

**The genus *Tyrannochthonius* in the eastern United States
(Pseudoscorpionida: Chthoniidae).
Part I. The historical taxa.**

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Abstract: All available material pertaining to *Tyrannochthonius* Chamberlin from the United States east of the Mississippi River has been examined. The range of the single species already described from this area, *T. floridensis* Malcolm and Muchmore, is extended. Ten new species are described here; all are troglobites from caves in Alabama.

Introduction

Tyrannochthonius is a large genus, with about 100 described species (Harvey 1991). It is circumtropical in distribution, with many species in subtropical and even temperate localities. Representatives are often common in ground litter, and many have been found in caves, where some have become adapted as troglobites (Harvey 1989; Muchmore 1979, 1991). Though the presence of many representatives of *Tyrannochthonius* in the United States has been known for a long time (see Chamberlin and Malcolm 1960), only three species have been described, *T. floridensis* Malcolm and Muchmore (1985) from epigeal situations in Florida and Alabama, and *T. troglodytes* Muchmore (1986) and *T. texana* Muchmore (1992) from caves in Texas. For a variety of reasons, the numerous cavernicolous *Tyrannochthonius* referred to by Chamberlin and Malcolm have not yet been formally described. It is the purpose of this and following papers to rectify that situation.

In the late 1940's, J. C. Chamberlin began writing descriptions and making illustrations of the several species and subspecies of *Tyrannochthonius* that he recognized in the southeastern United States. He was later assisted on this project by D. R. Malcolm, and brief mention of these

forms was made in their publication on "The occurrence of false scorpions in caves . . ." (1960). The scope of the study was expanded to include consideration of all species of *Tyrannochthonius* in the world. However, because of Chamberlin's untimely death in 1962 and Malcolm's many other commitments, the project languished. More recently, I independently received and studied a good number of additional representatives of the genus from eastern states (many of these were reported as *Tyrannochthonius* spp. in Peck 1989: 20). I have now undertaken to bring the American part to completion, in order to ensure recognition of this important segment of the pseudoscorpion fauna. The present study is limited geographically to the United States east of the Mississippi River. Other material in Chamberlin's collection from western United States, Mexico, and Central America will, it is expected, be treated later.

The study of species of *Tyrannochthonius* in the eastern United States is presented in two parts. This paper (Part I) treats the historic species, those from caves in Alabama recognized long ago by Chamberlin, and *T. floridensis*, an epigeal species and the only one described thus far. Part II (in prep.) will describe 25 additional new species from both cave and epigeal sites in Alabama, Florida, Kentucky, and Tennessee, and will present a key for all of the eastern species.

Methods

The specimens dealt with here are in the following depositories: American Museum of Natural History, New York, NY (AMNH); California Academy of Sciences, San Francisco, CA (CAS); Florida State Collection of Arthropods, Gainesville, FL (FSCA); Museum of Comparative Zoology, Harvard University, Cambridge, MA (MCZ); University of California, Davis, CA (UCDC).

D. R. Malcolm, who has been custodian of Chamberlin's pseudoscorpion materials, kindly lent me the specimens and paperwork relevant to the *Tyrannochthonius* study. (NOTE: The entire J. C. Chamberlin Collection of pseudoscorpions has been transferred recently to the Department of Entomology, California Academy of Sciences).

All specimens have been dissected, cleared, and mounted in Canada balsam on microscope slides. They were studied and measured under a compound microscope. Some of the figures were drawn by JCC many years ago; the others were prepared by WBM for this paper (noted in the legends).

Locations and relations of the caves mentioned here were determined, for the most part, by consultation of the large volume on Alabama caves by Varnedoe (1973), and by correspondence with W. Torode, of the National Speleological Society, Huntsville, Alabama.

Of the 11 species and subspecies recognized by Chamberlin and Malcolm in 1960, 10 appear to be valid in the light of present knowledge; these are described here as originally conceived (rewritten to conform to style), with Chamberlin as author. The species later recognized by Muchmore are described by him, under his authorship, in Part II of this study (in prep.).

Through this paper (Part I) and Part II (in prep.), the species are numbered sequentially. These numbers also appear in the key (which will be published in Part II), facilitating reference to the species descriptions.

A few abbreviations are used in the text, as follows: L = length; L/B = ratio, length/breadth; L/D = ratio, length/depth; M = macrodentacles; m = microdentacles; v = vestigial teeth; T = tactile seta.

Genus *Tyrannochthonius* Chamberlin

Tyrannochthonius Chamberlin 1929: 74; Beier 1932: 62; Muchmore 1984: 119, 1991: 111; Harvey 1991: 205 (complete synonymy). Type species, *Chthonius terribilis* With 1906: 69.

