

Muchmore, W. B. 1981. Cavernicolous species of *Larca*, *Archeolarca* and *Pseudogarypus* with notes on the genera (Pseudoscorpionida, Garypidae and Pseudogarypidae). J. Arachnol., 9:47-60.

**CAVERNICOLOUS SPECIES OF *LARCA*, *ARCHEOLARCA*,
AND *PSEUDOGARYPUS* WITH NOTES ON THE GENERA,
(PSEUDOSCORPIONIDA, GARYPIDAE AND PSEUDOGARYPIDAE)**

William B. Muchmore

Department of Biology
University of Rochester
Rochester, New York 14627

Abstract

Six new species are described from caves in the western United States, as follows: *Larca laceyi* and *Pseudogarypus orpheus* from California, *Archeolarca welbourni*, *A. cavicola*, and *Pseudogarypus hypogeus* from Arizona, and *Archeolarca guadalupensis* from Texas. *Larca granulata* (Banks) is redescribed and other species of the genera are discussed.

INTRODUCTION

Over the past several years I have received for study several cavernicolous pseudoscorpions from western United States which deserve notice and description. Among these are representatives of *Larca* Chamberlin and *Pseudogarypus* Ellingsen sent by Lawrence A. Lacey, of *Larca* sent by Andrew G. Grubs, and of *Archeolarca* Hoff and Clawson and *Pseudogarypus* sent by W. Calvin Welbourn. In addition to describing the new forms I take this opportunity to report some observations made on these genera during the past 20 years.

FAMILY GARYPIDAE HANSEN

Subfamily Garypinae Simon

Genus *Larca* Chamberlin

For a recent review of this genus see Benedict and Malcolm 1977: 114-118.

Larca chamberlini Benedict and Malcolm

A single male referable to this species was found in Dirty Fissure, Calaveras County, California, 26 May 1977, by A.G. Grubbs. This is of the same size as the specimens from

Oregon and northern California described by Benedict and Malcolm (1977) but has somewhat more robust palps and legs. It is undoubtedly an epigeal form, only accidental in the cave.

It should be noted that this specimen has four setae in the flagellum on each chelicera, not three as mentioned by Benedict and Malcolm (1977:116) as characteristic of *L. chamberlini*. If the reduced number of setae is really characteristic of all the more northern forms, then this one may turn out to be a distinct species.

Larca laceyi, new species

Figs. 1-6

Materials.—Holotype male (WM 4652.01003) and eight paratypes (3 male, 4 female, 1 tritonymph) collected in Music Hall Cave, Calaveras County, California, 20 January 1973, by Lawrence A. Lacey. Types are deposited in the Florida State Collection of Arthropods, Gainesville.

Diagnosis.—Generally similar to *Larca granulata* (Banks) and *L. chamberlini* Benedict and Malcolm with only two trichobothria on the movable chelal finger; but much larger than those species, with carapace more than 0.55 mm and palpal femur more than 0.85 mm in length.

Description.—ADULTS: Males and females similar but females slightly larger. With the characters of the genus (see Benedict and Malcolm 1977:114). Well sclerotized and colored, palps reddish brown, other parts light brown. Carapace trapezoidal, with posterior width greater than length, surface covered with low granules and with a transverse furrow two-thirds distance from anterior margin; anterior margin nearly straight, slightly roughened near middle; with four strongly corneate eyes; about 40 prominent, curved setae, of which six are at anterior and 6-8 at posterior margin. Coxal area typical, widest across 4th coxae. Tergites 2-8 completely divided, 1 and 9 partly divided, 10 and 11 entire, surfaces covered with low granules; sternites 4-8 completely divided, others entire, surfaces reticulated to scaly; pleural membranes longitudinally plicate. Tergal chaetotaxy about 5:6:10:10:12:12:12:12:11:T6T:9:2; setae prominent and curved as on carapace. Sternal chaetotaxy of male about 20:[3-3]:(0)20(0):(0)6(0):9:9:9:8:8:7:6:2; all setae small and delicate; setae on male genital opercula and internal genitalia as shown in Fig. 1; setae on female genital opercula as in Fig. 2; female internal genitalia marked by three well sclerotized cribriform plates in a transverse row and a smaller one behind (Fig. 2).

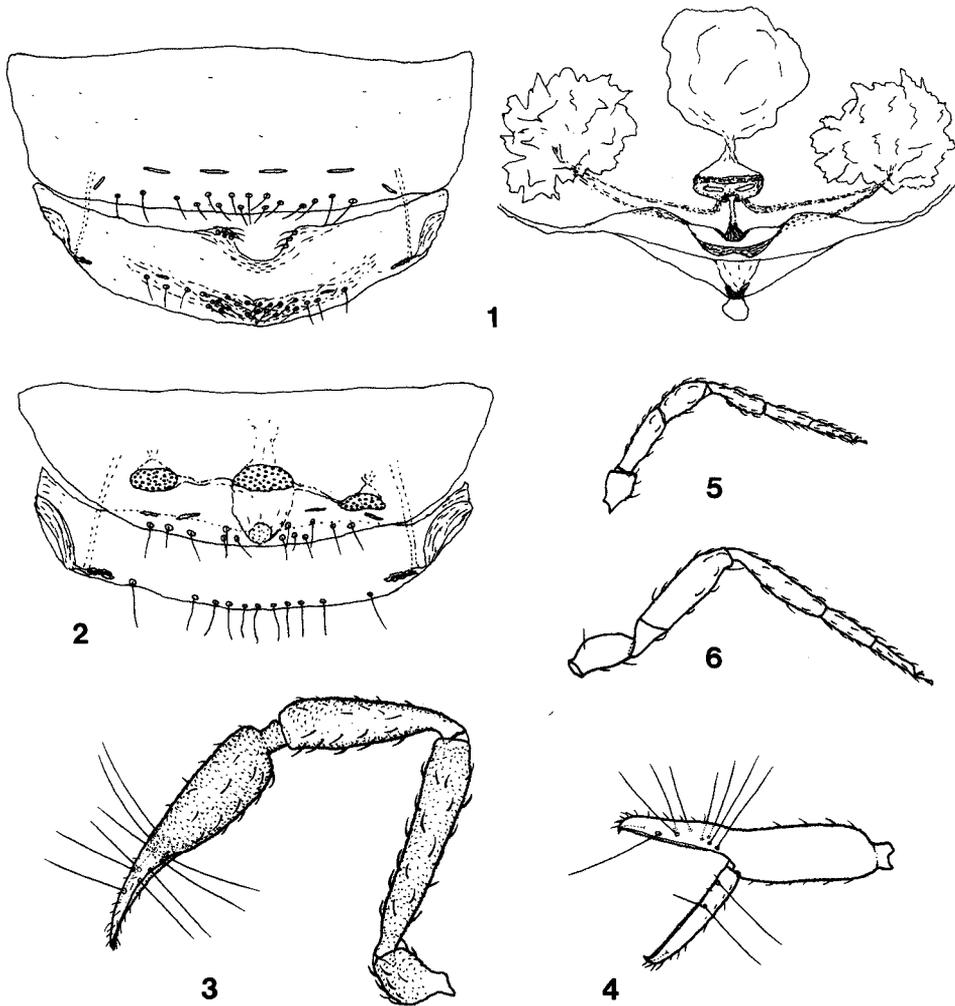
Chelicera small, about 0.35 as long as carapace; four setae on hand, *es* quite long (two setae in position *es* on three specimens); fixed finger with two tiny subterminal denticles and four small teeth, movable finger with a subterminal roughened area; galea of female very long (about 2/3 as long as movable finger), straight, and with three small rami near tip; galea of male short and with variable serrations near tip; serrula exterior of about 15 blades; flagellum of four sparsely denticulate setae.

