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New Species and Records of Cavernicolous Pseudoscorpions of the Genus *Microcreagris* (Arachnida, Chelonethida, Neobisiidae, Ideobisiinae)

BY WILLIAM B. MUCHMORE¹

J. C. Chamberlin's paper on cavernicolous pseudoscorpions (1962) discussed seven species of the genus *Microcreagris* which have been found in caves of the United States. Since that time assiduous collecting by a number of devoted biospeleologists has turned up representatives of nine species of the genus, together with additional specimens of previously described, but poorly known, species. It is now evident that, even though specimens are collected only infrequently, the genus is widely distributed in caves in both eastern and western United States.

I wish to give special thanks to the following for making specimens available for the present study: R. Bridgemon, J. E. Cooper, W. R. Halliday, R. E. Graham, S. B. Peck, and J. Reddell. Types of the new species are deposited in the collection of the American Museum of Natural History. The present work was supported in part by Grant No. GB-5299, from the National Science Foundation.

A key to the American species of cave-dwelling *Microcreagris* may be found at the end of the systematic treatment.

GENUS *MICROCREAGRIS* BALZAN

Microcreagris BALZAN, 1891, p. 543; CHAMBERLIN, 1930, p. 23; CHAMBERLIN, 1962,

¹ Associate Professor of Biology, University of Rochester, Rochester, New York.

p. 333; BEIER, 1963, p. 206.

The genus as presently defined is holarctic in distribution, and many epigeal species have been described. Cave-dwelling forms are known from several countries in southern Europe, namely Portugal, Spain, France, Italy, Sardinia, and Bulgaria (see Beier, 1963) as well as from the United States.

Microcreagris subatlantica Chamberlin

Microcreagris subatlantica CHAMBERLIN, 1962, p. 340

Three additional specimens of this species have been collected by S. B. Peck; one male from "debris below entrance" of Parker Cave, 2 miles northeast of Subligna, Chatooga County, Georgia, June 20, 1967; one female and one tritonymph from rotten tree roots near Bangor Cave, Bangor, Blount County, Alabama, March 19, 1966. The male and female appear closely similar to the holotype and allotype in all respects.

Microcreagris pumila, new species

Figures 1, 2

MATERIAL: Holotype male (WM1009.01001) collected from debris at entrance of Bryant Cave, 4 miles southwest of Blount Springs, Blount County, Alabama by Stewart B. Peck on March 19, 1966. Two paratype males from litter 1 mile southeast of Blount Springs on April 5, 1967 and one paratype female from Parker Cave, 2 miles northeast of Subligna, Chatooga County, Georgia on June 20, 1967, both collections by Peck.

DESCRIPTION: Male (figures given are for the holotype or ranges for the three types): A small species of epigeal facies but with only two eyes. Carapace, chelicerae, and palps light brown, body and legs tan. Carapace longer than broad; epistome low and rounded; two corneate eyes present, each about one ocular diameter from anterior margin; surface of carapace smooth. A total of 26 setae on carapace, with four at anterior margin and six (seven in one paratype) at posterior margin. Coxal area typical; palpal coxa with three apical setae; each coxa IV with seven or eight setae.

Abdomen long ovate. Tergal chaetotaxy 6:6:8:11:10:12:11:10:10:9:-6:2. Anterior genital operculum with three to six setae on each side of midpoint along margin; two internal guard setae on each side; posterior operculum with five to seven small setae grouped near middle of anterior margin and eight or nine along posterior margin. Each anterior spiracle with two or three, and each posterior spiracle with three, small guard setae. Sternites with about 10 marginal setae in single row.

Chelicera a little more than half as long as carapace, 1.9 times as long

as broad. Palm with six setae (seven on left chelicera of one paratype); both fixed and movable fingers with 15–20 marginal teeth; galea short and simple; serrula exterior with about 25 blades; flagellum of eight setae of which all but proximal one or two are long and finely pinnate.

Palps short and stout; proportions of segments as shown in figure 1; femur about 0.95 and chela (including pedicel) about 1.5 times as long as carapace. Surfaces of all segments smooth. Tactile setae of chela as shown in figure 2. Fixed finger of chela with 42–46 and movable finger with 42–47 contiguous teeth, distalmost 12–15 on fixed finger and five or six on movable finger with cusps. Trochanter 1.7–1.9, femur, 2.7–3.0, tibia 1.95–2.1, tibial pedicel 2.0, and chela 2.8–3.1 (including pedicel, 3.0–3.4) times as long as broad; hand 1.35–1.5 (including pedicel, 1.6–1.75) times as long as deep; movable finger 0.93–1.0 times as long as hand plus pedicel.

Legs relatively stout; leg IV with entire femur 2.9–3.1 and tibia 4.4–4.9 times as long as deep. Leg IV with tactile seta on tibia about 0.4, on metatarsus about 0.2 and on telotarsus about 0.25 length of segment from proximal end. Subterminal tarsal setae subequally furcate at about middle, each branch with a few fine spinules.

Female: Similar to male in nearly all respects, but larger. Galea on movable finger of chelicera unbranched as in male, but slightly larger. Anterior genital operculum with six setae on face; posterior operculum with 10 setae along margin. Fixed chelal finger with 50 and movable finger with 49 marginal teeth.

MEASUREMENTS (IN MM.): The first figures given are ranges for the three male types, whereas those following in parentheses are for the female paratype. Body length 1.8–2.3 (2.3). Carapace 0.53–0.56 (0.65) long; greatest breadth about 0.45 (0.50); eye about 0.045 (0.06) in diameter. Chelicera 0.285–0.30 (0.35) long by 0.16–0.17 (0.17) broad; movable finger 0.19–0.21 (0.235) long. Palpal trochanter 0.28–0.29 (0.31) by 0.15–0.17 (0.18); femur 0.47–0.515 (0.60) by 0.17–0.175 (0.20); tibia 0.40–0.445 (0.50) by 0.205–0.22 (0.235); tibial pedicel, exterior length 0.16–0.17 (0.19), least breadth 0.075–0.08 (0.085); chela 0.76–0.083 (0.90) [including pedicel 0.82–0.90 (0.98)] by 0.265–0.285 (0.32); hand 0.37–0.395 (0.475) by 0.265–0.285 (.34) deep; movable finger 0.405–0.465 (0.495) long. Leg IV: entire femur 0.41–0.46 (0.52) long; basifemur 0.205–0.22 (0.25) by 0.14–0.16 (0.155); telofemur 0.22–0.24 (0.285) by 0.14–0.16 (0.155); tibia 0.35–0.415 (0.43) by 0.08–0.085 (0.085); metatarsus 0.15–0.16 (0.185) by 0.06 (0.07); telotarsus 0.22–0.23 (0.25) by 0.05–0.06 (0.07).