Diagnosis. A chthoniid genus distinguished by the following characteristics. Females usually a little larger and a little more robust than males. Carapace longer than broad and narrowed posteriorly (Fig. 1). Epistome usually small, triangular (sometimes reduced or absent) and with closely flanking setae. Typically with 4 well developed, corneate eyes, but eyes usually reduced or absent in cavernicolous species. Chaetotaxy of carapace usually 4-4-4-2-2, occasionally with one or more micro- or dwarf setae at the anterolateral corners (only in *T. floridensis* in eastern U. S.). Coxa I with a prominent, rounded anteromedial process; occasionally this process bears a small seta medially near the tip (only in *T. floridensis* in eastern U. S.). Coxa II with an oblique row of 4-15 terminally incised coxal spines (Fig. 2). Intercoxal tubercle absent. Tergites 1-8 bordered by a single row of large setae, usually 2-4 setae on segments 1-4, and 4-7 setae on segments 5-8; segments 9-12 almost invariably with chaetotaxy -7:4:T2T:0. Chelicera (Fig. 3) large, about as long as carapace; 5 setae on hand; flagellum of about 8 pinnate setae; galea vestigial or absent; both fingers usually well provided with teeth. Palp typically chthoniid, long and slender (Fig. 4). Trichobothriotaxy of chela as shown in Fig. 5; on movable finger *st* close to *t*, and *sb* closer to *b* than to *st*; on fixed finger *et*, *it* and *est* near distal end, *ist*, *esb*, and *eb* at base, and *ib* and *isb* on dorsum of hand proximad of middle. Fixed finger of chela with a conspicuous long, heavy seta on medial side near base (Fig. 4). Chelal fingers heterodont, that is, with different kinds of teeth. The fixed finger has a conspicuous row of well-spaced teeth extending along the entire margin (Fig. 5); over most of this length large teeth, or macrodentacles (abbreviated M), alternate with smaller teeth, or microdentacles (abbreviated m); the so-called macrodentacles are largest in the middle of the row, smaller both distally and proximally; the spacing between macrodentacles usually is decreased proximally, where intervening microdentacles are often absent; further, microdentacles may be vestigial or absent entirely. The movable finger has a similar series of alternating macro- and microdentacles in the distal one-half or two-thirds; proximal to this row are usually 5-10 or more very small, low, rounded vestiges of teeth (abbreviated v), sometimes mere crenations of the margin; as with fixed finger, microdentacles may be vestigial or absent. Legs variably proportioned, rather robust in epigeal species, attenuated in cavernicolous forms (Fig. 6); leg I with femur 1.8-2.0x as long as patella. Legs III and IV with tactile setae on tibia and

both tarsal segments. Male and female genital apparatus typically chthoniid in configuration and chaetotaxy; internal genitalia of male relatively large, often one-half or more as long as carapace.

1. *Tyrannochthonius floridensis* Malcolm and Muchmore (Fig. 7)

Tyrannochthonius floridensis Malcolm and Muchmore 1985: 203, figs. 1-4. Holotype male from sinkhole, 5 km NW of Marianna, Jackson Co., Florida, in FSCA.

This species was described on the basis of specimens from Jackson and Liberty counties, Florida, and Hale Co., Alabama. Recently, other representatives have been recognized from 4 localities farther north and east in Alabama. These specimens are quite similar to the types, though a few fall slightly outside the ranges of measurements and proportions recorded in the original description; all possess the small seta on the apex of the anteromedial process of coxa I, though none has a dwarf preocular seta on the carapace. They are undoubtedly conspecific, in spite of the slight differences.

In the original description, it was stated that "*T. floridensis* is apparently unique in the genus in having a small seta on the apical projection of coxa I." As far as I know, this statement is still valid in reference to other species of *Tyrannochthonius* from the Americas. However, Harvey (1989) has transferred to *Tyrannochthonius* from *Morikawia* or *Paraliochthonius* several New Zealand species, which possess a small seta on the process of coxa I. Whether these species are truly congeneric with the eastern U.S. forms is debatable, but it must now be recognized that there appear to be some other *Tyrannochthonius* species which are similar to *T. floridensis* in the chaetotaxy of coxa I. The relationships of these geographically widely separated species remains to be worked out.

New records. Six males, 1 female from litter, Chewacla State Park, Lee Co., Alabama, 10 April 1975, C. Alteri; 1 male, 4 females from leaf and log litter, Cheaha State Park, Cleburne Co., Alabama, 13 June 1967, S. B. Peck and A. Fiske; 2 males, 1 female from forest litter, 5.5 km SE of Florette, Morgan Co., Alabama; 1 female from log-leaf litter outside Merrill Cave, N of Guntersville Dam, Marshall Co., Alabama, 26 June 1967, S. B. Peck and A. Fiske; all mounted on slides, in FSCA.

2. *Tyrannochthonius aladdinensis* Chamberlin, new species (Fig. 8)

Type material. Holotype female (WM386.01003), allotype male (WM386.01002), and 4 paratypes (3 male, 1 tritonymph) from Aladdin Cave (AL26), Sharp Cove, Madison Co., Alabama, 18 June 1938, W. B. Jones, in AMNH; 2 paratypes (1 male, 1 female) from same cave, 24 June 1936, A. Petrunkevitch, in CAS; 5 paratypes (1 male, 4 female) from same cave, 1 December 1939, W. B. Jones and A. F. Archer, in AMNH; 4 paratypes (3 male, 1 tritonymph) from same cave, 11 May 1957, T. C. Barr, Jr., in FSCA; 3 paratypes (1 male, 2 female) from under board in same cave, 11 May 1963, H. R. Steeves, in UCDC; 1 male paratype from same cave, 5 July 1965, S. B. Peck, in FSCA; all mounted on slides.