Palp long and moderately slender (Fig.3); femur 1.52-1.59 and chela 1.65-1.74 times as long as carapace. Palpal trochanter 1.75-1.95, femur 4.85-5.5, tibia 3.55-3.95, and chela (without pedicel) 3.8-4.45 times as long as broad; hand (without pedicel) 2.35-2.8 times as long as deep; movable finger 0.89-0.94 as long as hand. Surfaces of palp strongly granulate except distal halves of fingers; setae mostly prominent, arcuate. Trichobothria as shown in Fig. 4; fixed finger with eight, movable finger with only two, presumably *sb* and *b*. Fixed finger with 33-38 contiguous marginal teeth, retroconical distally and becoming flattened toward proximal end of row; movable finger with 35-38 similar teeth. Venom ducts in each finger inconspicuous, nodus ramosus 0.2 length of finger from tip.

Legs long and slender (Figs. 5 and 6); leg IV with entire femur 3.9-4.5 and tibia 4.7-5.1 times as long as deep. Proximal segments heavily granulate, becoming scaly distally. Setae of proximal segments large, arcuate, becoming smaller and straight distally; subterminal tarsal setae simple; no noticeable tactile setae present. Arolia twice as long as claws.

TRITONYMPH: Much like the adults but paler, smaller, and with less attenuate appendages and fewer setae. Palpal femur 5.05, tibia 3.6, and chela (without pedicel) 4.3 times as long as broad. Movable chelal finger with two trichobothria as in the adult, fixed finger with only seven, apparently *ist* missing. Chelicera with four setae on hand; flagellum of four setae; galea long and trifid at tip as in female.

Measurements (mm).—Figures given first for the holotype male, followed in parentheses by ranges for the adult paratypes. Body length 2.11(2.05-2.39). Carapace length 0.56(0.56-0.62). Chelicera 0.21(0.19-0.22) long. Palpal trochanter 0.33(0.33-0.355) by



Figs. 1 - 6.—*Larca laceyi*, new species: 1. male genital opercula and internal genitalia; 2, female genital opercula; 3, dorsal view of right palp; 4, lateral view of left chela; 5, leg I; 6, leg IV.

0.18(0.17-0.20); femur 0.89(0.865-0.96) by 0.17(0.16-0.19); tibia 0.71(0.69-0.76) by 0.19(0.185-0.21); chela (without pedicel) 0.96(0.97-1.06) by 0.23(0.22-0.27); hand (without pedicel) 0.51(0.50-0.57) by 0.19(0.185-0.235); pedicel about 0.07 long; movable finger 0.47(0.47-0.525) long. Leg IV: entire femur 0.59(0.59-0.64) by 0.13(0.14-0.155); tibia 0.445(0.445-0.47) by 0.095(0.09-0.095).

Tritonymph: Body length 1.65. Carapace length 0.52. Palpal femur 0.71 by 0.14; tibia 0.555 by 0.155; chela (without pedicel) 0.86 by 0.20; hand (without pedicel) 0.46 by ?; pedicel 0.06 long; movable finger 0.41 long.

Etymology.—The species is named for Lawrence Lacey who collected all the specimens.

Remarks.—*Larca laceyi* is definitely modified for cave life and is probably a troglobite. It may be compared with the local epigeal form, *L. chamberlini* (see above and Benedict and Malcolm 1977): it is considerably larger than *L. chamberlini*; it has six setae at the anterior margins of the carapace, rather than eight; the palps are longer with reference to the carapace; and the palpal and pedal segments are more slender.

Like *L. chamberlini*, this species has only four setae on the cheliceral hand, which probably indicates a close relationship between the two.

Also found in Music Hall Cave is a new species of *Pseudogarypus*, described below.

Larca granulata (Banks)

Garypus granulatus Banks, 1891:163.

Larca granulata; Chamberlin 1930:616, Hoff 1949:447, Hoff and Bolsterli 1956:163, Hoff 1958:15, Nelson 1975:282.

The type locality for this species is Ithaca, Tompkins County, New York. It has also been reported from Illinois, Tennessee, and Michigan.

New Records.—NEW YORK: Albany, Cattaraugus, Genesee, Monroe, Schuyler, and Wyoming counties. NEW HAMPSHIRE: Sullivan County. PENNSYLVANIA: Lycoming County. WEST VIRGINIA: Greenbrier, Mercer, and Pocohontas counties. VIRGINIA: Giles County. NORTH CAROLINA: Jackson, Macon, and Transylvania counties. KANSAS: Lincoln County.

Inasmuch as no complete description has ever been published for this species, the type species of the genus, it seems appropriate to present such a description here. It is based mainly on the three syntypes (1 male, 2 females) in the Museum of Comparative Zoology at Harvard University, of which a female (WM1216.01001) is selected as the lectotype; also considered are a number of other specimens from upstate New York, within 100 miles from the type locality.