REMARKS: This form seems to be epigeal and has only fortuitously

been collected in and around the mouths of caves. That it may be widespread and more variable than indicated above is suggested by two other female specimens at hand which are somewhat larger and more robust than the types. One of these specimens was collected in Ament Cave, 1 mile south-southeast of Cookeville, Putnam County, Tennessee, and the other was found on Sand Mountain below Sublett Gap, 5 miles west of Pisgah, Jackson County, Alabama.

***Microcreagris pecki*, new species**

Figures 3, 4

MATERIAL: Holotype male (WM863.01001) collected in Beech Spring Cave, 2.5 miles north of Union Grove, Marshall County, Alabama, on September 9, 1965, by Stewart B. Peck.

DESCRIPTION: Male: A large, attenuated form with two eyes. Carapace, chelicera, and palps light yellowish brown; rest of body and limbs colorless. Carapace slightly longer than broad; epistome distinct, rounded; two relatively small eyes situated about three ocular diameters from anterior margin; surface of carapace smooth. A total of 27 setae on carapace, with four at anterior and six at posterior margin. Coxal area typical; palpal coxa with four large apical setae; each coxa IV with nine setae.

Abdomen long ovate. Tergal chaetotaxy 6:6:7:9:9:10:11:12:10:7:5:2. Anterior genital operculum with six setae on one side and seven setae on other side of midpoint of margin; four internal guard setae on one side and five on other; posterior operculum with six small setae grouped near center of anterior margin and 11 setae along posterior margin. Each spiracle with two guard setae. Sternites with about 12 marginal setae in a single row.

Chelicera about two-thirds length of carapace, 2.1 times as long as broad. Palm with six setae; fixed finger with about 21 teeth of different sizes and shapes and movable finger with about 14 similar teeth; galea very short and unbranched; serrula exterior with 36 blades; flagellum of eight setae, of which distal four are unilaterally pinnate; setae nearly equal in size except most proximal one, which is half the length of others.

Palps relatively long and slender; proportions of segments shown in figure 3; femur 1.6 and chela (including pedicel) 2.4 times as long as carapace. Surfaces of all segments smooth. Tactile setae of chela as shown in figure 4. Fixed chelal finger with 117 contiguous teeth and movable finger with 123 teeth, nearly all on distal half of fixed finger and distal-most 20 on movable finger with cusps. Trochanter 2.0, femur 6.4, tibia 4.8, tibial pedicel 5.4, and chela (including pedicel) 5.7 times as long as broad; hand (including pedicel) 2.75 times as long as deep; movable

finger 1.33 times as long as hand plus pedicel.

Legs quite slender; leg IV with entire femur 7.1 and tibia 9.0 times as long as deep. Leg IV with tactile setae on tibia 0.07, on metatarsus 0.10 and 0.37 and 0.85, and on telotarsus 0.27 length of segment from proximal end. Subterminal tarsal setae unequally furcate at middle, each branch with a few small spinules.

Female: Unknown.

MEASUREMENTS (IN MM.): Holotype male: Body length 3.6. Carapace 1.06 long; anterior breadth 0.79; greatest breadth 0.91. Chelicera 0.69 long by 0.33 deep; movable finger 0.47 long. Palpal trochanter 0.56 long by 0.28 broad; femur 1.71 by 0.27; tibia 1.49 by 0.31; tibial pedicel, exterior length 0.65, least breadth 0.12; chela (including pedicel) 2.55 by 0.45; hand (including pedicel) 1.20 by 0.435 deep; movable finger 1.60 long. Leg IV: entire femur 1.46 long; basifemur 0.73 by 0.21; telofemur 0.76 by 0.21; tibia 1.36 by 0.15; metatarsus 0.54 by 0.12; telotarsus 0.71 by 0.105.

REMARKS: Although *M. pecki* does possess two eyes, it is definitely a troglobite, being large and pale in color, and with more slender appendages than any other eastern form except *M. valentinei* and *M. nickajackensis*.

Microcreagris nickajackensis Muchmore

Microcreagris nickajackensis MUCHMORE, 1966, p. 97.

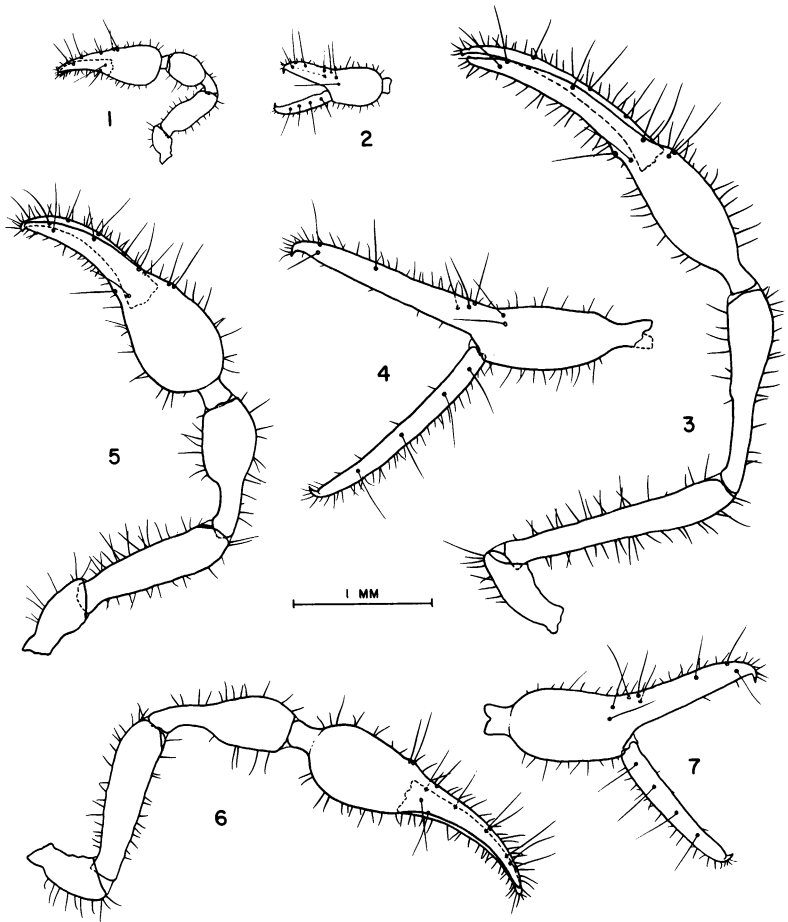
MATERIAL: Topotype female from Nickajack Cave, Marion County, Tennessee, collected by S. B. Peck on April 8, 1967.

Because the description of this species was based on a single specimen, the holotype male, it is worthwhile to record a few pertinent data about this female specimen from the type locality.

The female is similar to the male in most respects, but is slightly smaller. Carapace with no eyes and with total of only 22 setae, of which four are at anterior and six at posterior margin. Coxal area typical; palpal coxa with three large apical setae; coxa IV with eight setae. Tergal chaetotaxy 6:6:6:7:9:10:11:10:7:6:2. Anterior genital operculum with three small setae on each side of midpoint along margin; posterior operculum with 11 marginal setae. Each spiracle with three guard setae. Sternites with about 10 marginal setae in a single row.

