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ABSTRACT

Three new epigeal species of *Kleptochthonius* are described: *K. sheari* (type locality, Preston Co., West Virginia); *K. inusitatus* (type locality, Belmont Co., Ohio); and *K. polychaetus* (type locality, Shenandoah National Park, Virginia).

Each of the three new species is unusual in some aspect of the sensory seta(e) on the fixed finger of the palpal chela. In *Kleptochthonius* (*K.*) *sheari*, the single sensory seta is large and spinelike, and is situated near the base of the finger; in *K. (K.) inusitatus*, the sensory seta is very small, and is located just distad of trichobothrium; and in *K. (K.) polychaetus*, there are 10-15 small sensory setae in an irregular row dorsomedial and distad of the trichobothrium.

Key Words: Arachnida, Pseudoscorpionida, Chthoniidae, *Kleptochthonius*, new species, palpal chela, sensory setae, Ohio, Pennsylvania, Virginia, West Virginia.

Representatives of the pseudoscorpion genus *Kleptochthonius* Chamberlin (1949) have been grouped into two (possibly artificial) subgenera (Malcolm & Chamberlin, 1961). The nominate subgenus, *Kleptochthonius*, includes the smaller, more robust, 4-eyed, epigeal species, while *Chamberlinochthonius* Vachon (1952) includes larger forms, with attenuated appendages, degenerate eyes, and reduced chaetotaxies, from caves. In the eastern United States, only three species have been included in the subgenus *Kleptochthonius*, while 29 have been assigned to *Chamberlinochthonius* (see Harvey, 1991). The small number of known epigeal species is almost certainly a reflection, not of the absence of *Kleptochthonius* from the soil fauna, but rather

from lack of serious collection and study. Therefore, it is not unexpected to find new epigean species when some effort is made to look for them.

Recently, while I was puzzling over the identity of an isolated pseudoscorpion palp found in a cave in Indiana and searching through available material for forms with similar palpal structure (Muchmore, 1994), I recognized an apparently related, new epigean species of *Kleptochthonius* with representatives in West Virginia, Virginia, and Pennsylvania. During the same search, I discovered two other undescribed epigean species of the genus with unusual features of the palps from Ohio and Virginia. All of these species are here assigned to the subgenus *Kleptochthonius*.

Holotypes and most paratypes are deposited in the Florida State Collection of Arthropods, Gainesville, Florida (FSCA); one paratype is in the collection of the University of New Hampshire, Durham, New Hampshire (UNH), and two are in the Virginia Museum of Natural History, Martinsville, Virginia (VMNH).

Genus *Kleptochthonius*

Kleptochthonius Chamberlin, 1949: 4. For complete synonymy, see Harvey, 1991: 177.

Subgenus *Kleptochthonius*

Kleptochthonius (*Kleptochthonius*) Chamberlin: Malcolm & Chamberlin, 1961: 3, 5.