Descriptions.—Males and females are quite similar except for a few sexually dimorphic characters and the slightly larger size of the latter. With general characters of the genus (see Benedict and Malcolm 1977:114). Well sclerotized and colored, palps light brown, other parts tan. Carapace trapezoidal with posterior width greater than length, surface heavily granulate and with a transverse furrow behind the middle; 4 strongly corneate eyes; 40 or more arcuate setae, usually 8 at anterior and 8 at posterior margins. Coxal area typical. Tergites 1-8 and sternites 4-8 at least partly divided; surfaces covered with low, irregular granulations; pleural membranes longitudinally plicate. Tergal chaetotaxy usually about 8:8:10:12:14:14:12:10:10:T6T:10;2, most setae rather heavy and arcuate; sternal chaetotaxy of female usually about 12:(0)14(0):(0)10(0):12:12:12:10:9:8:6:2,

most setae fine and straight. Anterior genital operculum of male with irregular row of 12-20 small setae, genital opening internally with 1 or 2 setae on each side, posterior operculum with irregular row of 20-25 setae.

Chelicera small, about 0.35 as long as carapace; 5 setae on hand, *es* quite long; fixed finger with a very narrow lamina exterior; fixed finger with 6-8 small teeth, movable finger with an irregular subapical lobe; galea slender and with 3 terminal rami, longer and better developed in female (Hoff 1949:448); serrula exterior of about 15 blades; flagellum of 4 setae, the distal one with several erect spinules along the free border.

Palp long and moderately slender (Hoff 1949:448); femur 1.25-1.35 and chela 1.6-1.7 times as long as carapace; femur 4.1-4.6, tibia 2.9-3.5, and chela (without pedicel) 3.6-4.2 times as long as broad; hand (without pedicel) 2.1-2.4 times as long as deep; movable finger nearly as long as hand. All surfaces heavily granulate except distal parts of fingers; setae mostly arcuate. Trichobothria as shown in Hoff (1949:448); apparently, only *sb* and *b* present on movable finger. Each finger with 35-40 marginal teeth.

Legs slender; leg I with basifemur about 1.25 times as long as telofemur; leg IV with entire femur 3.6-4.0 and tibia 3.9-4.5 times as long as deep. Surfaces heavily granulate; most setae arcuate; no obvious tactile setae; subterminal tarsal setae simple; arolia much longer than claws.

Measurements (mm) of females.—Figures given first for the lectotype, followed in parentheses by ranges for eight others. Body length 2.03(1.91-2.12). Carapace length 0.57(0.51-0.59). Chelicera 0.205(0.19-0.215) long. Palpal trachanter 0.32(0.285-0.33) by 0.19(0.145-0.20); femur 0.75(0.655-0.775) by 0.165(0.145-0.175); tibia 0.61(0.52-0.65) by 0.185(0.16-0.20); chela (without pedicel) 0.91(0.86-0.96) by 0.25(0.22-0.265); hand (without pedicel) 0.465(0.445-0.50) by 0.21(0.205-0.245); pedicel about 0.06 long; movable finger 0.46(0.425-0.47) long. Leg I: basifemur 0.24(0.21-0.255) long; telofemur 0.19(0.17-0.19) long. Leg IV: entire femur 0.54(0.48-0.565) by 0.13(0.125-0.145); tibia 0.41(0.33-0.41) long.

Males.—Ranges for five specimens. Body length 1.74-1.88. Carapace length 0.46-0.515. Chelicera 0.155-0.18 long. Palpal trochanter 0.26-0.29 by 0.14-0.165; femur 0.605-0.67 by 0.14-0.15; tibia 0.49-0.54 by 0.155-0.175; chela (without pedicel) 0.78-0.87 by 0.18-0.21; hand (without pedicel) 0.40-0.445 by 0.175-0.19; pedicel about 0.05 long. Leg I: basifemur 0.19-0.22 long; telofemur 0.155-0.175 long. Leg IV: entire femur 0.425-0.475 by 0.11-0.125; tibia 0.32-0.355 long.

Remarks.—It is impossible, on the basis of published accounts, to distinguish clearly between *L. granulata* and *L. lata* (Hansen) from Europe (see Beier 1963). Probably only a direct comparison of representatives of the two species will reveal any differences which may exist.

Most specimens of *Larca granulata* have been found in dry situations under rocks or logs, or in debris in old stumps or logs, occasionally in association with mice or chipmunks.

Larca notha Hoff

This species has until recently been known only from a single specimen (male) from Larimer County, Colorado (Hoff 1961). Mention (but no description) of a single adult from Harney County, Oregon, is made by Benedict (1978).

New record.—CANADA: Saskatchewan, Val Marie, 10 June 1955, 3 males 2 females, 3 tritonymphs, and 1 deutonymph collected by J.R. Vockeroth from the nest of bank swallows [Canadian National Collection of Insects].

Diagnosis.—The only obvious difference between this species and *L. granulata* is in the number of trichobothria on the movable finger of the chela, three in the former, two in the latter.

Supplemental description.—The description of the holotype male by Hoff is very complete and nothing need be added except to note that reexamination of the specimen reveals five setae on the hand of the chelicera, as in *L. granulata*. The males from Saskatchewan are quite similar in all respects to the holotype.

The females show some sexual differences and are a little larger than males. Chaetotaxy of genital opercula and anterior sternites 10:(0)12(0):(0)4(0):-. Cheliceral hand with five setae; galea long and trifid terminally.

The nymphs are much like the adults but smaller and with reduced numbers of trichobothria on the chelal fingers. Tritonymphs are lacking both *t* and *st* from the movable finger and *ist* from the fixed finger. All nymphs have five setae on the hand of the chelicera and four setae in the flagellum.

Measurements of adults from Saskatchewan (mm).—Body length 1.85-1.95. Carapace length 0.465-0.51. Palpal femur 0.59-0.63 by 0.16-0.175; tibia 0.50-0.54 by 0.185-0.19; chela (without pedicel) 0.80-0.83 by 0.235-0.24; hand (without pedicel) 0.415 by 0.21-0.215; pedicel 0.055 long; movable finger 0.415-0.42 long. Leg IV: entire femur 0.46 by 0.12-0.125.

Genus *Archeolarca* Hoff and Clawson

For a recent review of this genus see Benedict and Malcolm (1977:118-119).

Archeolarca rotunda Hoff and Clawson

This species has been reported from Utah County, Utah, Bernalillo County, New Mexico, and Deschutes County, Oregon. In addition it can be mentioned here that several specimens were collected by G.F. Knowlton from pack rat nests in shallow caves in Blacksmith Fork Canyon, Cache County, Utah, in June 1970. These are somewhat varied in morphology but are certainly referable to this species.

