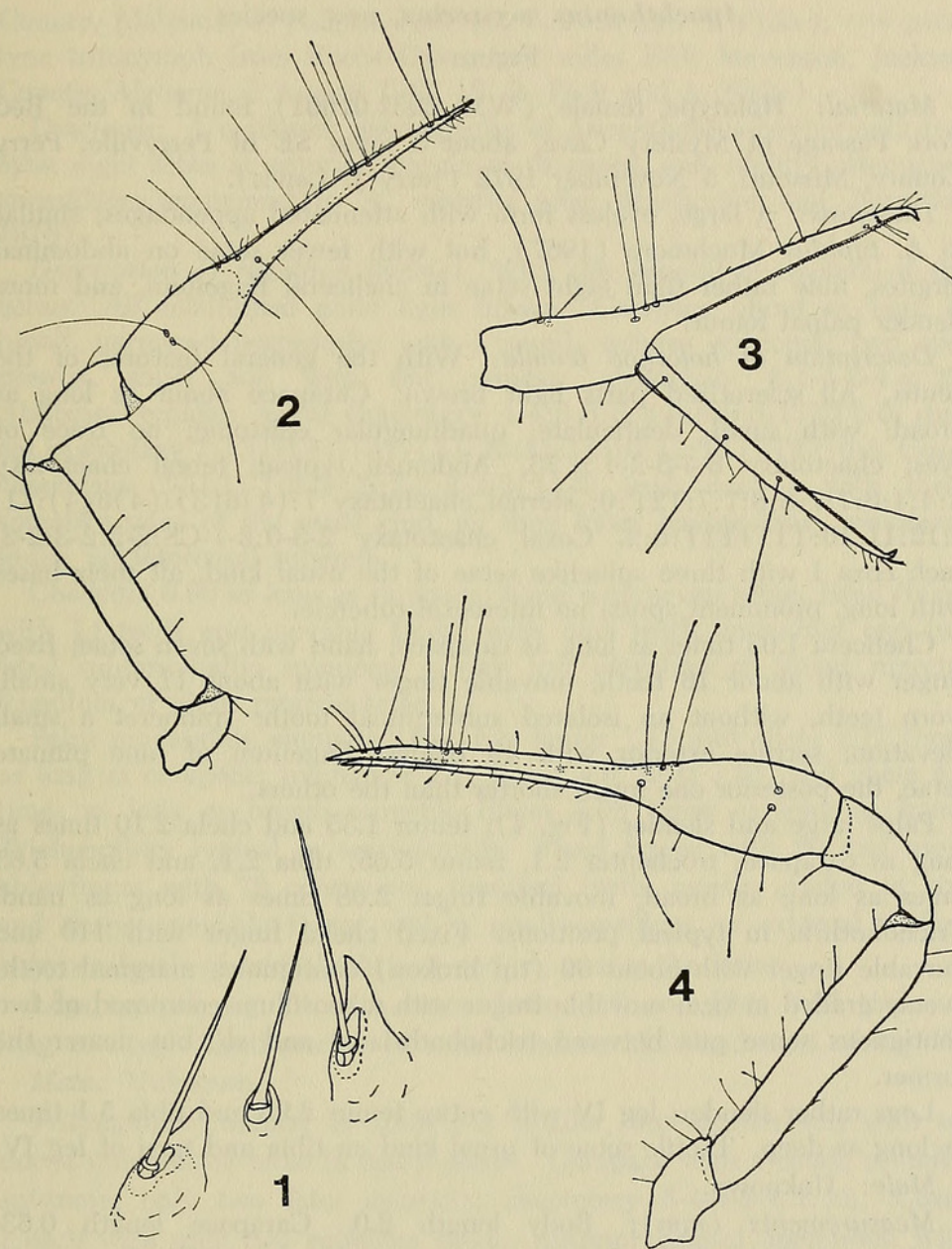
**Female:** Unknown.