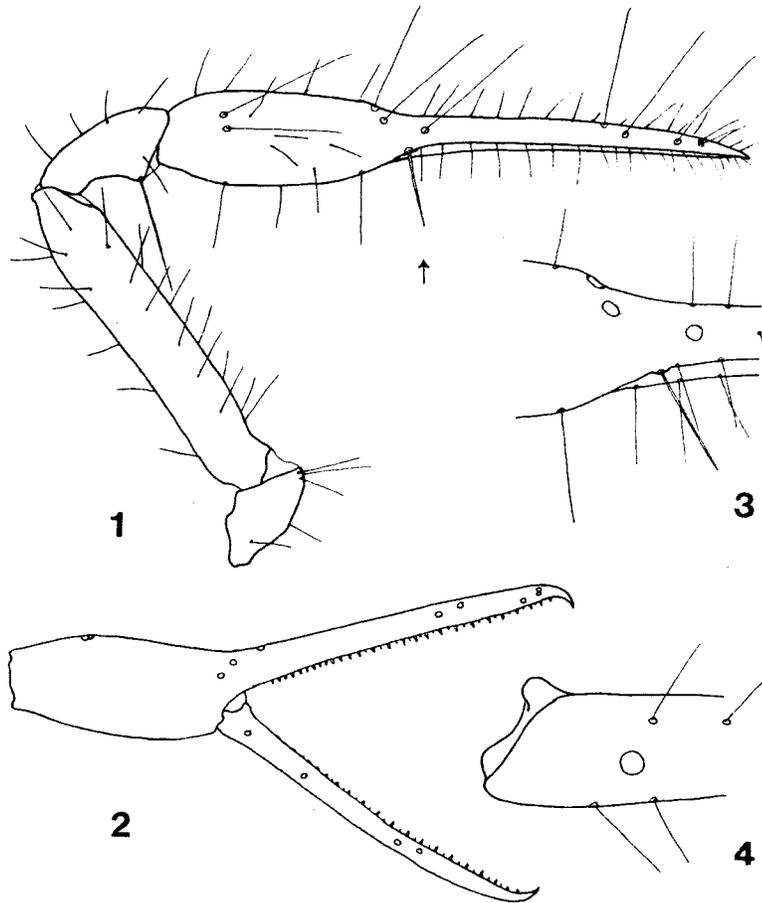
Each of the following three new species will key out to the subgenus *Kleptochthonius* in the key provided by Malcolm & Chamberlin (1961: 3).

***Kleptochthonius* (K.) *sheari*, new species**

(Figures 1–4)

Type material. Holotype male (WM2546.02001): WEST VIRGINIA, Preston Co., Coopers Rock State Forest, NE of Morgantown, chestnut oak litter under cliffs, 25 June 1971, W. A. Shear, mounted on slide, in Florida State Collection of Arthropods. Paratypes:

PENNSYLVANIA, Huntingdon Co., Alan Seeger State Forest, SE of State College, hemlock litter on hillside, 9 July 1984, D. S. Chandler, 1 male, mounted (UNH); Centre Co., Black Moshannon State Park, NW of State College, in moss, 8 October 1975, S. W. Frost, 1 male,



Figures 1-4. *Kleptochthonius sheari*, new species, holotype male: 1) left palp (dorsal view); 2) right chela (lateral view); 3) base of fixed finger of chela (dorsal view), showing long sensory seta (arrow); 4) base of movable finger of chela (lateral view), showing short, rounded, dorsal process.

mounted (FSCA); Lycoming Co., rest area on US 15, S of Williamsport, deciduous litter on hillside, 23 July 1973, C. R. Hignutt, 1 male, mounted (FSCA); Lycoming Co., Skyline Drive, S of Williamsport, litter among rocks under oak and maple, 18 September 1969, W. B. Muchmore, 1 female, mounted (FSCA); Lycoming Co., S of Williamsport, under log in oak-maple woods, 20 August 1966, W. B. Muchmore, 1 tritonymph, mounted (FSCA). VIRGINIA, Prince William Co., Prince William State Forest, litter, 24 June 1969, W. B. Muchmore, 1 female, mounted, (VMNH). WEST VIRGINIA, Preston Co., same data as for holotype, 1 male, mounted (FSCA).

Description. Adults. With the general characters of the genus (Malcolm & Chamberlin, 1961) and the following particular features. Males and females similar, but female palps a little more robust. Carapace and palps light brown, other parts lighter. Carapace a little longer than broad; anterior margin nearly straight, with 1 or 2 small denticulations at center; 4 large, corneate eyes; chaetotaxy 8-4-4-2-4. Coxal area typical; chaetotaxy usually 2-2-1:2-1-CS: 2-2:2-3:2-3, each coxa I with 5-7 spines (CS) of the usual type (see Malcolm & Chamberlin, 1961: fig. 2C). Abdominal chaetotaxy of holotype male 4:4:6:6:6:7:9:9:7:1T2T1:0, others similar. Sternal chaetotaxy of holotype male 23:[4-4]:(3)13-13/8(3):(4)8(4):10:11:12:12: 12:10:0:2, other males similar; anterior sternites of female 10:(4)6(4):(4)9(4):-.