Archeolarca welbourni, new species

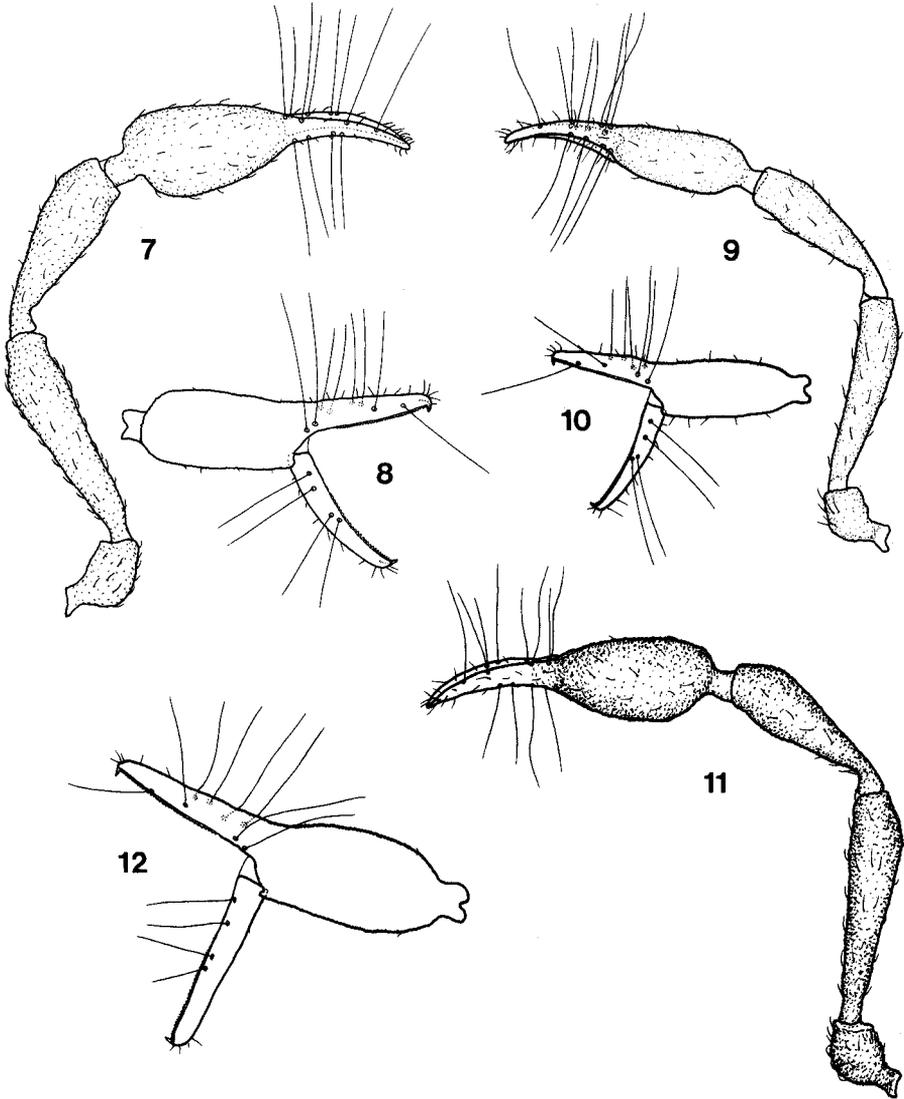
Figs. 7 and 8

Material.—Holotype female (WM 4453.01003) and six paratype females found on wall in Malmquist Fissure, 25 September 1975 and 31 January 1976; one paratype male from "lower level, dark zone" of Lomacki Fissure, 27 September 1975; three paratype females from Dangling Flake Crack, 21 January 1976; one male and two female paratypes from Sipapu Cavern, 31 January 1976 -- all locations in Wupatki National Monument, Coconino County, Arizona, and all collections made by W. Calvin Welbourn. The types are in the Florida State Collection of Arthropods, Gainesville.

Diagnosis.—Similar to *A. rotunda* but significantly larger, with palpal femur greater than 0.9 mm in length.

Description.—With the characters of the genus (Benedict and Malcolm 1977:118). Males and females similar but females larger. Generally well sclerotized and colored, palps and carapace reddish brown, other parts light brown. Carapace trapezoidal, with posterior width greater than length; anterior margin slightly concave; surface heavily

granulate and with a distinct transverse furrow 0.6 the distance from anterior margin; with four bulging eyes; with 25-30 setae, usually including six at anterior and four at posterior margin. Coxal area typical, widest across 4th coxae. Abdomen typical; tergal chaetotaxy of female holotype 5:7:8:11:12:10:13:11:12:T4T:7:2; sternal chaetotaxy 16:(0)9(0): (0)4(0):8:7:8:9:8:6:2:2; others are varied but similar. Internal genitalia marked by four cribriform plates, as in *Larca* (see Fig. 2), but posterior smaller plate appearing fragmented. Chaetotaxy of anterior sternites of male about 24:[3-3]: (0)20(0):(0)6(0):8:8 -; internal genitalia much like that in *Larca* (see Fig. 1).



Figs. 7 and 8.—*Archeolarca welbourni*, new species: 7, dorsal view of left palp; 8, lateral view of right chela. Figs. 9 and 10.—*Archeolarca guadalupensis*, new species: 9 dorsal view of right palp; 10, lateral view of left chela. Figs. 11 and 12.—*Archeolarca cavicola*, new species: 11, dorsal view of right palp; 12, lateral view of left chela.

Chelicera small, about 0.35 as long as carapace; four setae on hand, *es* quite long; galea very long, slender, with three small rami near tip; flagellum of four setae, of which the distal one or two are sparsely denticulate; narrow lamina exterior present; serrula exterior of 17-18 blades.

Palp long and moderately slender (Fig. 7), femur about 1.45 and chela about 1.75 times as long as carapace; femur 4.3-4.9, tibia 3.2-3.8, and chela (without pedicel) 3.3-3.9 times as long as broad; hand (without pedicel) 1.8-2.25 times as long as deep; movable finger about 0.95 as long as hand. Surfaces strongly granulate, except for chelal fingers; setae mostly prominent, arcuate. Trichobothria as in Fig. 8. Fixed finger with about 35 contiguous, cusped marginal teeth; movable finger with about 30 similar teeth and 2-3 low, rounded ones proximally. Venom ducts present in each finger but inconspicuous, nodus ramosus about 0.15 length of finger from tip.