**Tritonymph:** Much like adult but smaller and paler. Carapacial chaetotaxy 8-4-4-2-4 = 22. Coxal chaetotaxy 2-2-1:3-0-CS:2-2:1-3:1-3; each coxa I with two spinelike setae, each base with a long prominent spur. Sternal chaetotaxy 4:(1)6(1):(1)6(1):9:10:10:11:11:T1T1T1T:0:2. Hand of chelicera with six setae; flagellum of seven pinnate setae; spinneret a distinct, low elevation. Fixed finger of palpal chela with about 83 and movable finger with about 67 contiguous marginal teeth, none of unusual size or proportions.

**Measurements (mm):** Holotype male: Body length 2.01. Carapace length 0.59. Chelicera 0.525 by 0.23. Palpal trochanter 0.245 by 0.13; femur 0.74 by 0.13; tibia 0.355 by 0.16; chela 1.12 by 0.19; hand 0.385 by 0.185; movable finger 0.785 long. Leg IV: entire femur 0.615 by 0.185; tibia 0.45 by 0.09; metatarsus 0.23 by 0.065; telotarsus 0.41 by 0.05.

**Tritonymph:** Body length 1.56–1.62. Carapace length 0.445–0.46.





FIGS. 1-3. *Apochthonius titanicus*, new species. 1, Coxal spines on left coxa I; 2, Dorsal view of left palp; 3, Lateral view of right chela.

FIG. 4. *Apochthonius mystereus*, new species. Dorsal view of right palp.

Chelicera 0.40-0.445 long. Palpal femur 0.53 by 0.105-0.11; tibia 0.265-0.27 by 0.13-0.14; chela 0.835-0.86 by 0.14-0.15; hand 0.29 by 0.15-0.155; movable finger 0.555-0.57 long.

*Etymology*: The species is named *titanicus* for the large stalagmites, "The Titans," near which the specimens were found in Blanchard Springs Cave.



***Apochthonius mysterius*, new species**

## Figure 4

**Material:** Holotype female (WM 2932.01001) found in the Red Fork Passage of Mystery Cave, about 5 miles SE of Perryville, Perry County, Missouri, 5 November 1972 (Jerry J. Lewis).

**Diagnosis:** A large, eyeless form with attenuated appendages; similar to *A. typhlus* Muchmore (1967), but with fewer setae on abdominal tergites, nine rather than eight setae in cheliceral flagellum, and more slender palpal femur.

**Description of holotype female:** With the general features of the genus. All sclerotized parts light brown. Carapace about as long as broad; with small, denticulate, quadrangular epistome; no trace of eyes; chaetotaxy 8-4-5-2-4 = 23. Abdomen typical; tergal chaetotaxy 2:4:4:6:7:7:8:8:7:7:T2T:0; sternal chaetotaxy 7:(4)6(3):(4)6(4):11:9:12:11:10:T1T1T1T:0:2. Coxal chaetotaxy 2-3-0:2-1-CS:2-2:2-3:2-3; each coxa I with three spinelike setae of the usual kind, all their bases with long, prominent spurs; no intercoxal tubercle.

Chelicera 1.03 times as long as carapace; hand with seven setae; fixed finger with about 16 teeth; movable finger with about 11 very small, worn teeth, without an isolated subterminal tooth; spinneret a small elevation; serrula exterior with 19 blades; flagellum of nine pinnate setae, the posterior one much shorter than the others.

Palps large and slender (Fig. 4); femur 1.35 and chela 2.10 times as long as carapace; trochanter 2.1, femur 5.65, tibia 2.1, and chela 5.65 times as long as broad; movable finger 2.08 times as long as hand. Trichobothria in typical positions. Fixed chelal finger with 110 and movable finger with about 90 (tip broken) contiguous, marginal teeth, evenly graded in size; movable finger with a sensillum composed of two contiguous sense pits between trichobothria *st* and *sb*, but nearer the former.

Legs rather slender; leg IV with entire femur 2.95 and tibia 5.1 times as long as deep. Tactile setae of usual kind on tibia and tarsi of leg IV.