Chelicera nearly $3/4$ as long as carapace; hand with 7 setae; flagellum of 8 or 9 pinnate setae; spinneret a low elevation of the finger margin, smaller in male than in female.

Palp (Fig. 1) moderately long and slender. Femur 1.2-1.4x and chela 1.9-2.1x as long as carapace. Proportions of segments, male (female): trochanter 1.8-2.0x (1.9x), femur 5.25-5.8x (4.6-4.9x), patella 1.95-2.05x (1.85-1.95x), and chela 4.9-5.9x (4.5-4.6x) as long as broad; hand 1.85-2.2x (1.65-1.75x) as long as deep; movable finger 1.7-1.75x (1.65-1.75x) as long as hand. Trichobothria as shown in Fig. 2. Medial side of fixed finger with a conspicuous, long, heavy seta, set in an enlarged, slightly elevated areole, at or just proximad of level of trichobothrium ist (Fig. 3); this seta is relatively stout compared to other setae on the palp; it is about twice as thick at the base as any other seta of the same length, and is only 0.6 as long as one (on patella) equally thick at the base. Base of movable finger with a small rounded process on dorsal side (Fig. 4). Fixed finger of holotype with 29 spaced, large, sharp, macrodenticles and 15 pointed microdenticles alternating

distally; movable finger with 14 similar spaced macrodenticles, 13 alternating microdenticles, and 13 low, rounded teeth at proximal end of row; others similar.

Legs moderately slender; leg I with femur 2.0-2.1x as long as patella; leg IV with femur+patella 2.75-2.9x and tibia 4.7-5.2x as long as deep.

Tritonymph. Generally similar to adults but paler, smaller and with more robust appendages. Carapacial chaetotaxy 8-4-4-3-4. Coxae I with 3 coxal spines on right side and 4 on left. Anterior tergal chaetotaxy 4:4:6:6:7:8:-. Palpal femur 4.5x, patella 1.9x, and chela 4.4x as long as broad. Medial side of fixed chelal finger with a long, heavy seta just distad of level of trichobothrium ist.

Measurements (mm). Male (figures given first for holotype, followed in parentheses by ranges for the 4 paratypes). Body length 2.09 (1.93-2.16). Carapace length 0.61 (0.57-0.60). Chelicera length 0.43 (0.43-0.46). Palpal trochanter 0.265 (0.25-0.28)/0.14 (0.13-1.15); femur 0.85 (0.78-0.835)/0.15 (0.14-0.155); patella 0.33 (0.325-0.35)/0.16 (0.16-0.18); chela 1.27 (1.15-1.27)/0.215 (0.215-0.26); hand 0.47 (0.415-0.47)/0.215 (0.22-0.26); movable finger length 0.82 (0.73-0.835). Leg I: femur 0.48 (0.41-0.495)/0.08 (0.08-0.09); patella 0.235 (0.22-0.235)/0.075 (0.075-0.085). Leg IV: femur+patella 0.74 (0.665-0.73)/0.26 (0.23-0.265); tibia 0.52 (0.45-0.52)/0.10 (0.095-0.11); basitarsus 0.27 (0.23-0.28)/0.075 (0.075-0.08); telotarsus 0.57 (0.445-0.56)/0.05 (0.05-0.055).

Female (figures for the 2 paratypes). Body length 1.92, 2.71. Carapace length 0.65, 0.72. Chelicera length 0.52, 0.58. Palpal femur 0.83, 0.865/0.17, 0.19; patella 0.355, 0.415/0.19, 0.215; chela 1.29, 1.48/0.28, 0.33; hand 0.48, 0.58/0.29, 0.33; movable finger length 0.835, 0.96. Leg IV: femur+patella 0.72, 0.85/0.245, 0.25; tibia 0.51, 0.59/0.11, 0.125.

Tritonymph. Body length 1.77. Carapace length 0.47. Chelicera length 0.39. Palpal femur 0.60/0.13; patella 0.27/0.14; chela 0.90/0.205; hand 0.36/0.215; movable finger length 0.59. Leg IV: femur+patella 0.51/0.20.