Legs long and slender; leg IV with entire femur about 5.0 and tibia about 6.0 times as long as deep. Surfaces mostly scaly; setae arcuate, rather conspicuous; no noticeable tactile setae; subterminal tarsal setae simple; arolia twice as long as claws.

Measurements (mm) of females.—Figures given first for the holotype, followed in parentheses by ranges for 10 paratypes. Body length 2.70(2.58-2.89). Carapace length 0.70(0.68-0.74). Chelicera 0.26(0.25-0.27) by 0.13(0.12-0.13). Palpal femur 1.03(0.925-1.07) by 0.21(0.20-0.25); tibia 0.88(0.78-0.90) by 0.23(0.23-0.28); chela (without pedicel) 1.21(1.20-1.31) by 0.32(0.31-0.39); hand (without pedicel) 0.62(0.63-0.70) by 0.29(0.29-0.37); pedicel about 0.09 long; movable finger 0.61(0.58-0.65) long. Leg I: basifemur 0.37(0.35-0.40) long; telofemur 0.26(0.24-0.29) long. Leg IV: entire femur 0.75(0.71-0.83) by 0.15(0.15-0.16); tibia 0.61(0.55-0.63) by 0.10 (0.09-0.11).

Males.—Body length 2.32-2.58. Carapace length 0.615-0.65. Chelicera 0.215-0.235 by 0.11-0.12. Palpal femur 0.90-0.985 by 0.19-0.21; tibia 0.76-0.84 by 0.21-0.25; chela (without pedicel) 1.10-1.175 by 0.27-0.32; hand (without pedicel) 0.57-0.63 by 0.25-0.28; pedicel about 0.08 long; movable finger 0.54-0.605 long. Leg I: basifemur 0.34-0.385 long; telofemur 0.235-0.27. Leg IV: entire femur 0.68-0.78 by 0.13-0.15; tibia 0.52-0.55 by 0.09-0.105.

Etymology.—The species is named *welbourni* in honor of W. Calvin Welbourn who has collected many pseudoscorpions of importance in the southwestern United States.

Remarks.—This is the second species to be described in the genus *Archeolarca*. As *A. rotunda* is regularly found in pack rat nests, it is not unexpected to find the new species in a cave. It is easy to conceive that pack rats have carried representatives of the genus down into the caves, where isolation and speciation have occurred. It is not known whether *A. welbourni* continues to associate with pack rats in the cave, as the specimens were found on bare walls.

Archeolarca guadalupensis, new species

Figs. 9 and 10

Material.—Holotype female (WM 4602.02004) and six paratypes (2 male, 1 female, 2 tritonymph) from Lower Sloth Cave, Guadalupe Mountains National Park, Culberson County, Texas, 17 April 1976 (W.C. Welbourn). The types are in the Florida State Collection of Arthropods, Gainesville.

Diagnosis.—Similar to *A. welbourni* but slightly smaller (palpal femur 0.81-0.96 mm long) and with more slender palpal segments (chela 1/w=4.0-4.7).

Description.—With the characters of the genus (Benedict and Malcolm 1977:118). Males and females similar but females larger and more robust. Generally well sclerotized and colored, palps and carapace reddish brown, other parts light brown. Carapace trapezoidal, with posterior width greater than length; anterior margin slightly concave, surface heavily granulate and with a distinct transverse furrow 0.6 the distance from anterior margin; with four corneate eyes, about equal in size; with 30-35 setae, six at anterior and 4-6 at posterior margin. Coxal area typical. Tergal chaetotaxy of holotype female 4:6:8:9:11:10:11:9:8:T3T:8:2; sternal chaetotaxy 12:(0)8(0):(0)4(0):7:6:7:5:9:6:3:2. Cribriform plates of internal genitalia as in *A. welbourni*. Chaetotaxy of anterior sternites of male about 20:[3-3]:(0)14(0):(0)4(0):5:7:-; internal genitalia like that of *A. welbourni*.

Chelicera small, about 0.37 as long as carapace; four setae on hand; galea of female long, slender, and trifid at tip, that of male short and unequally bifid; flagellum of four setae, the distal one sparsely denticulate; serrula exterior of 15-16 blades.

Palp long and slender (Fig. 9), femur about 1.4 and chela about 1.65 times as long as carapace; femur 4.75-5.05, tibia 3.45-3.85 and chela (without pedicel) 4.0-4.7 times as long as broad; hand (without pedicel) 2.7-3.15 times as long as deep; movable finger about 0.8 as long as hand. In lateral view especially, base of chelal hand tapering, not sharply set off from pedicel (Figs. 9 and 10); surfaces lightly granulate, except for chelal fingers; setae thin, mostly arcuate. Trichobothria as in Fig. 10. Fixed chelal finger with about 30 cusped marginal teeth, movable finger with about 25 similar teeth and 3-4 low, rounded ones proximally. Venom ducts inconspicuous.

Legs long and slender: leg IV with entire femur 4.6-5.0 and tibia 5.5-5.9 times as long as deep. Arolia twice as long as claws.

Measurements (mm) of females.—Figures given first for the holotype, followed in parentheses by those for the paratype. Body length 2.71(2.51). Carapace length 0.67(0.69). Chelicera 0.25(0.25) by 0.13(0.13). Palpal femur 0.90(0.96) by 0.19(0.20); tibia 0.76(0.81) by 0.22(0.21); chela (without pedicel) 1.08(1.12) by 0.27(0.28); hand without pedicel) 0.67(0.70) by 0.25(0.25); pedicel about 0.075 long; movable finger 0.53(0.55) long. Leg I: basifemur 0.33(0.34) long; telofemur 0.235(0.245) long. Leg IV: entire femur 0.70(0.73) by 0.14(0.16); tibia 0.53(0.54) by 0.09(0.10).

Male.—Body length 2.23-2.44. Carapace length 0.60-0.65. Chelicera 0.22-0.245 by 0.12. Palpal femur 0.71-0.95 by 0.16-0.19; tibia 0.67-0.78 by 0.18-0.21; chela (without pedicel) 0.98-1.10 by 0.21-0.24; hand (without pedicel) 0.60-0.69 by 0.20-0.22; pedicel about 0.075 long; movable finger 0.48-0.53. Leg I: Basifemur 0.295-0.35 long; telofemur 0.20-0.24 long. Leg IV: entire femur 0.60-0.72 by 0.12-0.15; tibia 0.46-0.56 by 0.08-0.10.

Etymology.—The species is named *guadalupensis* for the Guadalupe Mountains, where it is found.