Each chelicera with six setae on palm; galea, as in male, short and unbranched; flagellum with 10 setae, of which six or seven are pinnate along anterior margin, and two proximal ones half the length of others.

Palps not quite as attenuated as those of male; femur 1.5 and chela (including pedicel) 2.4 times as long as carapace. Palpal trochanter 2.85,



FIGS. 1, 2. *Microcreagris pumila*, new species, holotype male. 1. Dorsal view of right palp. 2. Lateral view of left chela; marginal teeth omitted.

FIGS. 3, 4. *Microcreagris pecki*, new species, holotype male. 3. Dorsal view of right palp. 4. Lateral view of left chela; marginal teeth omitted.

FIG. 5. *Microcreagris eurydice*, new species, holotype female. Dorsal view of right palp.

FIGS. 6, 7. *Microcreagris mortis*, new species, holotype female. 6. Dorsal view of left palp. 7. Lateral view of right chela; marginal teeth omitted.

femur 6.4, tibia 4.75 and chela 5.6 (including pedicel, 6.15) times as long as broad. Fixed chelal finger with 109 and movable finger with 116 contiguous, marginal teeth, only 15–20 teeth at distal end of each finger with cusps.

MEASUREMENTS (IN MM.): Body length 3.1. Carapace length 0.93, greatest breadth 0.745. Chelicera 0.56 long by 0.26 broad; movable finger 0.38 long. Palpal trochanter 0.63 by 0.22; femur 1.41 by 0.22; tibia 1.24 by 0.26; chela 2.03 (including pedicel, 2.215) by 0.36; hand 0.805 (including pedicel, 0.99) by 0.35; movable finger 1.39 long. Leg IV: entire femur 1.185 long; basifemur 0.57 by 0.20; telofemur 0.64 by 0.19; tibia 1.07 by 0.13; metatarsus 0.42 by 0.09; telotarsus 0.625 by 0.09.

Microcreagris persephone Chamberlin

Microcreagris persephone CHAMBERLIN, 1962, p. 348.

A specimen which appears to belong to this species was found by S. B. Peck, September 4, 1965, in Driftwood Cave (#176), 5.5 miles north of Scottsboro, Jackson County, Alabama. The cave is about 40 miles north-northeast of Davidson Cave, the type locality of the species, and on the opposite side of the Tennessee River.

The specimen, a female, is similar to the holotype female in most respects. There are, however, several differences in chaetotaxy and proportions of the appendages, which together with the geographical and geological separation, suggest the possibility that this may be a form distinct from *M. persephone*. This problem can only be resolved after more material becomes available from caves of this area.

Microcreagris eurydice, new species

Figure 5

MATERIAL: Holotype female (WM1010.01001) collected in Kennamer Cave, 2 miles east of Paint Rock, Jackson County, Alabama, on March 15, 1966 by Stewart B. Peck.

DESCRIPTION: Female: A large, richly colored, relatively robust form without eyes. Carapace, chelicerae, and palps medium reddish brown; tergites, sternites, and legs light tan. Carapace slightly longer than broad; epistome distinct, rounded; no eyes or eyespots present; surface smooth. A total of 25 setae on carapace, with four at anterior and six at posterior margin. Coxal area typical; palpal coxa with three large apical setae on one side and four on other; coxa IV with 10 setae.

Abdomen long ovate. Tergal chaetotaxy 6:8:10:11:11:13:12:12:12:-10:6:2. Anterior genital operculum with four small setae on one side and five on other side of midpoint of margin; posterior operculum with 11 setae along margin between spiracles. Each spiracle with three or four guard setae. Sternites with about 12 marginal setae in a single row.

Chelicera about two-thirds length of carapace, 2.05 times as long as

broad. Palm with six setae; fixed finger with 12 or more irregular and obsolescent teeth; movable finger with about 15 similar teeth; galea short and unbranched; serrula exterior with about 31 blades; flagellum of eight setae, of which distal four are unilaterally pinnate, and proximal one is much shorter than others.

Palps relatively robust for a cavernicolous form; proportions of segments as in figure 5; femur 1.2 and chela (including pedicel) 2.03 times as long as carapace. Surfaces of all palpal segments smooth. Tactile setae of chela as shown in figure 5. Fixed chelal finger with 75 and movable finger with 80 contiguous, marginal teeth; only 15–20 teeth at distal end of each row bearing cusps. Trochanter 2.3, femur 3.9, tibia 2.6, tibial pedicel 2.85, and chela (including pedicel) 3.4 times as long as broad; hand (including pedicel) 1.8 times as long as deep; movable finger 1.08 times as long as hand plus pedicel.

Legs moderately slender; leg IV with entire femur 4.1 and tibia 5.9 times as long as deep. Leg IV with tactile setae on tibia 0.35, on metatarsus 0.14 and 0.80, and on telotarsus 0.36 length of segment from proximal end. Subterminal tarsal setae unequally furcate, each branch with a few small spinules near tip.

Male: Unknown.

MEASUREMENTS (IN MM.): Holotype female: Body length 3.45. Carapace 0.97 long, greatest breadth 0.85. Chelicera 0.62 long by 0.30 broad; movable finger 0.44 long. Palpal trochanter 0.64 by 0.28; femur 1.18 by 0.30; tibia 0.99 by 0.38; tibial pedicel, exterior length 0.40, least breadth 0.14; chela 1.80 (including pedicel, 1.97) by 0.58; hand 0.83 (including pedicel, 0.99) by 0.55 deep; movable finger 1.07 long. Leg IV: entire femur 1.03 long; basifemur 0.50 by 0.25; telofemur 0.55 by 0.25; tibia 0.92 by 0.155; metatarsus 0.35 by 0.12; telotarsus 0.53 by 0.11.

***Microcreagris mortis*, new species**

Figures 6, 7

MATERIAL: Holotype female (WM1555.01001) found in "The Morgue" Cave (AL-942) about 1.5 miles east-northeast Paint Rock, Jackson County, Alabama, on June 23, 1968, by W. Torode.

DESCRIPTION: Female: A moderately large, rather pale, eyeless species, with appendages somewhat attenuated. Carapace, chelicerae, and palps light brown, body and legs yellowish brown. Carapace slightly longer than broad; epistome low and rounded. No definite eyes present; however, on each side, in the ocular region, there is a small, smooth area resembling a cornea but with a seta set into its surface. Surface of carapace smooth. A total of 24 setae on carapace, with four at anterior and

six at posterior margin. Coxal area typical; palpal coxa with four large apical setae; coxa IV with nine setae.

Abdomen elongate. Tergal chaetotaxy 6:7:9:11:11:13:13:12:12:10:-6:2. Anterior genital operculum with three small setae on one side and four on other side of midpoint of margin; posterior operculum with nine setae along margin between spiracles. Each spiracle with two to four guard setae. Sternites with about 12 marginal setae in a single row.