Diagnosis. A large species of the subgenus *Kleptochthonius*, with palpal femur 0.78-0.86 mm in length; palps relatively slender, with femur of male up to 5.8x and chela up to 5.9x as long as broad; carapacial chaetotaxy 8-4-4-2-4; anterior tergal chaetotaxy 4:4:6:6:-; and each coxa I with 5-7 coxal spines. It is unique among known species of

the genus in having a long, stout (spinelike) sensory seta on the medial side of the fixed chelal finger near its base.

Name. The species is named in honor of William A. Shear, who collected the holotype and many other pseudoscorpions in West Virginia.

Distribution. This species is known only from northeastern West Virginia, southcentral Pennsylvania, and northern Virginia.

Remarks. *Kleptochthonius sheari* is characterized particularly by the occurrence of a long, heavy seta on the medial side of the fixed chelal finger near its base. This is the same sort of seta seen on the isolated pseudoscorpion palp reported recently from an Indiana cave (Muchmore, 1994); it is heavier than a vestitural seta of equal length and is set in a larger, raised areole. As discussed below, this seta probably has some specialized sensory function.

***Kleptochthonius* (K.) *inuitatus*, new species**

(Figures 5, 6)

Type material. Holotype female (WM 4605.01001): OHIO, Belmont Co., Barkcamp State Park, near Belmont, deciduous litter, 8 August 1976, W. B. Muchmore, mounted on slide, in Florida State Collection of Arthropods.

Description of female (male unknown). With the general characters of the genus (Malcolm & Chamberlin, 1961) and the following particular features. Carapace, tergites and palps light brown, other parts lighter. Carapace a little longer than broad; no epistome; 4 corneate eyes; chaetotaxy 6-4-4-2-4. Coxal area typical; chaetotaxy 2-2-1:3-0-CS:2-3:2-3:2-3, each coxa I with 3 spines (CS). Tergal chaetotaxy 4:4:6:9:9:10:11:10:9:7:1TT2T1:2; sternal chaetotaxy 9:(3)7(3):(3)9(3):13:15:13:14:14:11:0:2.

Chelicera 0.8 as long as carapace; hand with 7 setae; flagellum of about 8 pinnate setae; spinneret a low elevation of the finger margin.

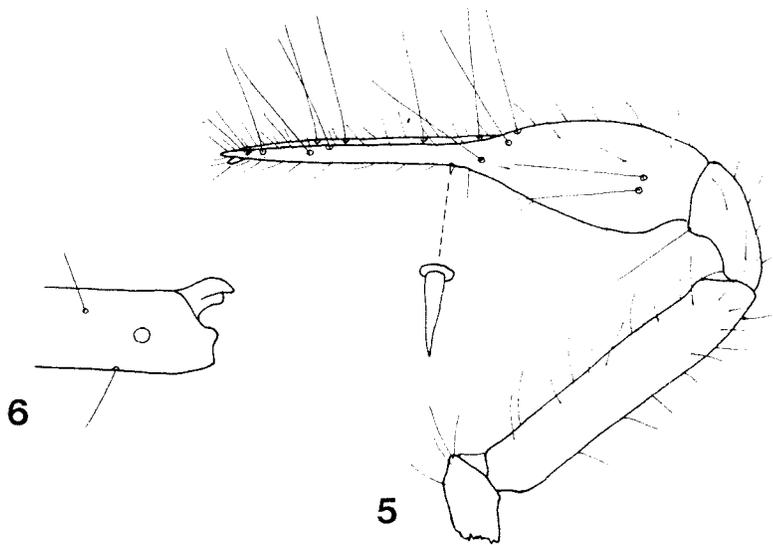
Palp (Fig. 5) only moderately long and slender: femur 1.3x and chela 1.95x as long as carapace; trochanter 1.95x, femur 5.5x, patella 2.15x, and chela 4.7x as long as broad; hand 1.95x as long as deep; movable finger 1.5x as long as hand. Trichobothria as shown in Fig. 5. A very short sensory seta on medial side of fixed finger as far distad of trichobothrium *ist as ist* is from *esb*. Fixed finger with 22 spaced, tall, sharp macrodentacles and 11 small, rounded microdentacles alternating

distally; movable finger with 10 tall, spaced macrodenticles, 8 small, rounded interspersed microdenticles, and 10 low, rounded teeth proximally. Movable finger with a small sensillum proximad of level of last macrodenticle. Proximal end of movable finger with a short bifurcate process on dorsal side (Fig. 6).