**Male:** Unknown.

**Measurements (mm):** Body length 2.0. Carapace length 0.63. Chelicera 0.65 by 0.30. Palpal trochanter 0.325 by 0.155; femur 0.85 by 0.15; tibia 0.39 by 0.185; chela 1.325 by 0.235; hand 0.445 by 0.235; movable finger about 0.925 long. Leg IV: entire femur 0.68 by 0.23; tibia 0.51 by 0.10; metatarsus 0.245 by 0.075; telotarsus 0.465 by 0.055.

**Etymology:** The species is named for Mystery Cave, where it is found.

***Apochthonius russelli*, new species**

## Figure 5

**Material:** Holotype female (WM 1289.01001) found in the Pig Entrance of Russell Cave, Russell Cave National Monument, Jackson



County, Alabama, 17 August 1967 (S. B. Peck and A. Fiske); one paratype tritonymph from Reece Cave, four miles ESE Stevenson, Jackson County, Alabama, 3 August 1967 (S. B. Peck and A. Fiske).

*Diagnosis:* A moderate sized species of *Apochthonius* having only two eyes, eight setae at anterior margin of carapace, and slightly attenuated appendages compared to *A. moestus* (See Muchmore and Benedict, 1976).

*Description of holotype female:* With the general characters of the genus. All sclerotized parts light brown. Carapace about as long as broad, narrowed posteriorly; with a small, spinous epistome; two eyes present, small and with flat corneas; chaetotaxy 8-4-4-2-4 = 22. Abdomen typical: tergal chaetotaxy 4:4:6:6:6:8:9:8:9:6:1T2T1:0; sternal chaetotaxy 7:(3)7(3):(4)7(3):12:11:11:10:12:T1T2T2T:0:2. Coxal chaetotaxy 2-1(2)-1:2-0-CS:2-2:2-3:2(1)-3; each coxa I with three spinelike setae of the usual kind, all their bases having long, prominent spurs; no intercoxal tubercle.

Chelicera 0.98 as long as carapace; hand with seven setae; fixed finger with 14 teeth and movable finger with nine teeth, including one isolated subterminally; spinneret a very low elevation of finger margin; flagellum of eight pinnate setae.

Palps moderately elongate (Fig. 5); femur 1.15 and chela 1.77 times as long as carapace; trochanter 1.7, femur 4.6, tibia 1.85, and chela 4.7 times as long as broad; movable finger 1.98 times as long as hand. Trichobothria typical in arrangement. Fixed finger with 80 and movable finger with 72 contiguous, marginal teeth, evenly graded in size and shape; movable finger with a small sensillum on external surface between levels of trichobothria *st* and *sb*, nearer the latter.

Legs typical; leg IV with entire femur 2.8 and tibia 4.05 times as long as deep. Tactile setae of usual kind on tibia and tarsi of leg IV.

*Male:* Unknown.

*Tritonymph:* Similar to adult but smaller, less slender and with reduced numbers of setae in many places. Carapace with a small, rounded epistome; only two faint eyespots; chaetotaxy 8-4-4-2-4 = 22. Coxae I each with only two spinelike setae. Anterior genital operculum with four small setae. Cheliceral hand with six setae, and flagellum of seven pinnate setae. Palpal femur 4.1, tibia 1.8, and chela 4.6 times as long as broad. Fixed chelal finger with 59 and movable finger with 53 marginal teeth; movable finger with a small sensillum just proximad of *st*.

*Measurements (mm):* Holotype female: Body length 1.65. Carapace length 0.48. Chelicera 0.47 by 0.245. Palpal trochanter 0.215 by 0.125; femur 0.555 by 0.12; tibia 0.28 by 0.15; chela 0.85 by 0.18; hand 0.295 by 0.18; movable finger 0.585 long. Leg IV; entire femur 0.45 by 0.16; tibia 0.325 by 0.08; metatarsus 0.15 by 0.065; telotarsus 0.29 by 0.045.