Diagnosis. Adults. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A medium-to-large species (palpal chela length 1.30-1.68 mm) with slender appendages. Body very pale, chelicerae and palps tan. Epistome usually small, rounded triangular. No eyes. Tergal chaetotaxy 4:4:4:4:4:4:6:6:6:7:4:T2T:0. Coxa II with 10-13 coxal spines. Chelicera usually a little longer than carapace. Palp as shown in Fig. 8: L/B of trochanter 1.7-2.0, femur 5.5-6.1, patella 1.9-2.3, chela 5.7-6.75; L/D of hand 2.15-2.5; movable finger L/hand L 1.65-1.8. Chelal fingers heterodont, both macro- and microdenticles relatively tall, sharp; fixed finger with 27-37M, 23-32m; movable finger with 22-27M, 20-22m, 4-7v. Leg IV: L/D of femur+patella 3.2-3.6, tibia 5.25-5.95.

Tritonymph. Similar to adults but smaller, paler, and with less slender appendages. Tergal chaetotaxy 4:4:4:4:4:4:5:6:6:-. Coxa II with 8-10 coxal spines. Palp slender: L/B of femur 5.2-5.3, patella 1.9-2.0, chela 5.2-5.6; L/D of hand 2.0-2.3; movable finger L/hand L 1.6-1.65. Chelal fingers heterodont, both macro- and microdenticles tall, sharp; fixed finger with 27-29M, 25-26m; movable finger with 18M, 17m, 8v. Leg IV slender: L/D of femur+patella 3.2-3.4, tibia 4.75-4.8.

Measurements. Female. Figures given first for holotype, followed in parentheses by ranges for the 7 paratypes. Body L 2.15 (2.05-2.4). Carapace L 0.70 (0.59-0.74). Chelicera L 0.71 (0.605-0.74). Palp:

trochanter 0.385 (0.33-0.41)/0.21 (0.18-0.21); femur 1.19 (1.01-1.19)/0.205 (0.18-0.21); patella 0.51 (0.41-0.50)/0.23 (0.19-0.235); chela 1.67 (1.46-1.68)/0.29 (0.235-0.29); hand 0.64 (0.54-0.615)/0.29 (0.24-0.29); movable finger L 1.07 (0.93-1.10). Leg IV: femur+patella 0.975 (0.86-1.00)/0.28 (0.265-0.30); tibia 0.66 (0.58-0.68)/0.11 (0.105-0.125); basitarsus 0.295 (0.26-0.30)/0.095 (0.09-0.095); telotarsus 0.69 (0.62-0.70)/0.065 (0.06-0.065).

Male. Figures given first for allotype, followed in parentheses by ranges for the 10 paratypes. Body L 2.15 (1.8-2.25). Carapace L 0.60 (0.52-0.62). Chelicera L 0.605 (0.52-0.665). Palp: trochanter 0.33 (0.28-0.37)/0.185 (0.15-0.19); femur 1.05 (0.90-1.11)/0.175 (0.155-0.19); patella 0.42 (0.37-0.47)/0.19 (0.16-0.21); chela 1.49 (1.30-1.56)/0.23 (0.19-0.26); hand 0.555 (0.47-0.59)/0.23 (0.19-0.26); movable finger L 0.96 (0.835-1.00). Leg IV: femur+patella 0.84 (0.74-0.90)/0.25 (0.21-0.28); tibia 0.585 (0.50-0.63)/0.105 (0.09-0.115); basitarsus 0.23 (0.23-0.27)/0.09 (0.08-0.095); telotarsus 0.60 (0.53-0.66)/0.055 (0.05-0.06).

Tritonymph. Body L 1.35-1.6. Carapace L 0.445-0.45. Chelicera L 0.42-0.43. Palp: femur 0.65-0.665/0.125; patella 0.28-0.295/0.14-0.155; chela 0.95-0.96/0.17-0.185; hand 0.37-0.38/0.16-0.185; movable finger L 0.615. Leg IV: femur+patella 0.53-0.54/0.155-0.17; tibia 0.36-0.37/0.075-0.08.

Etymology. The species is named for Aladdin Cave, which it inhabits.