Legs moderately slender: leg I with femur 2.2x as long as patella; leg IV with femur+patella 2.95x and tibia 4.4x as long as deep.

Measurements (mm). Body length 2.04. Carapace length 0.55. Chelicera length 0.45. Palpal trochanter 0.245/0.125; femur 0.73/0.13; patella 0.30/0.14; chela 1.07/0.23; hand 0.445/0.23; movable finger length 0.66. Leg I: femur 0.41/0.08; patella 0.185/0.075. Leg IV: femur+patella 0.63/0.215; tibia 0.42/0.095; basitarsus 0.23/0.07; telotarsus 0.43/0.05.

Diagnosis. A moderate sized species of the subgenus *Kleptochthonius*, with palpal femur 0.73 mm in length; palps moderately slender, with



Figures 5, 6. *Kleptochthonius inusitatus*, new species, holotype female: 5) right palp (dorsal view), with enlargement of sensory seta; 6) base of movable finger of chela (lateral view), showing bifurcate dorsal process.

femur 5.5x and chela 4.7x as long as broad; carapacial chaetotaxy 6-4-4-2-4; anterior tergal chaetotaxy 4:4:6:9:-; and each coxa I with 3 coxal spines. It is unique among known species of the subgenus in having a very small, sensory seta on medial side of fixed chelal finger near its base.

Name. The species is called *inusitatus* because of its unexpected and unusual combination of characters.

Distribution. Known only from the type locality in southeastern Ohio.

Remarks. A small sensory seta on the medial side of the base of the fixed chelal finger has been reported previously only in highly cave-adapted species belonging to the subgenus *Chamberlinochthonius* (large size, attenuated appendages, reduced eyes, reduced chaetotaxy) (Muchmore, 1976). It was, therefore, a great surprise to find this new species, otherwise a typical epigeic form (small size, normally proportioned appendages, 4 corneate eyes, normal chaetotaxy), with the small sensory seta on the chela. The significance of this discovery can only be understood after reexamination of all described species of *Kleptochthonius* and study of any undescribed material available (in progress).

It was originally thought that this was a representative of *K. sheari*; this erroneous supposition was implied in an earlier paper (Muchmore, 1994).

Kleptochthonius (K.) *polychaetus*, new species

(Figures 7-9)

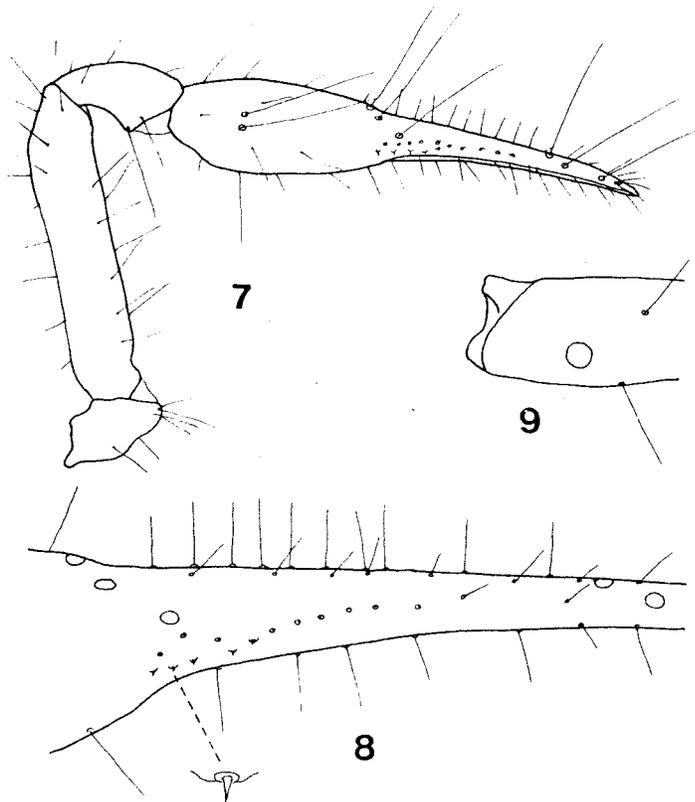
Type material. Holotype male (WM 1791.01003) and 2 male, 4 female paratypes: VIRGINIA, Shenandoah National Park, Stony Man Mountain Nature Trail, under rocks, mostly oak cover, 6 July 1969, W. B. Muchmore, all but 1 paratype mounted on slides; holotype and 5 paratypes in FSCA, one paratype in VMNH.