*Tritonymph:* Body length 1.00. Carapace length 0.33. Palpal femur



0.33 by 0.08; tibia 0.18 by 0.10; chela 0.51 by 0.11; hand 0.185 by 0.115; movable finger 0.35 long. Leg IV: entire femur 0.28 by 0.11.

*Etymology*: The species is named for Russell Cave, where the holotype was found.

*Remarks*: This is the first record of a definitely troglobitic species of *Apochthonius* from a southern state, previous such species being known from the mideastern states of Virginia and West Virginia and from the midwestern states of Indiana, Missouri and Arkansas. It is from an area in northeastern Alabama where troglobitic species of *Tyrannochthonius* are not uncommon (see Chamberlin and Malcolm, 1960).

### ***Apochthonius minor*, new species**

Figures 6 and 7

*Material*: Holotype male (WM 1275.02002) and two paratype males from litter at entrance to Parker Cave, 2 miles NE of Subligna, Chatooga County, Georgia, on 20 June 1967 (S. Peck and A. Fiske). One female paratype from Morrison Cave, 2 miles E of Trenton, Dade County, Georgia, on 13 July 1967 (S. Peck and A. Fiske).

*Diagnosis*: A small species of *Apochthonius*, with only two distinct eyes and rather robust appendages. In size it is close to *A. minimus* Schuster (1966), but it differs from that species and from the larger *A. moestus* (Banks) in having only eight setae along the anterior margin of the carapace, rather than ten (see Muchmore and Benedict, 1976).

*Description of male*: With the general features of the genus. All sclerotized parts light brown. Carapace about as long as broad, somewhat narrowed posteriorly; small spinous epistome present; two small corneate eyes in anterior position, at most, very faint, none-corneate eyespots in posterior position; chaetotaxy 8-4-4-2-4 = 22. Abdomen typical; tergal chaetotaxy of holotype 4:4:6:7:7:8:9:9:8:6:1T2T1:0; sternal chaetotaxy of holotype 12:[4-4]:(3)<sup>7-6</sup><sub>4-4</sub>(3):(3)6(2):12:11:11:11:12:T2T2T2T:0:2. Coxal chaetotaxy 2-3-0:3-0-CS:2-2:2-3:2-3; each coxa I with three spinelike setae of the usual kind, all bases with small spurs; no intercoxal tubercle.

Chelicera about 0.85 as long as carapace; hand with seven setae; fixed finger with about 10 teeth, movable finger with seven, including one isolated subterminally; spinneret absent, though openings of silk ducts can be seen at the finger margin; serrula exterior with about 15 blades; flagellum apparently of eight pinnate setae.

Palps relatively short and stout (Fig. 6); femur about 0.95 and chela about 1.53 as long as carapace; trochanter 1.6-1.65, femur 4.0-4.3, tibia 1.75-1.9 and chela 4.5-4.7 times as long as broad; movable finger 1.94-2.06 times as long as hand. Trichobothria arranged as in Figure 7. Fixed chelal finger with 45-51 and movable finger with 52-53 contiguous, marginal teeth; distal 35-40 teeth on fixed finger and distal