Chelicera about three-fifths as long as carapace, two times as long as broad. Right palm with six setae, left palm with five; fixed finger with about 23 teeth and movable finger with about 15 teeth; galea short and simple; serrula exterior with 30 blades; flagellum of eight setae, of which distal four or five are unilaterally pinnate, and proximal one much shorter than others.

Palps somewhat attenuated, compared with eastern epigean species; proportions of segments as in figure 6; femur 1.1 and chela (including pedicel) 2.05 times as long as carapace. Surfaces of all segments smooth. Tactile setae of chela as shown in figure 7. Fixed chelal finger with 71 and movable finger with 81 contiguous, marginal teeth, only 15–20 teeth at distal end of each finger bearing cusps. Trochanter 2.1, femur 4.2, tibia 2.75, tibial pedicel 3.3, and chela (including pedicel) 4.15 times as long as broad; hand (including pedicel) 2.0 times as long as deep; movable finger 1.11 times as long as hand with pedicel.

Legs moderately slender; leg IV with entire femur 4.6 and tibia 6.9 times as long as deep. Leg IV with tactile setae on metatarsus 0.135 and on telotarsus 0.33 length of segment from proximal end. Subterminal tarsal setae unequally furcate distal to middle, each branch with one or two spinules at tip.

Male: Unknown.

MEASUREMENTS (IN MM.): Holotype female: Body length 3.70. Carapace 1.07 long, greatest breadth 0.99. Chelicera 0.625 long by 0.31 broad; movable finger 0.46 long. Palpal trochanter 0.61 by 0.285; femur 1.15 by 0.285; tibia 1.02 by 0.37; tibial pedicel, exterior length 0.45, least breadth 0.135; chela 2.02 (including pedicel, 2.19) by 0.53; hand 0.82 (including pedicel, 0.99) by 0.50; movable finger 1.10 long. Leg IV: entire femur 1.055; basifemur 0.515 by 0.23; telofemur 0.56 by 0.225; tibia 0.93 by 0.135; metatarsus 0.37 by 0.11; telotarsus 0.52 by 0.105.

REMARKS: Although this form is similar to *M. eurydice* in many respects and comes from a cave close to the type locality of *M. eurydice*, it appears to be sufficiently different to be considered distinct. This opinion can only be confirmed, of course, after additional material becomes available from these and neighboring caves.

Microcreagris grandis Muchmore

Microcreagris grandis MUCHMORE, 1962, p. 1.

MATERIAL: Topotype female from Lehman Caves, Baker, White Pine County, Nevada, July 27, 1967; collected by R. Bridgemon.

Inasmuch as the species has heretofore been known only from the holotype male and a tritonymph, it is worthwhile to record some data about this female specimen.

The female is similar to the male in most respects but is slightly larger. The carapace is similar to that of male and the four eyes are well-developed; carapacial setae 24 (4, 6). Coxal area typical; palpal coxa with 4–5 large, apical setae; coxa IV with 14–16 setae. Tergal chaetotaxy 7:7:8:10:9:9:10:10:10:10:6:2. Anterior genital operculum with five setae on one side and four on other side of midpoint of margin; posterior operculum with 17 marginal setae. Each spiracle with six or seven guard setae. Sternites with about 16 marginal setae, and in addition sternites 6, 7, and 8 with two setae on face near middle.

Chelicera with six setae on palm; galea, as in male, bifid and terminally denticulate; flagellum with 11 setae, all of which are pinnate along anterior margin, most proximal one very short.

Palps elongate, but not so much as in male; femur 1.35 and chela (including pedicel) 2.05 times as long as carapace. Fixed chelal finger with 111 contiguous, marginal teeth, all with cusps; movable finger with 108 contiguous teeth, of which only about 13 at distal end bear cusps.

MEASUREMENTS (IN MM.): Body length 6.63. Carapace length 2.08, greatest breadth 1.7; diameter of eyes about 0.10. Chelicera 1.18 by 0.57 broad; movable finger 0.78 long. Palpal trochanter 1.33 by 0.58; femur 2.82 by 0.55; tibia 2.80 by 0.63; tibial pedicel, exterior length 1.21, least breadth 0.27; chela 4.12 (including pedicel, 4.24) by 1.05; hand 2.15 (including pedicel, 2.42) by 0.94; movable finger 2.06 long. Leg IV: entire femur 2.21 long; basifemur 1.02 by 0.435; telofemur 1.22 by 0.42; tibia 2.23 by 0.265; metatarsus 0.79 by 0.19; telotarsus 0.97 by 0.16.

Microcreagris columbiana Chamberlin

Microcreagris columbiana CHAMBERLIN, 1962, p. 334.

MATERIAL: One female, collected in Pillar of Fire Cave, 1.5 miles south of Trout Lake, Klickitat County, Washington, on September 25, 1966, by W. R. Halliday.

Inasmuch as the species has heretofore been known only from the holotype male, it seems advisable to record some of the features of the specimen at hand. The female is generally similar to the male, but is

somewhat larger, as is usually the case in species of this genus. Carapace with small, truncated epistome and with two weakly corneate eyes. A total of 24 setae on carapace with four at anterior and six at posterior margin. Apex of palpal coxa with five large setae; coxa IV with 15 setae. Tergal chaetotaxy 11:13:12:12:12:12:13:13:14:12:8:2. Anterior genital operculum with a group of eight or nine setae on either side of middle; posterior operculum with marginal row of 20 setae including five small setae near middle.

Chelicera much like that of male, but galea somewhat longer and with three or four short, terminal branches. Flagellum of eight setae all of which are pinnate along anterior margins; most proximal seta only half as long as others.

Palps larger than those of male, but with essentially same proportions and chaetotaxy. Fixed finger of chela with 80 contiguous, marginal teeth, all with cusps; movable finger with 67 teeth, only 18 at distal end with cusps. Palpal trochanter 2.7, femur 4.8, tibia 3.5, chela (including pedicel) 3.75 times as long as broad; hand (including pedicel) 2.25 times as long as deep; movable finger 0.83 times as long as hand plus pedicel.

MEASUREMENTS (IN MM.): Body length 4.96. Carapace 1.46 long. Chelicera 0.78 long by 0.50 broad; movable finger 0.56 long. Palpal trochanter 0.98 by 0.36; femur 1.72 by 0.36; tibia 1.62 by 0.465; chela 2.54 (including pedicel, 2.79) by 0.745; hand 1.33 by 0.70; movable finger 1.31 long. Leg IV: entire femur 1.36 by 0.32; tibia 1.34 by 0.165; metatarsus 0.43 by 0.125; telotarsus 0.575 by 0.105.