Remarks.—Though it is generally smaller than the other two known cavernicolous species of *Archeolarca*, *A. guadalupensis* has the most attenuated palpal segments; in this respect it is more modified than the others as a cave dwelling form.

Archeolarca cavicola, new species

Figs. 11 and 12

Material.—Holotype female (WM 5398.01001) from Cave of the Domes, Grand Canyon National Park, Coconino County, Arizona, 15 April 1978 (W. Calvin Welbourn). The type is in the Florida State Collection of Arthropods, Gainesville.

Diagnosis.—Similar to *A. welbourni* but larger (palpal femur 1.09 mm in length) and hand of palpal chela more rounded, especially at base.

Description of female (male unknown).—Generally well sclerotized and colored, palps and carapace reddish brown, other parts light brown. Carapace trapezoidal; anterior margin nearly straight; surface heavily granulate and with a shallow transverse furrow 0.6 the distance from anterior margin; with four corneate eyes, but posterior pair much smaller than anterior; about 26 vestitural setae, with six at anterior and four at posterior margin. Coxal area typical of genus.

Abdomen typical: tergal chaetotaxy 4:7:8:11:10:10:11:10:10:T5T:10:2; sternal chaetotaxy 15:(0)10(0):(0)4(0):6:7:7:6:6:2:3. Cribriform plates of internal genitalia as in *A. welbourni*.

Chelicera typical, about 0.35 as long as carapace; four setae on hand; galea very long and slender, with two small, subterminal rami; flagellum of four setae; serrula exterior of 21 blades.

Palp long and moderately slender (Fig. 11); femur 1.45 and chela 1.8 times as long as carapace; femur 4.65, tibia 3.45 and chela (without pedicel) 3.45 times as long as broad; hand (without pedicel) 1.95 times as long as deep; movable finger 1.01 times as long as hand. In lateral view especially, base of chelal hand gently rounded, not sharply set off from pedicel (Figs. 11 and 12). Surfaces strongly granulate, except for chelal fingers; setae arcuate, conspicuous. Trichobothria as in Fig. 12. Fixed chelal finger with 37 and movable finger with 35 cusped marginal teeth. Venom ducts inconspicuous.

Legs long and slender; leg IV with entire femur 5.4 and tibia 7.0 times as long as deep. arolia more than twice as long as claws.

Measurements (mm).—Body length 3.03. Carapace length 0.755. Chelicera 0.27 by 0.14. Palpal trochanter 0.455 by 0.265; femur 1.09 by 0.235; tibia 0.925 by 0.27; chela (without pedicel) 1.37 by 0.40; hand (without pedicel) 0.72 by 0.37; pedicel 0.11 long; movable finger 0.73 long. Leg I: basifemur 0.46 long; telofemur 0.295 long. Leg IV: entire femur 0.86 by 0.16; tibia 0.665 by 0.095.

Etymology.—The species is named *cavicola* in recognition of its subterranean habitat.

Remarks.—Of the three cavernicolous species of *Archeolarca* here described, *A. cavicola* shows the greatest overall adaption to the special habitat. Compared to either *A. welbourni* or *A. guadalupensis*, it is larger, has longer appendages, has more reduced posterior eyes, and has fewer setae on the carpace.

FAMILY PSEUDOGARYPIDAE CHAMBERLIN

Genus *Pseudogarypus* Ellingsen

For a recent review of this family and genus, see Benedict and Malcolm (1978).

Pseudogarypus orpheus, new species

Figs. 13 and 14

Material.—Holotype male (WM 4657.01001) and paratype female from Music Hall Cave, 5 miles E of Parrots Ferry, Calaveras County, California, 24 December 1976 and 20 January 1973 respectively (Lawrence A. Lacey). The specimens are deposited in the Florida State Collection of Arthropods, Gainesville.

Diagnosis.—Much like *P. bicornis* (Banks), but larger and more attenuated than most specimens of that species, with palpal femur 1.55 mm long and 6.0 times as long as broad.

Description.—With the general characters of the genus (Benedict and Malcolm 1978) and the following notable features. Male and female similar. Carapace about 1.25 times as long as posterior breadth; anterior margin with relatively deep notch between anterolateral and median protuberances; eyes well developed. Abdomen 1.2 times as long as broad; pleural membranes of male showing indistinct sclerites anteriorly, those of both sexes with numerous, scattered, tiny, thickened plaques. Male with anterior genital operculum bearing about 55 scattered, small setae, half of them concentrated near the middle of the hind margin; five long setae on each internal, crescent-shaped sclerite; posterior operculum bearing about 50 scattered setae, some concentrated at the middle of the front margin. Female anterior operculum with about 50 small setae scattered over entire surface, and posterior operculum also with about 50 scattered setae. Chelicera typical (Morris 1948: Figs. 16-19); 0.43 as long as carapace; hand with 11 fine setae; flagellum of two slender, curved setae; galea simple, gently curved, longer in female than in male. Palp somewhat attenuate (Fig. 13), femur 1.95 and chela (with pedicel) 2.3 times as long as carapace; trochanter 1.45, femur 6.0, tibia 2.9, and chela (with pedicel) 5.0 times as long as broad; hand (with pedicel) 2.3 times as long as deep; movable finger 1.6 times as long as hand. Fixed chelal finger with 46 and movable finger with 36 spaced, generally conical marginal teeth; each finger with a large, terminal "venedens." provided with a conspicuous modified seta alongside (called a "lamina defensor" by Chamberlin 1931:133), but without an obvious venom duct. Trichobothria positioned as is usual in the genus (Fig. 14), including a close-set pair of short, accessory trichobothria on external surface of fixed finger near distal end. Each coxa I with five or six spines. Legs moderately attenuate; leg IV with basifemur 3.2, telofemur 3.6, tibia 6.7 and tarsus 14.0 times as long as deep.

Measurements (mm).—Figures given first for holotype male, followed in parentheses by those for paratype female. Body length 3.07(2.98). Carapace length 0.87(0.76); posterior breadth 0.63(0.58). Chelicera 0.33(0.325) by 0.155(0.16). Palpal trochanter 0.40(0.40) by 0.28(0.27); femur 1.51(1.47) by 0.25(0.25); tibia 0.74(0.695) by 0.25(0.25); chela (without pedicel) 1.71(1.70) by 0.36(0.355); hand (without pedicel) 0.665(0.66) by 0.33(0.325); pedicel 0.08 long; movable finger 1.05(1.065) long. Leg IV: basifemur 0.42(0.41) by 0.13(0.13); telofemur 0.58(0.59) by 0.16(0.16); tibia 0.70(0.70) by 0.105(0.105); tarsus 0.89(0.93) by 0.065(0.065).