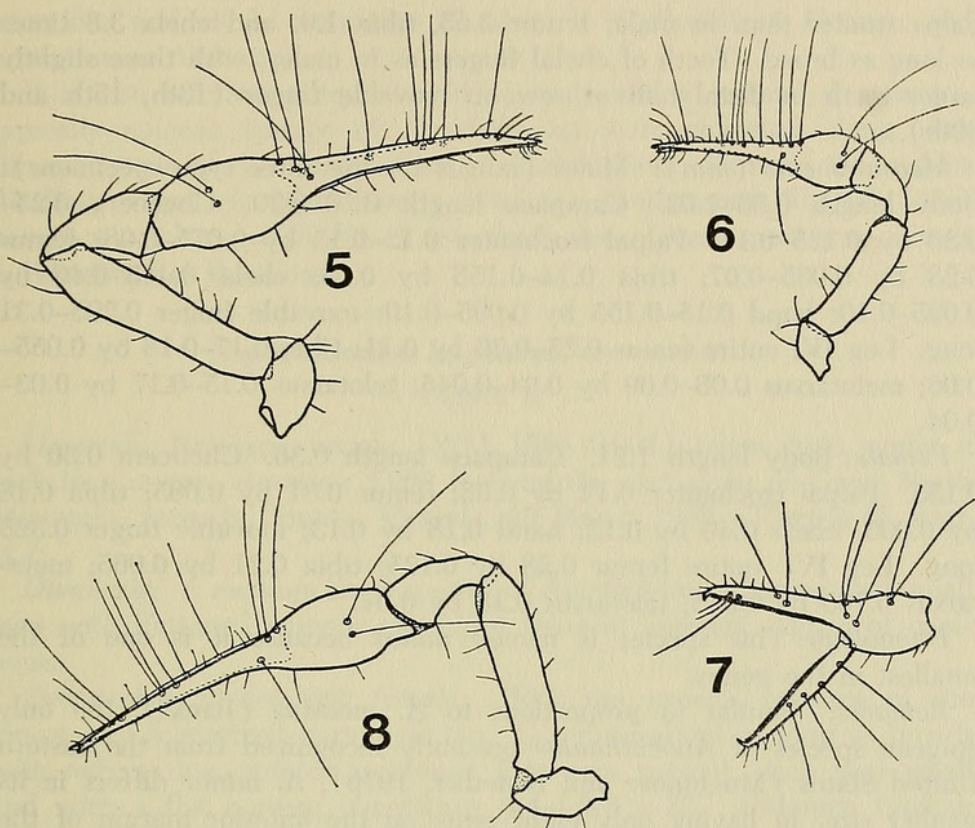


FIG. 5. *Apochthonius russelli*, new species. Dorsal view of left palp.

FIGS. 6 and 7. *Apochthonius minor*, new species. 6, Dorsal view of right palp; 7, Lateral view of left chela.

FIG. 8. *Apochthonius hypogeus*, new species. Dorsal view of right palp.

25–30 on movable finger distinctly cusped, more basal ones rounded and lower; most teeth evenly graded in size, but movable finger with four or five larger ones in distal half of row (15th, 17th, 20th, 24th, and 28th in holotype). Movable finger with a prominent, elevated, rounded sensillum on external surface between trichobothrium *st* and the dental row (at level of teeth 38–40).

Legs rather robust; leg IV with entire femur 2.3–2.35 and tibia 3.0–3.1 times as long as deep. Tactile setae of usual kind on tibia and tarsal segments of leg IV.

*Female*: Much like the male, but slightly larger and more robust. No posterior eyespots visible on carapace. Tergal chaetotaxy 4:4:8:8:9:10:9:9:9:6:1T2T1:0; sternal chaetotaxy 8:(3)5(3):(3)8(3):11:11:11:11:13:T2T2T2T:0:2. Coxal chaetotaxy as in the males, but only two spinelike setae present on right coxa I, while left coxa I has the usual three. Movable finger of chelicera with a distinct knoblike spinneret.



Palps stouter than in male; femur 3.65, tibia 1.9, and chela 3.8 times as long as broad. Teeth of chelal fingers as in males, with three slightly larger teeth in distal half of row on movable finger (13th, 15th and 20th).

*Measurements (mm)*: Males (ranges for the three type specimens): Body length 0.88–1.02. Carapace length 0.29–0.30. Chelicera 0.25–0.26 by 0.125–0.14. Palpal trochanter 0.12–0.13 by 0.075–0.08; femur 0.28 by 0.065–0.07; tibia 0.14–0.155 by 0.08; chela 0.445–0.46 by 0.095–0.10; hand 0.15–0.155 by 0.095–0.10; movable finger 0.295–0.31 long. Leg IV: entire femur 0.25–0.26 by 0.11; tibia 0.17–0.18 by 0.055–0.06; metatarsus 0.08–0.09 by 0.04–0.045; telotarsus 0.15–0.17 by 0.03–0.04.