***Microcreagris grahami*, new species**

Figures 8, 9

MATERIAL: Holotype male (WM1125.01001) taken by Richard E. Graham in Pseudoscorpion Cave, 2 miles south of Vallecito, Calaveras County, California, on August 17, 1963; in "Semi-dark, traveling on open limestone wall." Paratype female taken by Graham in Moaning Cave, 1 mile south of Vallecito, on August 22, 1963; on "floor of main room, artificial lights on (commercial cave) otherwise true darkness, found on rotting wood-pile, plenty of prey, wood wet, temperature 56°F."

DESCRIPTION: Male: A large, eyeless form with attenuated appendages. Carapace, chelicerae, and palps a rich, reddish brown, body and legs pallid. Carapace about one-third longer than broad; anterior margin with small, triangular epistome; no eyes or eyespots present; surface smooth. A total of 24 setae on carapace, with four at anterior and six at posterior margin. Coxal area typical; palpal coxa with three large apical

setae; coxa IV with 11–13 setae.

Abdomen long ovate. Tergal chaetotaxy 6:8:10:10:11:11:11:12:-10:5:2. Anterior genital operculum with 23 setae scattered on face; three internal guard setae on each side; posterior operculum with six small setae grouped near middle of face and 11 setae along posterior margin. Each spiracle with four or five guard setae. Sternites with about 12 marginal setae; in addition sternites 6, 7 and 8 with two setae on face near middle.

Chelicera about three-fifths as long as carapace, 2.1 times as long as broad. Palm with six setae; fixed finger with about 12 small teeth; movable finger with one large and nine smaller teeth on raised crest in distal half of margin; galea simple, but with a few, tiny subterminal spinules; serrula exterior with about 30 blades. Flagellum of eight setae, all of which are pinnate along anterior margins; setae subequal in size, except most proximal one, which is three-quarters length of others.

Palps relatively long and slender; proportions as shown in figure 8; femur 1.45 and chela (including pedicel) 2.35 times as long as carapace. Distinct granulations over most of trochanter and femur, and on chelal hand and bases of fingers; fine granulations on tibial pedicel. Tactile setae of chela as shown in figure 9. Fixed chelal finger with 93 contiguous teeth, all with cusps. Movable finger with 89 contiguous teeth of which only about 15 at distal end have cusps. Trochanter 3.1, femur 6.1, tibia 4.6, tibial pedicel 6.5, and chela (including pedicel) 4.7 times as long as broad; hand (including pedicel) 2.5 times as long as deep; movable finger 1.15 times as long as hand plus pedicel.

Legs slender; leg IV with entire femur 5.4 and tibia 8.7 times as long as deep. Leg IV with tactile seta on tibia 0.60, on metatarsus 0.16, and on telotarsus 0.46 length of segment from proximal end. Subterminal tarsal setae unequally furcate at middle, each branch with few small spinules.

Female: Similar to male in most respects, but noticeably larger. Carapace without eyes or eyespots; with total of 23 setae, of which five are at anterior margin and only four at posterior margin. Palpal coxae with three and four large apical setae. Anterior genital operculum with a row of five or six setae on either side of midpoint of margin; posterior operculum with 22 marginal setae, including about six on each spiracular plate. Cribriform plates are particularly evident on this specimen—a single, large median plate, on each side of which is a transversely oriented row of about eight smaller plates. Cheliceral galea longer than that of male and with two short, stout subterminal spinules. Palpal trochanter 3.1, femur 5.8, tibia 4.6, tibial pedicel 7.1, and chela (including pedicel)

5.0 times as long as broad; hand (including pedicel) 2.8 times as long as deep; movable finger 1.06 times as long as hand plus pedicel. Fixed chelal finger with 98 and movable finger with 99 contiguous teeth.

MEASUREMENTS (IN MM.): Holotype male, paratype female in parentheses: Body length 3.4 (4.1). Carapace 1.15 (1.36) long; anterior breadth 0.70 (0.84); greatest breadth 0.90 (1.11). Chelicera 0.68 (0.79) long by 0.32 (0.36) broad; movable finger 0.47 (0.56) long. Palpal trochanter 0.83 (0.97) by 0.27 (0.32); femur 1.68 (2.01) by 0.27 (0.35); tibia 1.61 (1.89) by 0.35 (0.41); tibial pedicel, exterior length 0.78 (0.99), least breadth 0.12 (0.14); chela (including pedicel) 2.70 (3.19) by 0.57 (0.64); hand (including pedicel) 1.32 (1.67) and 0.53 (0.60) deep; movable finger 1.52 (1.77) long. Leg IV: entire femur 1.28 (1.49) long; basifemur 0.58 (0.66) by 0.24 (0.26); telofemur 0.71 (0.84) by 0.23 (0.26); tibia 1.30 (1.49) by 0.15 (0.14); metatarsus 0.45 (0.50) by 0.12 (0.11); telotarsus 0.55 (0.63) by 0.09 (0.085).

REMARKS: The occurrence of four (rather than six) setae at the posterior carapacial margin of the paratype female, together with several other differences, suggests that this specimen might represent a distinct form. However, the similarities with the holotype appear preponderant and the two specimens are, for the present, considered conspecific.

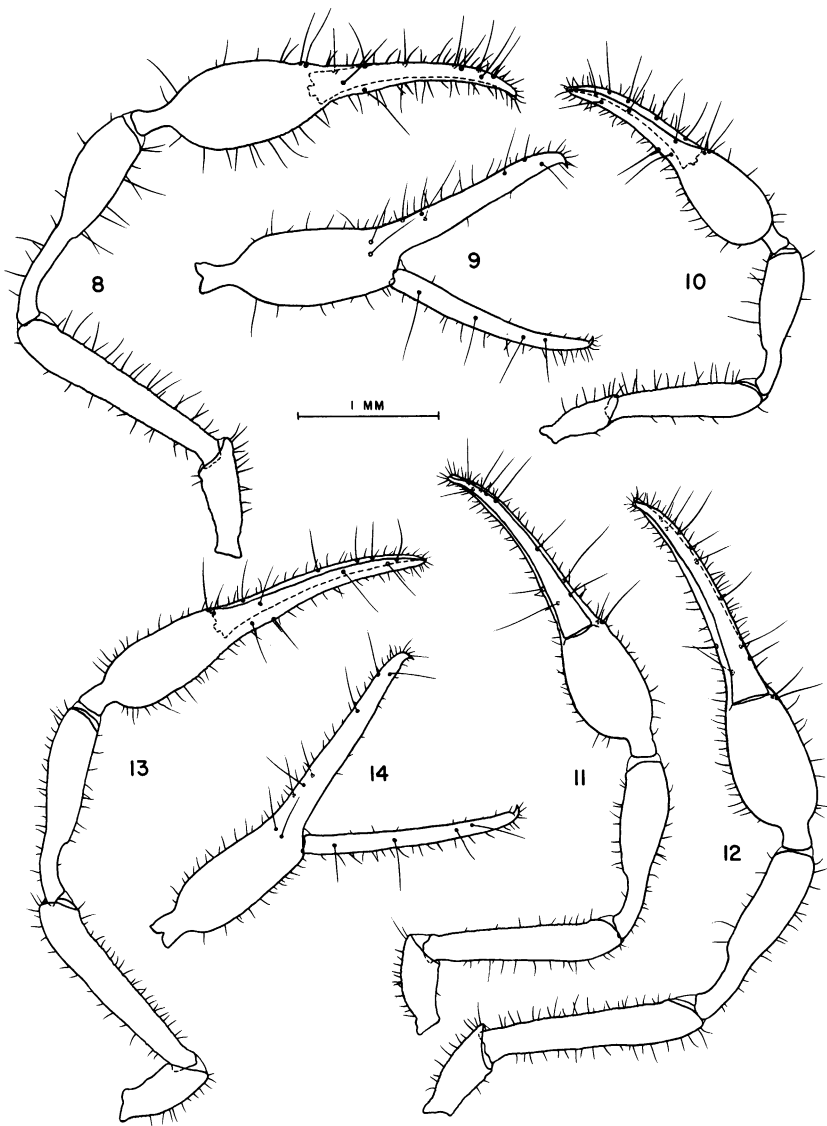
***Microcreagris imperialis*, new species**