Etymology.—The species is named for Orpheus, the Greek musician who went to the underworld in search of his wife.

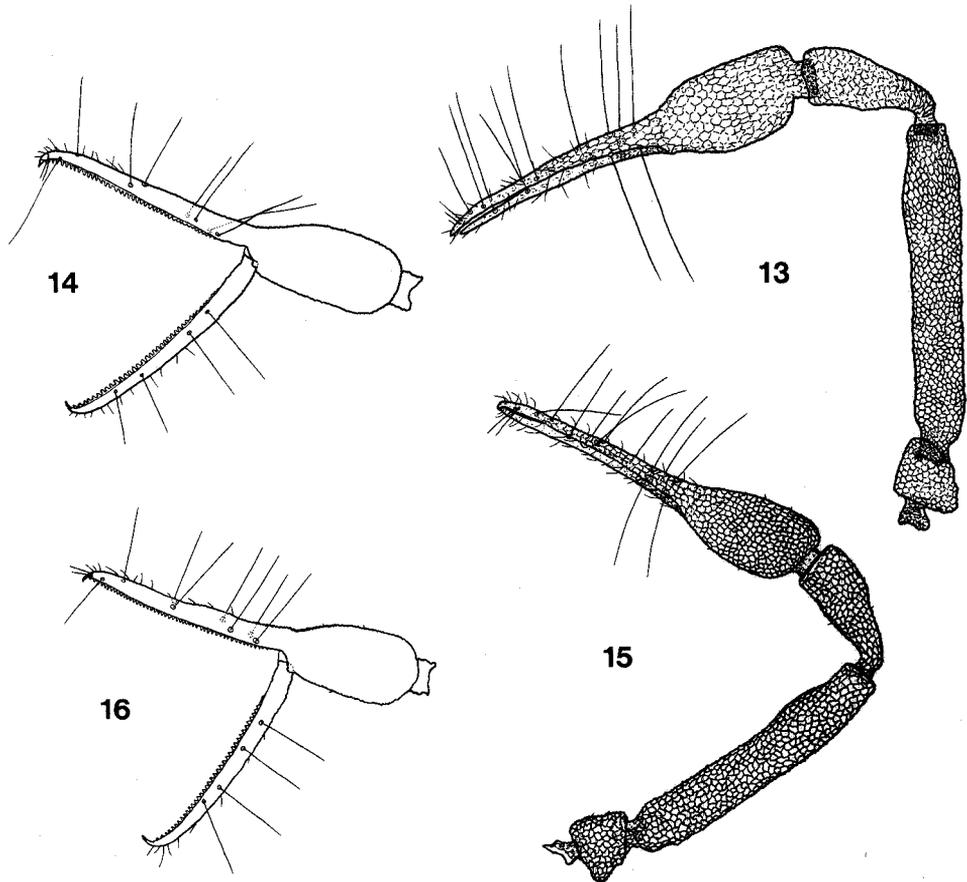
Remarks.—Attention should be called to the occurrence near the tip of the fixed chelal finger of a pair of short, accessory trichobothria. These were first reported by Hoff (1946) in *P. bicornis* and then by Morris (1948) for *Neopseudogarypus scutellatus*. Curiously, Benedict and Malcolm (1978) make no mention of these setae, although they figure them on the palps of all species treated. Such accessory trichobothria are found elsewhere among the pseudoscorpions only in members of the Chthonioidea. It is interesting to speculate that this common occurrence indicates some close phylogenetic relationship between the pseudogarypids and the chthonioids. Such speculations are strengthened by the occurrence in the two groups of distinct spines on the coxae of the anterior legs and by the similar appearance of internal guard setae in the male genitalia.

Also of interest, but of unknown significance, is the occurrence of tiny thickened plaques in the pleural membranes of this species (these are distinct from the larger,

heavier, sclerotized plates which are seen in the male). Again it is tempting to speculate that these plaques represent the vestiges of setae, such as may be found in the pleural membranes of *Garypus californicus* (see Lee 1979) and *Anagarypus oceanusindicus* Chamberlin (unpublished observation).

The chelicerae of pseudogarypids are not "very small" as stated by Benedict and Malcolm (1978:87), but actually are of fair size, being a third or more as long as the carapace. In the intact animal they do, however, appear very small because they are mostly hidden under the front edge of the carapace.

Though it is true that venom ducts and glands are not apparent in pseudogarypids, there is some reason to believe that a functional venom apparatus may be present. Each of the chelal fingers has a long, sharp terminal "fang", within which can be seen faint lines suggestive of a duct. That the duct cannot be followed into the finger may be due simply to the heavy, rough cuticle which covers the surface. It should be noted too that each "fang" is accompanied by a modified seta of the kind called "lamina defensor" by Chamberlin (1931:133). In other pseudoscorpions this structure is typically developed in association with a functional venedens; where the venom apparatus is reduced or absent,



Figs. 13 and 14.—*Pseudogarypus orpheus*, new species: 13, dorsal view of right palp; 14, lateral view of left chela. Figs. 15 and 16.—*Pseudogarypus hypogeus*, new species: 15, dorsal view of right palp; 16, lateral view of left chela.

also the "lamina defensor" is reduced or absent. Though the function of this modified seta has never been demonstrated, I suggest that it might act as a trigger for the release of venom. It is strategically placed so that it is moved in a particular way when the venedens penetrates the body of a prey animal; nerve impulses from its base might then stimulate the release of venom through the venedens. If this is so, then presence of a well developed "lamina defensor" should indicate presence of a functional venom apparatus.

In addition to this species and *Larca laceyi* (see above), the caves of Calaveras County, California, are home to several other troglotic pseudoscorpions, namely *Neochthonius troglodytes* Muchmore (1969a), *Microcreagris grahami* Muchmore (1969b) and undescribed species of *Apochthonius* and *Aphrastochthonius*.

Pseudogarypus hypogeus, new species

Figs. 15 and 16

Material.—Holotype female (WM 4452.01001) and tritonymph from Doney Fissure, 27 September 1975, and four paratypes (1 male, 2 females, 1 tritonymph) from Dangling Flake Crack, 31 January and 2 October 1976 -- both locations in the Wupatki National Monument, Coconino County, Arizona and all collections by W. C. Welbourn. The types are in the Florida State Collection of Arthropods, Gainesville.