*Female*: Body length 1.21. Carapace length 0.36. Chelicera 0.30 by 0.155. Palpal trochanter 0.14 by 0.08; femur 0.31 by 0.085; tibia 0.18 by 0.095; chela 0.49 by 0.13; hand 0.18 by 0.13; movable finger 0.325 long. Leg IV: entire femur 0.28 by 0.125; tibia 0.21 by 0.065; metatarsus 0.105 by 0.045; telotarsus 0.18 by 0.04.

*Etymology*: This species is named *minor* because it is one of the smallest in the genus.

*Remarks*: Similar in proportions to *A. moestus* (Banks), the only epigean species of *Apochthonius* presently recognized from the eastern United States (Muchmore and Benedict, 1976), *A. minor* differs in its smaller size, in having only eight setae on the anterior margin of the carapace, and in having the posterior pair of eyes reduced or absent. This last feature is most interesting in view of the fact that the species has been found both inside and outside of caves. Reduction of the eyes to this extent (virtual loss of the posterior pair) has heretofore been seen in *Apochthonius* only in forms that are almost certainly troglomorphic (see Benedict and Malcolm, 1973). It appears probable then that *A. minor* lives in the soil well away from light and perhaps preferably in rock crevices and the mouths of caves, whence it would be easy to move right into the caves, at least occasionally.

Because the possession of three coxal spines on each coxa I is almost invariable in *Apochthonius*, it is noteworthy that the single known female of *A. minor* has only two such spines on right coxa I. This condition may be teratological or may be indicative of a tendency toward reduction in the number of spines in this species.

The occurrence of *A. minor*, one of the smallest species of the genus, in Chatooga County, Georgia, is reminiscent of the presence of *Microcreagris pumila*, one of the smallest *Microcreagris*, in the same place (see Muchmore, 1969). In addition to small size, both have stouter appendages than most species of their respective genera, both are paler than usual, and both have the posterior pair of eyes reduced or lacking. It seems likely that the two species have been modified in similar ways to meet the same conditions (whatever they may be) in hypogean



situations and at the entrances of caves in northwestern Georgia and northeastern Alabama.

It is also interesting to note that a male and a female of a larger, typically epigean species of *Apochthonius* were collected along with the specimens of *A. minor* outside of Parker Cave. Because the surface dwelling forms of *Apochthonius* from the southeastern United States have not yet been studied and described, these larger specimens cannot be identified at this time.

***Apochthonius hypogeus*, new species**

Figure 8

**Material:** Holotype female (WM 1552.01001) taken from under a rock in a ravine, elevation 3,000 feet, on the east slope of Great North Mountain, Augusta County, Virginia, 20 March 1968 (Thomas C. Barr, Jr.).

**Diagnosis:** A medium sized species of *Apochthonius*, having four small eyes with flattened corneas and eight setae at anterior margin of carapace.

**Description of holotype female:** With the general features of the genus. All sclerotized parts pale tan. Carapace about as long as broad; with only a tiny, spinous epistome; four eyes present, each very small and with a flat cornea; chaetotaxy 8-4-4-2-4 = 22. Abdomen typical; tergal chaetotaxy 4:4:7:7:7:8:9:9:9:7:1T1T1:0; sternal chaetotaxy 8: (3)8(3):(4)6(4):12:12:12:12:14:T2T2T2T:0:2. Coxal chaetotaxy 2-2-1:3-0-CS:2-2:2-3:2-3; each coxa I with three spinelike setae of the usual kind, their bases having very short anterior spurs; no intercoxal tubercle.

Chelicera 0.91 as long as carapace; hand with seven setae; fixed finger with nine teeth, and movable finger with five small teeth, including one isolated subterminally; spinneret a small, but distinct, elevation; flagellum apparently of eight pinnate setae.

Palps only moderately slender (Fig. 8); femur 1.02 and chela 1.67 times as long as carapace; trochanter 1.9, femur 4.35, tibia 2.0, and chela 4.75 times as long as broad; movable finger 1.96 times as long as hand. Trichobothria arranged in typical order. Fixed finger with 74 and movable finger with 71 contiguous, marginal teeth, evenly graded in size and proportions; movable finger with a small sensillum on external surface about midway between levels of trichobothria *st* and *sb*.