Figure 10

MATERIAL: Holotype male (WM1126.01003) and two paratype males collected in Empire Cave, 1 mile northeast of Santa Cruz, Santa Cruz County, California, by Richard E. Graham, on August 26, 1963. Found at "about middle of twilight zone. Each captured on floor either on side or bottom of wood, or in one case traveling over dripstone on floor. Temp. 53.5°F., air saturated, floor very damp."

DESCRIPTION: Male: A medium-sized, eyeless form with somewhat attenuated appendages. Carapace, chelicerae, and palps rich golden-brown in color, body and legs light straw-colored. Carapace about one-fifth longer than broad; anterior margin with small epistomal process; no eyes or eyespots present; surface smooth. A total of 26 setae on carapace, with four at anterior and six at posterior margin. Coxal area typical; palpal coxa with three large apical setae; each coxa IV with nine or 10 setae.

Abdomen long ovate. Tergal chaetotaxy 6:11:11:12:12:12:12:13:-12:6:2. Anterior genital operculum with 19-23 setae spread across face. Four internal guard setae on each side. Posterior operculum with five to nine setae near center of face and 20-25 setae along margin, including



FIGS. 8, 9. *Microcreagris grahami*, new species, holotype male. 8. Dorsal view of left palp. 9. Lateral view of right chela; marginal teeth omitted.

FIG. 10. *Microcreagris imperialis*, new species, holotype male. Dorsal view of right palp.

FIG. 11. *Microcreagris reddelli*, new species, holotype female. Ventral view of left palp.

FIG. 12. *Microcreagris infernalis*, new species, holotype female. Ventral view of left palp.

FIGS. 13, 14. *Microcreagris texana*, new species, holotype female. 13. Dorsal view of left palp. 14. Lateral view of right chela; marginal teeth omitted.

about five on each spiracular plate. Sternites with about 12 marginal setae; in addition sternites 6, 7 and 8 with two setae on face near middle.

Chelicera a little over half as long as carapace, and about twice as long as broad. Palm with six setae; fixed finger with about a dozen small, irregular teeth; movable finger with raised crest on distal third of margin, bearing about 10 poorly developed teeth; galea short and with four or five terminal spinules; serrula exterior with about 30 blades; flagellum of eight setae, all of which are pinnate along anterior margins, and proximal one only half as long as others.

Palps moderately long and slender; proportions as shown in figure 10; femur 1.2 and chela (including pedicel) 2.05 times as long as carapace. Distinct granulations on medial side of trochanter, most of femur, and chelal hand at base of fingers; fine granulations on medial side at distal end of tibia. Tactile setae of chela as shown in figure 10. Fixed chelal finger with 74–82 contiguous teeth, all with cusps; movable finger with about 70–76 contiguous teeth, of which only about 15 at distal end have cusps. Trochanter 2.7, femur 4.9–5.0, tibia 3.6–3.7, tibial pedicel 3.6–4.0, and chela 3.8–4.0 (including pedicel, 4.25–4.4) times as long as broad; hand 1.7–1.9 (including pedicel, 2.2–2.4) times as long as deep; movable finger 1.15–1.18 times as long as hand plus pedicel.

Legs moderately slender; leg IV with entire femur 3.95–4.1 and tibia 7.0–7.25 times as long as deep. Leg IV with tactile seta on tibia 0.53–0.56, on metatarsus 0.15–0.18 and on telotarsus 0.33–0.39 length of segment from proximal end. Subterminal tarsal setae unequally furcate, each branch with one or two strong spinules toward tip.

Female: Unknown.

MEASUREMENTS (IN MM.): Ranges for the three types. Body length 3.25–3.5. Carapace length 0.90–0.96; greatest breadth 0.74–0.79. Chelicera 0.50–0.56 long by 0.25–0.27 broad; movable finger 0.33–0.38 long. Palpal trochanter 0.56–0.61 by 0.205–0.23; femur 1.08–1.18 by 0.22–0.24; tibia 1.00–1.10 by 0.28–0.30; tibial pedicel, exterior length 0.35–0.37, least breadth 0.09–0.10; chela 1.69–1.80 (including pedicel, 1.86–2.01) by 0.43–0.47; hand 0.70–0.74 (including pedicel, 0.88–0.95) by 0.38–0.43 deep; movable finger 1.03–1.11 long. Leg IV: entire femur 0.81–0.92; basifemur 0.36–0.41 by 0.205–0.23; telofemur 0.44–0.52 by 0.205–0.23; tibia 0.79–0.87 by 0.11–0.12; metatarsus 0.29–0.31 by 0.08–0.09; telotarsus 0.40–0.43 by 0.07–0.075.

***Microcreagris infernalis*, new species**

Figure 12

MATERIAL: Holotype female (DM176.01001) taken in Inner Space

Caverns (Core Hole Cave), 2 miles south of Georgetown, Williamson County, Texas, on November 16, 1963, by James Reddell.

DESCRIPTION: Female: A large, eyeless form with attenuated appendages. Carapace, chelicerae, and palps golden brown. Carapace about one-third longer than broad; anterior margin with tiny, rounded epistome; no eyes or eyespots present; surface smooth. A total of 27 setae on carapace, with four at anterior margin and six along posterior margin. Coxal area typical; palpal coxa with three large, apical setae; coxa IV with 12 or 13 setae.

Abdomen long ovate. Tergal chaetotaxy 8:12:14:15:14:15:15:13-13:7:2. Anterior genital operculum with 13 small setae on face; posterior operculum with 13 marginal setae and three small setae on face near middle. Each spiracle with six guard setae. Sternites with about 16 marginal setae; in addition sternites 6, 7 and 8 with two setae on face near middle.