3. *Tyrannochthonius aralu* Chamberlin, new species

Type material. Holotype male (JC-2041.01005), allotype female (JC-2041.01001), and 3 paratypes (2 male, 1 female) from Twin Caves (AL 92), SW of Brownsboro, Madison Co., Alabama, 3 January 1942, W. B. Jones; mounted on slides, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A large species (palpal chela length 1.52-1.70 mm) with slender appendages. Chelicerae and palps light brown, carapace tan, other parts lighter. Epistome small, rounded. No eyes. Tergal chaetotaxy 4:4:4:4:5-6:6:6:7:4:T2T:0. Coxa II with 9-12 coxal spines. Chelicera as long as or longer than carapace. Palp similar in shape to *T. aladdinensis* (Fig. 8): L/B of trochanter 1.85-1.95,

femur 5.75-6.1, patella 1.95-2.2, chela 5.8-6.2; L/D of hand 2.25-2.4; movable finger L/hand L 1.55-1.60. Chelal fingers heterodont, both macro- and microdenticles tall, sharp; fixed finger with 30-34M, 20-25m; movable finger with 22-24M, 20-23m, 5-7v. Leg IV slender: L/D of femur+patella 3.05-3.35, tibia 5.3-5.75.

Measurements (mm). Figures given first for holotype male, followed in parentheses by ranges for the other 4 types. Body L 2.23 (2.17-2.36). Carapace L 0.64 (0.65-0.695). Chelicera length 0.665 (0.635-0.73). Palp: trochanter 0.36 (0.355-0.385)/0.19 (0.19-1.20); femur 1.07 (1.07-1.19)/0.185 (0.18-0.20); patella 0.45 (0.435-0.48)/0.21 (0.20-0.23); chela 1.61 (1.52-1.70)/0.26 (0.245-0.28); hand 0.615 (0.585-0.66)/0.26 (0.25-0.28); movable finger L 1.00 (0.95-1.06). Leg IV: femur+patella 0.94 (0.91-1.01)/0.31 (0.28-0.32); tibia 0.64 (0.635-0.71)/0.125 (0.115-0.13); basitarsus 0.28 (0.26-0.31)/0.105 (0.095-0.105); telotarsus 0.69 (0.69-0.71)/0.06 (0.06-0.065).

Etymology. The species is named for Aralu, the ancient Babylonian world of the dead.

4. *Tyrannochthonius archeri* Chamberlin, new species

Type material. Holotype female (JC-1258.01001) from Cave Spring Cave (AL53), 5 km NE of Priceville, Morgan Co., Alabama, 2 December 1939, W. B. Jones and A. F. Archer; paratype female from same cave, 16 June 1939; mounted on slide, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A medium-sized species (palpal chela length 1.26-1.30 mm), with slender palps. Chelicerae and palps light brown, carapace tan, other parts lighter. Epistome small, rounded triangular. No eyes. Tergal chaetotaxy 4:4:4:4:5:6:6:6:-. Coxa II with 7-9 coxal spines. Chelicera as long as carapace. Palp similar in shape to *T. aladdinensis* (Fig. 8), but chela a little more slender: L/B of trochanter 1.85, femur 5.75-5.8, patella 2.0, chela 6.0-6.15; L/D of hand 2.1-2.25; movable finger L/hand L 1.85-1.9. Chelal fingers weakly heterodont, macrodenticles large, sharp, and macrodenticles very small, triangular; fixed finger with 25-26M, 14-16m; movable finger with 15-18M, 13-17m, 8v. Leg IV slender, L/D of femur+patella 3.05-3.25, tibia 5.25-5.3.

Measurements (mm). Figures given first for holotype female, followed in parentheses by those for paratype female. Body L 1.84 (2.07). Carapace L 0.615 (0.59). Chelicera L 0.63 (0.585). Palp: trochanter 0.30 (0.295)/0.16 (0.16); femur 0.89 (0.90)/0.155 (0.155); patella 0.37 (0.37)/0.185 (?); chela 1.33 (1.26)/0.215 (0.21); hand 0.465 (0.47)/0.22 (0.21); movable finger L 0.895 (0.82). Leg IV: femur+patella 0.68 (0.70)/0.235 (0.215); tibia 0.50 (0.48)/0.105 (0.09); basitarsus 0.23 (0.23)/0.075 (0.07); telotarsus 0.52 (0.48)/0.055 (0.05).

Etymology. The species is named for Allan F. Archer, who helped collect the holotype, and many other specimens treated in this paper.

5. *Tyrannochthonius avernicolus* Chamberlin,
new species

Type material. Holotype female (JC-2054.02001) from Eudy Cave (AL 96), 1.5 km S of Oleander, Marshall Co., Alabama, 23 June 1942, W. B. Jones; paratype female from Line Point Cave, 1 km N of Mt. Carmel, Marshall Co., Alabama, 15 January 1939, W. B. Jones; mounted on slides, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A rather small species (palpal chela length 0.97-1.05 mm) with moderately slender palps and small microdenticles on chelal fingers. Chelicerae and palps tan, other parts pale. Epistome very small, rounded. No eyes. Tergal chaetotaxy 4:4:4:4:4-5:6:6:6-7:4:T2T:0. Coxa II with 9-11 coxal spines. Chelicera 0.9-0.95 as long as carapace. Palp similar in shape to *T. parvus* (Fig. 9), but a little more slender: L/B of trochanter 1.85-1.9, femur 5.3-5.4, patella 1.95-2.05, chela 5.65-5.7; L/D of hand 1.95-2.0; movable finger L/hand L 1.75-1.85. Chelal fingers heterodont, macrodenticles tall, sharp, microdenticles small but distinct; fixed finger with 25M, 16m; movable finger with 14M, 12m, 13v. Leg IV somewhat robust: L/D of femur+patella 2.9, tibia 4.6-4.8.