Legs much as in *A. moestus*; leg IV with entire femur 2.55 and tibia 3.7 times as long as deep. Tactile setae of usual kind on tibia and tarsi of leg IV.

**Male:** Unknown.

**Measurements (mm):** Body length 1.54. Carapace length 0.47. Chelicera 0.43 by 0.21. Palpal trochanter 0.21 by 0.11; femur 0.48 by 0.11; tibia 0.26 by 0.13; chela 0.785 by 0.165; hand 0.27 by 0.16; movable



finger 0.53 long. Leg IV: entire femur 0.42 by 0.165; tibia 0.295 by 0.08; metatarsus 0.14 by 0.06; telotarsus 0.265 by 0.045.

*Etymology:* The species is named *hypogeus* because of its apparent adaptation for life beneath the surface of the ground.

*Remarks:* While this species is similar in size and proportions to *A. moestus*, it is less well sclerotized, therefore lighter in color, and has the eyes much reduced in size; thus, it would appear to be specifically adapted to life in a subterranean environment. It may be troglophilic, though there are no known caves in the immediate vicinity of its capture. An interesting fact is that four colorless isopods of the genus *Miktoniscus* (possibly *racovitzai*?) were collected along with the pseudoscorpion. This may indicate either that there are cave passages underlying this area and connecting with caves to the east, or that these forms may undergo depigmentation and reduction of eyes outside of a true cave environment.

*Apochthonius colecampi* Muchmore

*A. colecampi* Muchmore, 1967, p. 89.

Recently two females, possibly referable to this species, have been collected by John L. Craig in Bat Cave, east central Crawford County, and in Mushroom Cave, south central Franklin County, Missouri. Most of the measurements and proportions are nearly identical to those of the holotype female from Cole Camp Cave. They differ from the holotype mainly in the numbers of some setae and the teeth on the chelal fingers. However, acceptance of these specimens as *A. colecampi* presents some distributional difficulties, because Bat Cave and Mushroom Cave are over 100 miles from the type-locality. In order for the same species to occupy both caves, easy access between the caves would have had to exist in fairly recent times. Because the species appears to be somewhat cave adapted (larger size and elongated appendages), it would seem doubtful that movement between the caves has occurred overland. Since we know nothing of the pseudoscorpion faunae of neighboring caves or of the surface around and between the caves, it is impossible to understand the relations of these forms at the present time.

*Apochthonius indianensis* Muchmore

*A. indianensis* Muchmore, 1967, p. 92.

A single female apparently assignable to this species was found by J. R. Reddell in Donahue Cave, 1½ miles SW of Bedford, Lawrence County, Indiana. This specimen is very similar to the holotype male in all respects, except for a few differences directly attributable to the difference in sex. As Donahue Cave is about 10 miles NW of Donaldson Cave, the type-locality, it seems likely that the species is distributed through several caves in the area.



*Apochthonius holsingeri* Muchmore

*A. holsingeri* Muchmore, 1967, p. 93.

At hand is a tritonymph collected by L. M. and B. L. Ferguson in Blue Spring Cave, Alleghany County, Virginia, which may represent this species. Like the holotype male, it is completely eyeless and has six setae on the cheliceral hand, and the chaetotaxies of carapace and tergites are similar; further, it is of the right size for a tritonymph of the species. Blue Spring Cave is about 35 miles SW of Cave Run Pit Cave, the type-locality.