Chelicera about two-thirds as long as carapace, 2.0 times as long as broad. Palm with six setae; fixed finger with about 15 teeth along margin; movable finger with eight teeth on slightly raised crest in distal third of margin; galea bifurcated distal to midpoint, each ramus with two or three terminal branches; serrula exterior with 32 blades; flagellum of eight setae, all of which are pinnate along anterior margins, most proximal seta only half length of others.

Palps relatively long and slender; proportions as shown in figure 12; femur 1.45 and chela (including pedicel) 2.55 times as long as carapace. Distinct granulations over most of femur and on chelal hand at base of fingers; fine granulations over much of trochanter and tibia. Tactile setae of chela as shown in figure 12. Fixed chelal finger with 97 low, contiguous teeth and movable finger with 114 similar teeth; only about 20 teeth at distal end of each finger with cusps. Trochanter 2.6, femur 5.65, tibia 4.3, tibial pedicel 3.9, and chela (including pedicel) 5.0 times as long as broad; hand (including pedicel) 2.3 times as long as deep; movable finger 1.42 times as long as hand plus pedicel.

Legs slender; leg IV with entire femur 5.1 and tibia 8.9 times as long as deep. Leg IV with tactile setae on tibia 0.45, on metatarsus 0.20, and on telotarsus 0.59 length of segment from proximal end. Subterminal tarsal setae not furcate, but each with a prominent spine just distal to middle; tips with two or three spinules.

Male: Unknown.

MEASUREMENTS (IN MM.): Holotype female: Body length 3.8. Carapace length 1.08; anterior breadth 0.71; greatest breadth 0.87. Chelicera 0.69 long by 0.335 broad; movable finger 0.465 long. Palpal trochanter

0.74 by 0.29; femur 1.58 by 0.28; tibia 1.38 by 0.32; tibial pedicel, exterior length 0.53, least breadth 0.135; chela (including pedicel) 2.77 by 0.55; hand (including pedicel) 1.18 by 0.52 deep; movable finger 1.70 long. Leg IV: entire femur 1.21 long; basifemur 0.56 by 0.24; telofemur 0.65 by 0.23; tibia 1.15 by 0.13; metatarsus 0.40 by 0.10; telotarsus 0.595 by 0.09.

***Microcreagris reddelli*, new species**

Figure 11

MATERIAL: Holotype female (DM171.01001) taken in Schulze Cave about 2 miles east of Volente, Travis County, Texas, by James Reddell on August 21, 1963.

DESCRIPTION: Female: A large, attenuated eyeless form. Carapace, chelicerae, and palps golden; legs and body yellowish brown. Carapace about one-third longer than broad; anterior margin evenly rounded with no epistome; no eyes or eyespots present; surface smooth. A total of 21 setae on carapace, with four at anterior margin and four along posterior margin. Coxal area typical; palpal coxa with three large, apical setae; coxa IV with 11 or 12 setae.

Abdomen long ovate. Tergal chaetotaxy 8:10:12:11:11:12:11:11:11:9:5:2. Anterior genital operculum with eight small setae on face; posterior operculum with 13 marginal setae. Each anterior spiracle with seven, and each posterior spiracle with six guard setae. Sternites with about 13 marginal setae; in addition, sternites 6, 7 and 8 with two setae on face near middle.

Chelicera about three-fifths as long as carapace, 2.0 times as long as broad. Palm with seven setae; fixed finger with about 13 teeth along margin; movable finger with six or seven teeth on slightly raised crest in distal third of margin; galea broken off from each chelicera of this specimen; serrula exterior with about 29 blades; flagellum of eight setae, all of which are pinnate along anterior margins, most proximal seta only about half length of others.

Palps relatively long and slender; proportions as shown in figure 11; femur 1.35 and chela (including pedicel) 2.25 times as long as carapace. Distinct granulations over most of femur and on medial surfaces of trochanter, tibia and chelal hand, and on bases of both chelal fingers. Tactile setae of chela as shown in figure 11. Fixed chelal finger with 84 and movable finger with 95 low, contiguous teeth, only distalmost 15–20 of each finger having cusps. Trochanter 2.45, femur 5.55, tibia 3.8, tibial pedicel 4.0 and chela (including pedicel) 4.8 times as long as broad; hand (including pedicel) 2.1 times as long as deep; movable finger 1.45

times as long as hand plus pedicel.

Legs moderately slender; leg IV with entire femur 4.9 and tibia 7.9 times as long as deep. Leg IV with tactile seta on tibia 0.46, on metatarsus 0.19, and on telotarsus 0.57 length of segment from proximal end. Subterminal tarsal setae not furcate but each with a short spine distal to middle; tips with two or three spinules.

Male: Unknown.

MEASUREMENTS (IN MM.): Holotype female: Body length 3.7. Carapace length 1.07; anterior breadth 0.65; greatest breadth 0.78. Chelicera 0.63 long by 0.305 broad; movable finger 0.40 long. Palpal trochanter 0.68 by 0.28; femur 1.41 by 0.255; tibia 1.25 by 0.32; tibial pedicel, exterior length 0.50, least breadth 0.125; chela (including pedicel) 2.43 by 0.51; hand (including pedicel) 1.02 by 0.48 deep; movable finger 1.48 long. Leg IV: entire femur 1.13 long; basifemur 0.54 by 0.23; telofemur 0.60 by 0.22; tibia 1.07 by 0.135; metatarsus 0.38 by 0.105; telotarsus 0.53 by 0.09.

***Microcreagris texana*, new species**

Figures 13, 14

MATERIAL: Holotype female (WM849.01001) taken in Tooth Cave, one-fourth mile north of Hickmuntown, Travis County, Texas, on May 16, 1965 by James Reddell, "from the underside of a small rock in darkness and in silt."

DESCRIPTION: Female: A large, eyeless form with attenuated appendages. Carapace, chelicerae, and palps golden brown, body and legs light tan. Carapace about one-third longer than broad; anterior margin nearly straight, with tiny, rounded epistome; no eyes or eyespots present; surface smooth. A total of 23 setae on carapace, with four at anterior margin and six along posterior margin. Coxal area typical; one palpal coxa with three large, apical setae, other with four setae; each coxa IV with 10 setae.

Abdomen long ovate. Tergal chaetotaxy 8:8:12:14:13:14:13:12:13:-10:4:2. Anterior genital operculum with a group of four setae on either side of middle; posterior operculum with 16 marginal setae, of which some are large and some small. Each spiracle with six guard setae. Sternites with about 14 marginal setae; in addition, sternites 6, 7 and 8 with two setae on face near middle.

Chelicera about two-thirds as long as carapace, 1.95 times as long as broad. Palm with seven setae; fixed finger with about 15 teeth along margin; movable finger with six larger teeth on distal third of margin; galea bifurcated at about midpoint, each ramus with two to four ter-

minal branches; serrula exterior with about 30 blades; flagellum of eight setae, all of which are pinnate along anterior margins, proximal two somewhat shorter than others.