Measurements (mm). Figures given first for holotype, followed in parentheses by those for paratype. Body L 1.83 (1.70). Carapace L 0.53 (0.52). Chelicera L 0.48 (0.465). Palp: trochanter 0.235 (0.23)/0.125 (0.125); femur 0.70 (0.665)/0.13 (0.125); patella 0.295 (0.28)/0.15 (0.135); chela 1.05 (0.97)/0.185 (0.17); hand 0.37 (0.355)/0.185 (0.18); movable finger L 0.68 (0.615). Leg IV: femur+patella

0.58 (0.555)/0.20 (0.19); tibia 0.41 (0.39)/0.09 (0.08); basitarsus 0.20 (0.18)/0.065 (0.065); telotarsus 0.415 (0.39)/0.045 (0.045).

Etymology. The species is called an inhabitant of Avernus, the underworld.

Remarks. The type locality, Eudy Cave, is also the type locality of *T. pluto* new species, described below.

6. *Tyrannochthonius jonesi* Chamberlin,
new species

Type material. Holotype female (JC-1284.02001) from Bangor Cave (AL14), 1.5 km NE of Bangor, Blount Co., Alabama, 9 March 1940, W. B. Jones; mounted on slide, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A medium-sized species (palpal chela length 1.07 mm), with moderately slender appendages. Chelicerae and palps light brown, carapace tan, other parts lighter. Epistome small, rounded. No eyes. Tergal chaetotaxy 4:4:4:4:4:6:6:6:-. Coxa II with 11 coxal spines. Chelicera 0.95 as long as carapace. Palp similar in shape to *T. aladdinensis* (Fig. 8): L/B of trochanter 1.85, femur 5.3, patella 2.0, chela 5.5; L/D of hand 2.1; movable finger L/hand L 1.55. Chelal fingers heterodont, macrodenticles tall, sharp, microdenticles small; fixed finger with 23M, 20m; movable finger with 13M, 8-9m, 10v. Leg IV rather slender; L/D of femur+patella 3.05, tibia 4.75.

Measurements (mm). Body L 1.93. Carapace L 0.525. Chelicera L 0.495. Palp: trochanter 0.25/0.135; femur 0.74/0.14; patella 0.32/0.16; chela 1.07/0.195; hand 0.42/0.21; movable finger L 0.65. Leg IV: femur+patella 0.635/0.21; tibia 0.45/0.095; basitarsus 0.21/0.075; telotarsus 0.445/0.05.

Etymology. This species is named in honor of Walter B. Jones, who collected many of the specimens studied herein.

Remarks. Bangor Cave is also the type locality of the chthoniid pseudoscorpion *Aphrastochthonius tenax* Chamberlin (Chamberlin 1962; Peck 1989; Harvey 1991).

7. *Tyrannochthonius nergal* Chamberlin,
new species

Type material. Holotype female (JC-1280.01001) and 2 paratypes (1 female, 1 tritonymph) from Natural Well (AL 5), Monte Sano State Park, Madison Co., Alabama, 6 August 1939, W. B. Jones; mounted on slides, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A large species (palpal chela length 1.65-1.68 mm) with 4 setae on tergites 1-5 and 5 setae on tergite 6, and with quite slender appendages. Chelicerae and palps light brown, carapace tan, other parts lighter. Epistome small, rounded. No eyes. Tergal chaetotaxy 4:4:4:4:5:6:6:-. Coxa II with 11-13 coxal spines. Palp similar in shape to *T. tenuis* (Fig.10), but a little less slender: L/B of trochanter 1.8-1.9, femur 6.25, patella 2.05-2.15, chela 6.1-6.35; L/D of hand 2.35-2.45; movable finger L/hand L 1.6-1.65. Chelal fingers heterodont, both macro- and microdenticles rather tall, sharp; fixed finger with 29M, 26m; movable finger with 19M, 18m, 7v. Leg IV: L/D of femur+patella 3.2, tibia 5.55-5.6.

Tritonymph. Similar to adults but smaller and more robust. Tergal chaetotaxy 4:4:4:4:6:6:6:-. Coxa II with 8 coxal spines. Palp: L/B of femur 5.2, patella 1.9, chela 5.8; L/D of hand 2.4; movable finger L/hand L 1.55. Leg IV: proportions not determinable.

Measurements (mm). Adults. Figures given first for holotype, followed in parentheses by those for paratype. Body L 2.63 (2.87). Carapace L 0.70 (0.70). Chelicera 0.71 (0.71). Palp: trochanter 0.38 (0.38)/0.21 (0.20); femur 1.19 (1.19)/0.19 (0.19); patella 0.49 (0.47)/0.23 (0.23); chela 1.68 (1.65)/0.265 (0.27); hand 0.65 (0.64)/0.265 (0.27); movable finger L 1.05 (1.07). Leg IV: femur+patella 1.00 (0.99)/0.31 (0.31); tibia 0.70 (0.695)/0.125 (0.13); basitarsus 0.295 (0.295)/0.105 (0.105); telotarsus 0.76 (0.73)/0.065 (0.065).