Description. With the general characters of the genus (Malcolm & Chamberlin, 1961) and the following particular features. Carapace and palps tan, other parts lighter. Carapace a little longer than broad; no epistome, but anterior margin dentate or irregular at middle; 4 large, corneate eyes; chaetotaxy 6-4-4-2-4. Coxal area typical, chaetotaxy 2-2-1-3-0-CS:2-2(3):2-3:2-3, each coxa I with 3 spines (CS) of the usual type. Abdomen typical. Tergal chaetotaxy of holotype 4:4:6:6:6:7:8:10:9:7:1T3T1:0, others similar. Sternal chaetotaxy of holotype male

15:[4-4):(3)9-10/7(3):(3)10(3):13:14:12:12:13:11:0:2, other males similar; anterior sternites of females about 10:(3)9(3):(3)9(3):-.

Chelicera about 0.8 as long as carapace; hand with 7 setae, flagellum of about 8 pinnate setae; spinneret a low elevation of the finger margin, barely discernible in male.

Palp (Fig. 7) moderately slender: femur 1.3-1.35x and chela 1.95-2.05x as long as carapace; trochanter 1.8-1.9x, femur 4.9-5.2x,



Figures 7-9. *Kleptochthonius polychaetus*, new species, holotype male: 7) left palp (dorsal view); 8) fixed finger of chela (dorsal view), showing dorsomedial row of small, sensory setae; 9) base of movable finger of chela (lateral view), showing short, irregular, dorsal process.

patella 1.8-1.95x, and chela of male 4.9-4.95x (of female 4.4-4.5x) as long as broad; hand of male 2.0-2.05x (of female 1.8-1.85x) as long as deep; movable finger 1.4-1.45x as long as hand. Trichobothria as shown in Fig. 7. An irregular row of 10-15 small, sensory setae on dorsomedial surface of fixed finger extending distally from level of trichobothrium *ist* (Fig. 8). Fixed finger with 24-27 spaced, sharp macrodenticles, and 10-13 very small microdenticles alternating distally; movable finger with 15-17 spaced macrodenticles, 7-9 very small, alternating microdenticles, and about 10 very low rounded teeth proximally. Movable finger with a small sensillum near level of last macrodenticle. Proximal end of movable finger with a short irregular process on dorsal margin (Fig. 9).

Legs moderately slender: leg I with femur 2.0-2.2x as long as patella; leg IV with femur+patella 2.75-2.9x and tibia 4.35-4.65x as long as deep.

Measurements (mm). Male (figures given first for holotype, followed in parentheses by those for the two paratypes. Body length 1.85 (1.70, 1.85). Carapace length 0.54 (0.50, 0.52). Chelicera length 0.415 (0.385, 0.39). Palpal trochanter 0.25 (0.23, 0.245)/0.13 (0.125, 0.13); femur 0.74 (0.66, 0.695)/0.14 (0.135, 0.135); patella 0.295 (0.27, 0.29)/0.155 (0.14, 0.155); chela 1.05 (0.99, 1.04)/0.215 (0.20, 0.21); hand 0.445 (0.415, 0.445)/0.215 (0.21, 0.215); movable finger length 0.635 (0.605, 0.635). Leg I: femur 0.39 (0.37, 0.385)/0.08 (0.075, 0.08); patella 0.195 (0.17, 0.185)/0.075 (0.065, 0.075). Leg IV: femur+patella 0.63 (0.58, 0.62)/0.23 (0.215, 0.225); tibia 0.415 (0.385, 0.415)/0.095 (0.09, 0.095); basitarsus 0.24 (0.22, 0.235)/0.07 (0.065, 0.065); telotarsus 0.41 (0.40, 0.40)/0.05 (0.05, 0.05).