Palps relatively long and slender; proportions as shown in figure 13; femur 1.5 and chela (including pedicel) 2.55 times as long as carapace. Distinct granulations over much of femur and on chelal hand at bases of fingers; fine granulations on medial sides of trochanter and tibia; otherwise, surfaces smooth. Tactile setae of chela as shown in figure 14. Fixed chelal finger with 99 low, contiguous teeth and movable finger with 108 similar teeth, only about 12–15 at distal end of each finger with cusps. Trochanter 2.65, femur 6.1, tibia 4.8, tibial pedicel 4.25, and chela (including pedicel) 6.0 times as long as broad; hand (including pedicel) 2.7 times as long as deep; movable finger 1.38 times as long as hand plus pedicel.

Legs slender; leg IV with entire femur 5.4 and tibia 9.2 times as long as deep. Leg IV with tactile setae on tibia 0.33, on metatarsus 0.16 and 0.83, and on telotarsus 0.59 length of segment from proximal end. Sub-terminal tarsal setae not furcate, but each with a strong spine at about middle; tips with two or three spinules.

Male: Unknown.

MEASUREMENTS (IN MM.): Holotype female: Body length 4.1. Carapace 1.03 long, anterior breadth 0.71, greatest breadth 0.82. Chelicera 0.66 long by 0.34 broad; movable finger 0.42 long. Palpal trochanter 0.70 by 0.27; femur 1.58 by 0.26; tibia 1.39 by 0.29; tibial pedicel, exterior length 0.51, least breadth 0.12; chela (including pedicel) 2.64 by 0.44; hand (including pedicel) 1.13 by 0.42 deep; movable finger 1.56 long. Leg IV: entire femur 1.19 long; basifemur 0.56 by 0.22; telofemur 0.64 by 0.215; tibia 1.15 by 0.125; metatarsus 0.38 by 0.10; telotarsus 0.58 by 0.10.

REMARKS: Although small when taken individually, the differences among this and the previous two new species, viewed altogether, appear to define three distinct forms. Even though the caves in which the three forms were found are relatively close geographically, they are well separated geologically (J. Reddell, personal communication) and might reasonably have supplied the isolation necessary for the independent evolution and speciation of the three forms.

KEY TO THE CAVERNICOLOUS SPECIES OF *Microcreagris* KNOWN TO OCCUR IN THE UNITED STATES

- 1. Abdominal sternites 5–11 with setae in single marginal rows; east of Mississippi River 2

- In addition to marginal row, sternites 6, 7, and 8 with two setae on face near middle; found west of Mississippi River 10
- 2(1). Palpal femur sparsely granulate; cheliceral galea lacking
 *fallax* Chamberlin
 Palpal femur, as well as other palpal segments, completely smooth; galea present 3
- 3(2). With four eyes *subatlantica* Chamberlin
 With two eyes 4
 Eyeless 5
- 4(3). Small, with robust appendages *pumila*, new species
 Large, with attenuate appendages *pecki*, new species
- 5(3). Palps slender, with tibia more than 4.7 and femur more than 6.2 times as long as broad 6
 Palps less slender or even robust, with tibia less than 4.5 and femur less than 6.0 times as long as broad 7
- 6(5). Chelicera with only five setae on palm; palps more slender, with tibia 6.4–6.6 and chela (including pedicel) 7.4–8.3 times as long as broad; leg IV with entire femur 6.6–7.1 times as long as deep; from Lee County, Virginia *valentinei* Chamberlin
 Chelicera with six (or seven) setae on palm; palps less slender, with tibia 4.75–5.2 and chela (including pedicel) 6.15–6.55 times as long as broad; leg IV with entire femur 6.0 times as long as deep; from Marion County, Tennessee *nickajackensis* Muchmore
- 7(5). Palps moderately slender, with tibia more than 3.5 and femur more than 4.7 times as long as broad 8
 Palps rather robust, with tibia less than 3.0 and femur less than 4.5 times as long as broad 9
- 8(7). Female palp more slender, with femur 5.2–5.8 and chela (including pedicel) 5.1–5.8 times as long as broad; tibia IV 8.8 times as long as deep; chelal fingers with 97–109 marginal teeth *persephone* Chamberlin
 Female palp less slender, with femur 4.9 and chela (including pedicel) 4.4 times as long as broad; tibia IV 7.2 times as long as deep; chelal fingers with 85–90 marginal teeth *pluto* Chamberlin
- 9(7). Female palp more robust, with tibia 2.6, femur 3.9, and chela (including pedicel) 3.4 times as long as broad; leg IV with entire femur 4.1 times as long as deep; carapace and palps strongly colored
 *eurydice*, new species
 Female palp less robust, with tibia 2.75, femur 4.2, and chela (including pedicel) 4.15 times as long as broad; leg IV with entire femur 4.6 times as long as deep; carapace and palps pale *mortis*, new species
- 10(1). Subterminal tarsal setae subequally furcate at about middle; fixed chelal finger with greater number of marginal teeth than movable finger, all teeth on fixed finger with cusps; from Pacific states and Nevada . . . 11
 Subterminal tarsal setae not furcate but with prominent spine near middle; fixed chelal finger with fewer marginal teeth than movable finger, only 15–20 teeth at distal end of fixed finger with cusps; from Texas . . . 14
- 11(10). With eyes; palps and carapace strongly colored 12
 Eyeless; palps and carapace pallid 13
- 12(11). Very large animals, with palpal femur longer than 2.5 mm; four well-

- developed eyes present; from Nevada *grandis* Muchmore
- Smaller animals, with palpal femur shorter than 2.0 mm; two weakly corneate eyes present; from Oregon and Washington *columbiana* Chamberlin
- 13(11). Palpal femur longer than 1.6 mm; palps more slender, with femur 5.8–6.1 and tibia 4.6 times as long as broad *grahami*, new species
- Palpal femur shorter than 1.3 mm; palps less slender, with femur 4.9–5.0 and tibia 3.6–3.7 times as long as broad *imperialis*, new species
- 14(10). Carapace without epistome on anterior margin and with four setae at posterior margin; palpal femur less than 1.45 mm. long; fixed chelal finger with less than 90 marginal teeth (female only, male not known) *reddelli*, new species
- Carapace with small epistome on anterior margin and with six setae at posterior margin; palpal femur more than 1.55 mm. long; fixed chelal finger with more than 95 marginal teeth (female only, male not known) 15
- 15(14). Cheliceral palm with six setae; second tergite with 12 setae; sternites with 16–18 marginal setae; palp less slender, chela 5.0 times as long as broad *infernalis*, new species
- Cheliceral palm with seven setae; second tergite with 8 setae; sternites with 13–15 marginal setae; palp more slender, chela 6.0 times as long as broad *texana*, new species

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