Tritonymph: Body L 1.65. Carapace L 0.465. Chelicera 0.46. Palp: femur 0.73/0.14; patella 0.295/0.155; chela 1.04/0.18; hand 0.41/0.17; movable finger L 0.635.

Etymology. The species is named for Nergal, in Akkadian mythology the god ruling the world of the dead.

8. *Tyrannochthonius osiris* Chamberlin,
new species

Type material. Holotype male (JC-1282.01001) and allotype female (JC-1282.01002) from Gary Self Pit, Cave Stand entrance (AL 290E), 3 km N of Garth, Jackson Co., Alabama, 9 June 1940, W. B. Jones and A. F. Archer; mounted on slides, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A medium-sized species (palpal chela length 1.34-1.48 mm) with slender appendages. Chelicerae and palps light brown, carapace tan, other parts lighter. Epistome small, triangular. No eyes. Tergal chaetotaxy 4:4:4:4:4:6:6:6:-. Coxa II with 9-12 coxal spines. Chelicera as long as carapace. Palp similar in shape to *T. aladdinensis* (Fig. 8): L/B of trochanter 1.9-2.0, femur 5.7-6.0, patella 2.1-2.15, chela 6.1-6.45; L/D of hand 2.25-2.3; movable finger L/hand L 1.8. Chelal fingers heterodont, macrodenticles tall, sharp, microdenticles small, triangular; fixed finger with 27-29M, 20-25m; movable finger with 18-20M, 17-19m, 5-6v. Leg IV: L/D of femur+patella 3.35, tibia 5.4-5.8.

Measurements (mm). Figures given first for holotype male, followed in parentheses by those for allotype female. Body L 1.98, (?). Carapace L 0.58 (0.63). Chelicera L 0.58 (0.65). Palp: trochanter 0.32 (0.34)/0.16 (0.18); femur 0.91 (1.00)/0.16 (0.165); patella 0.39 (0.40)/0.18 (0.19); chela 1.34 (1.48)/0.22 (0.23); hand 0.49 (0.52)/0.215 (0.23); movable finger L 0.87 (0.93). Leg IV: femur+patella 0.725 (0.79)/0.215 (0.235); tibia 0.51 (0.555)/0.095 (0.095); basitarsus 0.235 (0.26)/0.07 (0.08); telotarsus 0.54 (0.58)/0.05 (0.055).

Etymology. The species is named for Osiris, the Egyptian god of the underworld.

9. *Tyrannochthonius parvus* Chamberlin,
new species (Fig. 9)

Type material. Holotype female (JC-1283.01001) from Ingram Cave (AL 70), near Algood, Blount Co., Alabama, 8 March 1940, W. B. Jones; mounted on slide, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular

features. A small species (palpal chela length 0.85 mm), with no eyes and long chelal fingers. Chelicerae light brown, palps and carapace tan, other parts lighter. Epistome small, rounded. No eyes. Tergal chaetotaxy 4:4:4:4:6:6:6:6:-. Coxa II with 9 coxal spines. Chelicera 0.95 as long as carapace. Palp as shown in Fig. 9: L/B of trochanter 1.85, femur 4.7, patella 1.95, chela 5.3; L/D of hand 1.8; movable finger L/hand L, 2.05. Chelal fingers heterodont, macrodentacles tall, sharp, microdentacles of both fingers up to one-half length of macrodentacles; fixed finger with 24M, 16m; movable finger with 11M, 10m, 12-13v. Leg IV rather robust: L/D of femur+patella 2.7, tibia 4.0.

Measurements (mm). Body L 1.48. Carapace L 0.445. Chelicera L 0.415. Palp: trochanter 0.215/0.115; femur 0.555/0.12; patella 0.245/0.125; chela 0.85/0.16; hand 0.28/0.155; movable finger L 0.58. Leg IV: femur+patella 0.46/0.17; tibia 0.325/0.08; basitarsus 0.155/0.06; telotarsus 0.32/0.04.

Etymology. The species is named *parvus* because of its relatively small size.

Remarks. The exact location of Ingram Cave is not known. It is listed as AL 70 and a sketch map is shown in Varnedoe (1973), but at present no one seems to know where it is (Peck 1989: 16; W. Torode, in litt. 1994).