Diagnosis.—With longer and more attenuated appendages than the local epigeal form of *P. bicornis*; length of palpal femur about 1.3 mm, 1/w about 5.2, and femur about 1.9 times as long as carapace.

Description.—With the general characters of the genus (Benedict and Malcolm 1978:85) and the following noteworthy features. Male and female similar but female a little larger. Carapace about 1.25 times as long as posterior width; anterior margin with rather deep notch between anterolateral and median protuberances; eyes well developed. Abdomen typical; pleural membranes without obvious sclerites, but with occasional, tiny, thickened plaques. Anterior genital operculum with about 60 and posterior operculum with about 50 scattered, small setae. Chelicera 0.43 as long as carapace; hand with 10 setae; flagellum of two curved setae; galea simple, gently curved. Palp as in Fig. 15; femur about 1.9 and chela about 2.25 times as long as carapace; trochanter 1.4-1.45, femur 5.1-5.55, tibia 2.4-2.65, and chela (with pedicel) 4.7-5.0 times as long as broad; hand (with pedicel) 2.1-2.15 times as long as deep; movable finger about 1.7 times as long as hand. Fixed chelal finger with 41-47 and movable finger with 32-37 weakly spaced, marginal teeth; each finger with a large "venedens" accompanied by a conspicuous, modified seta ("lamina defensor"). Trichobothria placed as usual, including the accessory pair on the fixed finger (Fig. 16). Legs typical; each coxa I with five or six spines; leg IV moderately attenuate with basifemur 2.95-3.2 and telofemur 3.4-3.55 times as long as deep.

Measurements (mm).—Figures given first for the holotype, followed in parentheses by ranges for the three adult paratypes. Body length 2.88 (2.62-2.99). Carapace length 0.74(0.69-0.74). Chelicera 0.32(0.295-0.32) by 0.16(0.155-0.16). Palpal femur 1.39 (1.24-1.33) by 0.25(0.24-0.25); tibia 0.66(0.59-0.63) by 0.25(0.23-0.25); chela (without pedicel) 1.59(1.44-1.57) by 0.33(0.32-0.35); hand (without pedicel) 0.58(0.56-0.58) by 0.315(0.295-0.31); pedicel about 0.075 long; movable finger 1.02(0.91-1.0) long. Leg IV: basifemur 0.40(0.37-0.40) by 0.125(0.125); telofemur 0.55(0.50-0.54) by 0.155(0.15-0.155).

Etymology.—The species is named *hypogeus* in recognition of its habitat beneath the surface, in earth cracks.

Remarks.—The new species has noticeably longer and more attenuate appendages than representatives of a nearby population of the epigean *P. bicornis* (Banks). In the latter the palpal femur is about 1.1 mm long, 4.85 times as long as broad, and 1.55 times as long as carapace; and the chela (with pedicel) is about 1.4 mm long, 4.4 times as long as broad, and 1.95 times as long as carapace.

ACKNOWLEDGMENTS

I am greatly indebted to Andrew G. Grubbs, Lawrence A. Lacey and W. Calvin Welbourn for sending me pseudoscorpions from western United States caves. Credit for the illustrations belongs to Charlotte H. Alteri.

LITERATURE CITED

- Banks, N. 1891. Notes on North American Chernetidae. *Canadian Entomol.*, 23:161-166.
- Beier, M. 1963. Ordnung Pseudoscorpionidea. *Bestimmungsbücher zur Bodenfauna Europas*, 1:1-313.
- Benedict, E.M. 1978. A biogeographical study of currently identified Oregon pseudoscorpions with an emphasis on western Oregon forms. Ph.D. Dissertation, Portland State University, pp.i-xv and 1-143.
- Benedict, E.M. and D.R. Malcolm. 1977. Some garypoid false scorpions from western North America (Pseudoscorpionida: Garypidae and Olpiidae). *J. Arachnol.*, 5:113-132.
- Benedict, E.M. and D.R. Malcolm. 1978. The family Pseudogarypidae (Pseudoscorpionida) in North America with comments on the genus *Neopseudogarypus* Morris from Tasmania. *J. Arachnol.*, 6:81-104.
- Chamberlin, J.C. 1930. A synoptic classification of the false scorpions or chela-spinners, with a report on a cosmopolitan collection of the same — Part II. The Diplosphyronida (Arachnida-Chelonethida). *Ann. Mag. Nat. Hist. (ser. 10)*, 5:1-48 and 585-620.
- Chamberlin, J.C. 1931. The arachnid order Chelonethida. *Stanford Univ. Publ. Biol. Sci.* 7, no. 1:1-284.
- Hoff, C.C. 1946. A study of the type collections of some pseudoscorpions originally described by Nathan Banks. *J. Washington Acad. Sci.*, 36:195-205.
- Hoff, C.C. 1949. The pseudoscorpions of Illinois. *Bull. Illinois Nat. Hist. Surv.*, 24:407-498.
- Hoff, C.C. 1958. List of the pseudoscorpions of North America north of Mexico. *Amer. Mus. Novitates*, 1975:1-50.
- Hoff, C.C. 1961. Pseudoscorpions from Colorado. *Bull. Amer. Mus. Nat. Hist.*, 122:409-464.
- Hoff, C.C. and J.E. Bolsterli. 1956. Pseudoscorpions of the Mississippi River drainage basin area. *Trans. Amer. Micros. Soc.*, 75:155-179.
- Lee, V.F. 1979. The maritime pseudoscorpions of Baja California, Mexico (Arachnida: Pseudoscorpionida). *Occ. Pap. California Acad. Sci.*, 131:1-38.
- Morris, J.H.C. 1948. A new genus of pseudogarypin pseudoscorpions possessing pleural plates. *Pap. Proc. Roy. Soc. Tasmania*, 1947:43-47.
- Muchmore, W.B. 1969a. The pseudoscorpion genus *Neochthonius* Chamberlin (Arachnida, Chelonethida, Chthoniidae) with description of a cavernicolous species. *Amer. Midl. Nat.*, 81:387-394.
- Muchmore, W.B. 1969b. New species and records of cavernicolous pseudoscorpions of the genus *Microcreagris* (Arachnida, Chelonethida, Neobisiidae, Ideobisiinae). *Amer. Mus. Novitates*, 2392:1-21.
- Nelson, S.O., Jr. 1975. A systematic study of Michigan Pseudoscorpionida (Arachnida). *Amer. Midl. Nat.*, 93:257-301.