Female (ranges for the 3 paratypes). Body length 2.00-2.35. Carapace length 0.57-0.605. Chelicera length 0.465-0.50. Palpal trochanter 0.26-0.29/0.14-0.16; femur 0.73-0.805/0.15-0.165; patella 0.295-0.33/0.165-0.185; chela 1.10-1.24/0.25-0.28; hand 0.46-0.52/0.25-0.29; movable finger length 0.67-0.74. Leg IV: femur+patella 0.66-0.72/0.23-0.26; tibia 0.445-0.48/0.095-0.11.

Diagnosis. A moderate sized species of the subgenus *Kleptochthonius*, with palpal femur 0.66-0.80 mm in length; carapacial chaetotaxy 6-4-4-2-4; anterior tergal chaetotaxy 4:4:6:6:-; and each coxa I with 3 coxal spines. It is unique among known species in the genus in having an irregular row of 10-15 small, sensory setae on dorsomedial surface near base of fixed finger of palpal chela.

Name. The species is called *polychaetus* in recognition of the numerous small, sensory setae on the fixed finger of the palpal chela.

Distribution. Known only from the type locality in Shenandoah National Park, Virginia.

Remarks. *Kleptochthonius polychaetus* is unique among known chthoniid pseudoscorpions in having numerous (10-15) small, sensory setae on the fixed finger of the palpal chela, though *Tyrannochthonius tekauriensis* Moyle, from New Zealand, is reported to bear similar setae on the chelal hand (Moyle, 1989). These setae have a structure and location more or less similar to those of the small sensory seta found on the chela of *K. inusitatus* (above), *K. (C.) stygius* Muchmore, and others (Muchmore, 1976); they are short and stout and are set in slightly enlarged and elevated areoles, and they are found on the medial side of the fixed finger near its base. Otherwise, the new species seems to be a typical member of the subgenus *Kleptochthonius* (*Kleptochthonius*).

DISCUSSION

Nearly 20 years ago, a short, stout, apparently sensory, seta was discovered on the medial side of the fixed chelal finger of some cavernicolous pseudoscorpions of the genus *Kleptochthonius* Chamberlin, subgenus *Chamberlinochthonius* Vachon (Muchmore, 1976). At that time, it was noted briefly that a corresponding seta in epigeal species of *Kleptochthonius* was longer and more slender or was lacking. Since then, no work on *Kleptochthonius* has been published.

Recent studies, as reported above, have shown that the short, stout form of the chelal sensory seta does occur in an epigeal species of the genus (*inusitatus*), and that corresponding, but different, setae occur in still other species of the genus (*sheari* and *polychaetus*). These findings suggest that similar setae will be found in many, if not all, species of *Kleptochthonius*. A survey of all available material pertaining to the genus is under way.

The single, short, stout form of the seta has not yet been reported in any other genus of the Chthoniidae. However, as mentioned above, the series of short, stout setae found in *K. polychaetus* resembles somewhat the row of small setae reported for *Tyrannochthonius tekauriensis* (Moyle, 1989). In addition, the long form of the seta is reminiscent of the characteristic large seta of most species of *Tyrannochthonius*, *Lagynochthonius*, and allied forms (Chamberlin, 1962; Much-

more, 1991).

The short setae are probably sensory in function, but might be secretory. The long setae, because of their basic similarity to the short ones, probably also have some specialized sensory function; they have, however, been called "spinelike" and "guard setae" (Chamberlin, 1962; Muchmore, 1991), and may indeed be defensive in nature (or both?). Elucidation of the exact function(s) and relationships of these setae in the various species and genera requires much further study (in progress).

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