10. *Tyrannochthonius pluto* Chamberlin,
new species

Type material. Holotype female (JC-2054.02002) from Eudy Cave (AL 96), 1.5 km S of Oleander, Marshall Co., Alabama, 23 June 1942, W. B. Jones; mounted on slide, in AMNH.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A large species (palpal chela length 1.61 mm) with very slender palps and 4 setae on tergites 1-7. Chelicerae and palps light brown, carapace tan, other parts lighter. No epistome, anterior margin of carapace finely serrate at middle. No eyes. Tergal chaetotaxy 4:4:4:4:4:4:6:6:-. Coxa II with 11 coxal spines. Chelicera as long as carapace. Palp similar in shape to *T. tenuis* (Fig. 10), but a little less slender: L/B of trochanter 1.95, femur 6.1, patella 2.25, chela 7.1; L/D of hand 2.55; movable finger L/hand L 1.9. Chelal fingers heterodont, macrodentacles tall, sharp, microdentacles 1/3-1/2

as tall as macrodentacles; fixed finger with 30M, 24m; movable finger with 29M, 17m, 9v. Leg IV slender: L/D of femur+patella 3.05, tibia 5.5.

Measurements (mm). Body L 2.09. Carapace L 0.68. Chelicera L 0.695. Palp: trochanter 0.355/0.18; femur 1.04/0.17; patella 0.43/0.19; chela 1.61/0.225; hand 0.555/0.22; movable finger L 1.07. Leg IV: femur+patella 0.85/0.28; tibia 0.63/0.115; basitarsus 0.295/0.09; telotarsus 0.66/0.06.

Etymology. The species is named for Pluto, the classical god of the underworld.

Remarks. The type locality, Eudy Cave, is also the type locality of *T. avernicolus* new species, described above.

11. *Tyrannochthonius tenuis* Chamberlin,
new species (Fig. 10)

Type material. Holotype male (JC-1287.01001) and paratype male from Cave Spring Cave (AL 60), Chapman Mtn., Huntsville, Madison Co., Alabama, 8 October 1939, W. B. Jones and A. B. Flanagan, in AMNH; allotype female (WM1656.01001) from same cave, 21 August 1968, S. B. Peck, in FSCA; mounted on slides.

Diagnosis. Representative of *Tyrannochthonius* as outlined above, and with the following particular features. A large species (palpal chela length 1.60-1.84 mm) with 4 setae on tergites 1-5 and very slender appendages, especially in male. Chelicerae and palps light brown, carapace tan, other parts lighter. Epistome small, rounded. No eyes. Tergal chaetotaxy 4:4:4:4:4:4:6:6:-. Coxa II with 12-15 coxal spines. Chelicera slightly longer than carapace. Palp as shown in Fig. 10: L/B of trochanter 1.85-1.95, femur 6.2-6.35, patella 2.15, chela 5.9 (f), 6.8-6.95 (m); L/D of hand 2.25 (f), 2.65-2.7 (m); movable finger L/hand L 1.55-1.6. Chelal fingers heterodont, both macro- and microdentacles relatively tall, sharp; fixed finger with 25-29 M, 20-27m; movable finger with 22-24M, 19-22m, 6-7v. Leg IV slender: L/D of femur+patella 3.2-3.5, tibia 5.85-6.0.

Measurements (mm). Figures given first for holotype male, followed in parentheses by those for paratype male and allotype female. Body L 2.48 (2.08, ?). Carapace L 0.74 (0.64, ?). Chelicera L 0.77 (0.66, 0.815). Palp: trochanter 0.415 (0.355, 0.43)/0.215

(0.18, 0.23); femur 1.24 (1.10, 1.30)/0.20 (0.175, 0.205); patella 0.50 (0.43, 0.52)/0.235 (0.20, 0.245); chela 1.84 (1.60, 1.83)/0.27 (0.23, 0.31); hand 0.72 (0.63, 0.725)/0.27 (0.235, 0.32); movable finger L 1.11 (1.01, 1.12). Leg IV: femur+patella 1.06 (0.94, 1.05)/0.33 (0.27, 0.31); tibia 0.76 (0.66, 0.75)/0.13 (0.11, 0.125); basitarsus 0.325 (0.27, 0.31)/0.11 (0.095, 0.105); telotarsus 0.755 (0.68, 0.785)/0.065 (0.06, 0.06).

Etymology. The species is named *tenuis* in recognition of its distinctly attenuated appendages.

Remarks. This species shows some sexual dimorphism, in that the male has distinctly more slender appendages than the female (e.g. L/B of palpal chela 6.8-6.95 in male, but only 5.9 in female).

Discussion

In addition to the epigeal species (*T. floridensis*), Chamberlin and Malcolm (1960) mentioned 11 cavernicolous forms belonging to *Tyrannochthonius*, and pointed out the differences in sizes and proportions of the palpal segments (1960: 106-107, fig. 1.). These differences are clearly demonstrated in the present paper.

All of the cavernicolous species are larger than the epigeal *T. floridensis*, some by a small margin and others by a large margin. For example, the palpal femur and chela of *T. parvus* (Fig. 9) are 1.2 or more times as long as those of *T. floridensis* (Fig. 7), while those of *T. tenuis* (Fig. 10) are 2.3 or more times as long. And the length/breadth ratios of the palpal femur and chela of *T. parvus* are only slightly greater than those of *T. floridensis*, while those of *T. tenuis* are 1.2-1.4 times as great. The other cavernicolous species are generally intermediate in size and proportions between *T. parvus* and *T. tenuis*.