Other pseudoscorpions belonging to the genus *Apochthonius* have been collected in the following caves: ALABAMA: McKinney Cave #45, Colbert County (S. and J. Peck); Paint Rock Cave, Jackson County (S. Peck); Reece Cave, Jackson County (S. Peck and A. Fiske); Burwell Cave, Madison County (S. Peck); Ellis Cave, Madison County (S. Peck and A. Fiske); Hutton Cave, Madison County (W. B. Jones); Spook Cave, Madison County (S. Peck); Cave #824, Morgan County (S. Peck); McGlendon Cave, St. Claire County (S. Peck and A. Fiske). ILLINOIS: Brown's Hole Pit Cave, Hardin County (J. Lewis). KENTUCKY: Running Branch Cave, Edmonson County (S. Peck); Copelin Cave, Hart County (T. C. Barr, Jr.); Lester Collins #2 Cave, Jackson County (T. G. Marsh). MARYLAND: Rocky Gap Cave, Allegany County, (R. Franz). TENNESSEE: Round Mountain Cave, Franklin County, (S. Peck and A. Fiske).

Because none of the above specimens is noticeably modified for cave existence, it may be assumed that they are surface forms accidentally or facultatively living in the caves. The actual status of these forms will not be known until much more is learned about the epigean pseudoscorpions of the eastern half of the country.

## DISCUSSION

Benedict and Malcolm (1973) have discussed the troglobitic modifications among several of the known species of *Apochthonius*. The species described above fit fairly well into the pattern which those authors described. However, a few comments are in order here.

As with many cavernicolous animals, the cave-dwelling *Apochthonius* species usually show distinct lightening of the body and appendages. I question whether this is a real reduction of pigment, however; rather it seems to result simply from a thinning of the cuticle. Most pseudoscorpions appear not to have any true pigment in the cuticle but only show the color of the proteins, chitin, etc. in the cuticular layers. When these layers are thick the animal, or part of the animal, appears darker than when the layers are thin. Progressive thinning of the cuticle in cavernicolous animals, which live in areas of constant high humidity and do not require much protection against desiccation, results in the general lightening of the animals.



The reduction and loss of the unneeded visual apparatus of cavernicolous animals is probably fortuitous and proceeds at widely different rates in different species. If so, it is not surprising to find every condition, from four good eyes to none at all, in a large sampling of independently developing cavernicolous species.

Benedict and Malcolm (1973) use total body length as a measure of the size of the animals they studied. However, I am of the opinion that a better measure, at least when comparing individuals within a species or species in a genus, is the length of the carapace. Total body length, which is the sum of the lengths of the carapace and the abdomen, is greatly variable in an individual and therefore, in a species. While the length of the carapace is constant in a given stage of an individual, the length of the abdomen varies greatly according to the nutritional state, the reproductive condition, and, to some extent, the method of preservation of the creature. More reliable measurements and comparisons can, of course, be made using the constant character.

In addition to the length/width ratios of the palpal femur and chela, I have found that a good measure of the attenuation of the palp is given by the relative lengths of the femur and chela in comparison with the length of the carapace. In most epigean forms I have studied, the femur/carapace ratio is less than 1.1 and the chela/carapace ratio is less than 1.7, while in most of the troglobitic forms the corresponding ratios are greater than 1.15 and 1.75 respectively; as in the study of Benedict and Malcolm, *A. coecus* falls in between, together with *A. hypogeus*. I have at hand a number of specimens of *Apochthonius* sp. from southeastern United States which are larger than *A. moestus* and most other epigean forms; these tend to have appendages which approach some of the troglobites in slenderness. A detailed study may show that attenuation of the appendages is primarily a result of allometric growth.

The distribution of cavernicolous forms of *Apochthonius* is rather interesting. While the genus is apparently very common in the surface fauna all through the eastern United States (unpublished records), its representation in caves is sparse. Epigean forms seem to wander into caves occasionally in various parts of this range, but cave adapted forms have been found only in certain, rather narrowly prescribed locations. These places, in West Virginia, Virginia, Alabama, Indiana, Missouri and Arkansas, are all more or less at the periphery of the ranges of cavernicolous species of *Kleptochthonius*, (subgenus *Chamberlinochthonius*), which are fairly common in caves in Kentucky, Tennessee, southern West Virginia and western Virginia (see Malcolm and Chamberlin, 1961; Muchmore, 1965, 1966, 1970, 1974). It would appear that competitive exclusion is operating against the generally smaller *Apochthonius* species.

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