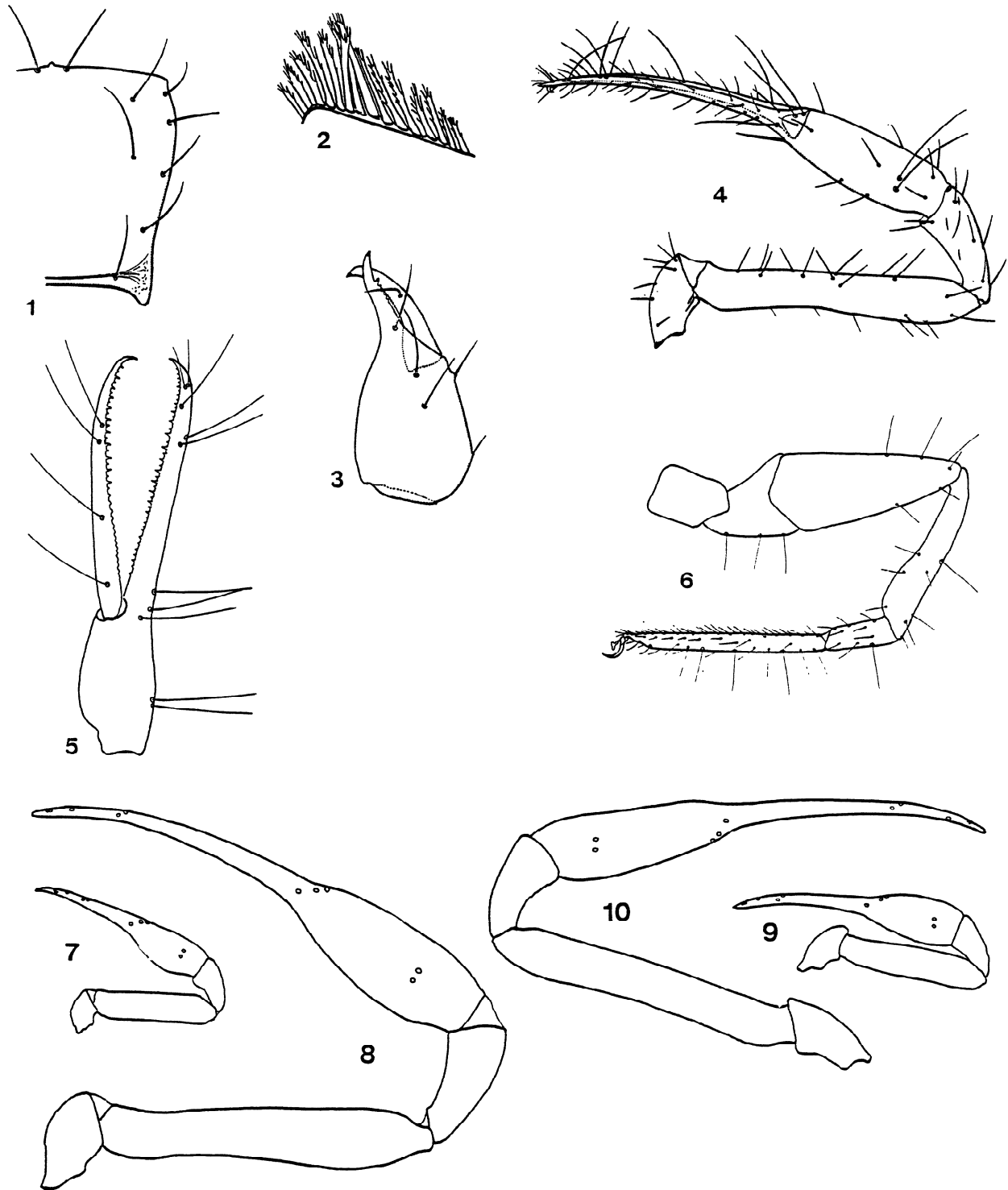
Further discussion of the modifications of these pseudoscorpions for life in caves will be presented in Part II of this study (in prep.).

Acknowledgments

I am greatly indebted to the late W. B. Jones and his colleagues, who collected most of the pseudoscorpions treated here. I also thank D. R. Malcolm (J. C. Chamberlin collection) and N. I. Platnick (AMNH) for the loan of specimens. W. Torode supplied much useful information about Alabama caves. I am very grateful to Doris Kist for her invaluable aid in preparing the manuscript for publication.

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Figures 1-10: *Tyrannochthonius* species, morphological features (1-4, 6, *T. nergal*; 5, *T. parvus*): 1, carapace, left side omitted (JCC); 2, coxal spines (JCC); 3, right chelicera, lateral view (JCC); 4, right palp, dorsal view (JCC); 5, left palpal chela, lateral view showing trichobothriotaxy and dentition, setae omitted (JCC & WBM); 6, leg IV (WBM). 7-10: *Tyrannochthonius* species, dorsal views of palps showing shapes of segments, setae omitted (all drawn to same scale, by WBM): 7, *T. floridensis*; 8, *T. aladdinensis*; 9, *T. parvus*; 10, *T. tenuis*.